



TEN SHADES OF GREEN – AN ESG THEMATIC PRIMER

Ten ESG themes that are here to stay

ESG is ready for prime time.

Yet, doing ESG research can be overwhelming. In this Blackbook, we dive into 10 material ESG themes that any ESG investor should care about.

Some are highly controversial (e.g., sin stocks), some are not yet well understood (e.g., biodiversity), some are hard to measure (e.g., modern slavery), and some are still quite early stage (e.g., blockchain), but with significant potential to shape the future.

Finally, we look into the future and see what the VC world tells us about emerging technologies and business models that could define the next generation of ESG investments.

PORTFOLIO MANAGER'S SUMMARY

ESG is ready for prime time. The past 18 months have been plagued by a prolonged pandemic, racial disparity, and supply chain bottlenecks. Yet the silver lining of the Covid-19 pandemic is that it has accelerated the growth of ESG investing by showcasing how ESG is no longer a nice-to-have.

The equity market has jumped on board. Since the beginning of 2020, ESG equity funds have seen US\$405bn inflows, while non-ESG active equity funds have seen outflows of US\$520bn. The same holds true over a longer time period. ESG equity funds have seen cumulative inflows of over US\$523bn since 2015, while non-ESG active equity funds have seen cumulative outflows of a whopping US\$2.7tn.

What does this mean for investors and where should we look for investment opportunities? ESG means different things to different people. But we focus on the most material ESG issues identified by our global sector analysts in our materiality mapping process.

In this *Blackbook*, we dive into 10 ESG themes with material financial, environmental, and social implications.

On the environmental front, we look beyond the basics to assess life cycle environmental impacts of *EV batteries* and the *fashion supply chain*. We turn to *meat alternatives* to identify ways to alleviate the livestock industry's environmental burden. In addition to climate issues, we discuss why *biodiversity* is a risk that cannot be ignored and how *blockchain* could transform the way we think about supply chain traceability and accounting for companies' environmental and biodiversity footprints.

On the social front, we debate what investors should do with *sin stocks* (tobacco, alcohol, and gambling). We also try to measure the unmeasured when it comes to *modern slavery*, labor issues in the *gig economy*, *data privacy*, and *healthcare affordability*.

We conclude this *Blackbook* by looking into the future. In the final chapter, we turn to *unicorn startups* to give us an idea of the next ESG mega trends. As many of these companies disrupt existing business models and unlock new ways to address ESG issues, they will focus us on the emerging ESG issues for the next decade.

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SIGNIFICANT RESEARCH CONCLUSIONS

The past 18 months have been plagued by a prolonged pandemic, racial disparity, and supply chain bottlenecks. Yet, the silver lining of the Covid-19 pandemic is that it has accelerated the growth of ESG investing by showcasing how ESG is no longer a nice-to-have.

What does this mean for investors and where should we look for investment opportunities? In this *Blackbook*, we dive into 10 ESG themes with material financial, environmental, and social implications. Some are highly controversial (e.g., sin stocks), some are not yet well understood (e.g., biodiversity), some are hard to measure (e.g., modern slavery), and some are in quite early stages (e.g., blockchain), but with significant potential to shape the future.

Before we get into the weeds, though, let's take a step back and review where we are on the ESG journey and where it's taking us next.

IS ESG A FAD?

Just like the keto diet and the flossing dance, investing trends come and go.

That said, ESG has been in the works for over 200 years. The idea of **socially responsible investing (SRI)** dates back more than 200 years, when religious groups avoided investing in what they deemed to be unethical enterprises that produce weapons, alcohol, and tobacco.¹ SRI became a more prominent idea in the 1960s during the Vietnam War, especially given concerns about the use of chemical weapons.² The SRI agenda then broadened to include inequality and environmental issues in the 1970s and further gained prominence in the 1980s as part of the global anti-apartheid movement. Environmental issues also became front-and-center in the 1980s, following the Chernobyl nuclear accident and the Exxon Valdez oil spill in Alaska.

The term ESG was coined in 2005 in a study presented at the Who Cares Wins conference, initiated by former UN Secretary General Kofi Annan. This study, along with another study led by the United Nations Environment Program (UNEP) around the same time, found ESG issues can have a financially material impact on companies, which then led to a series of discussions with investment professionals around how best to improve the integration of ESG into the investment decision-making process.³

Given the origin of SRI, it's perhaps not surprising that most ESG funds started with an **exclusion approach** to exclude "sin stocks" (e.g., tobacco, alcohol, and gaming) and others

¹ <https://www.thebalance.com/a-short-history-of-socially-responsible-investing-3025578>

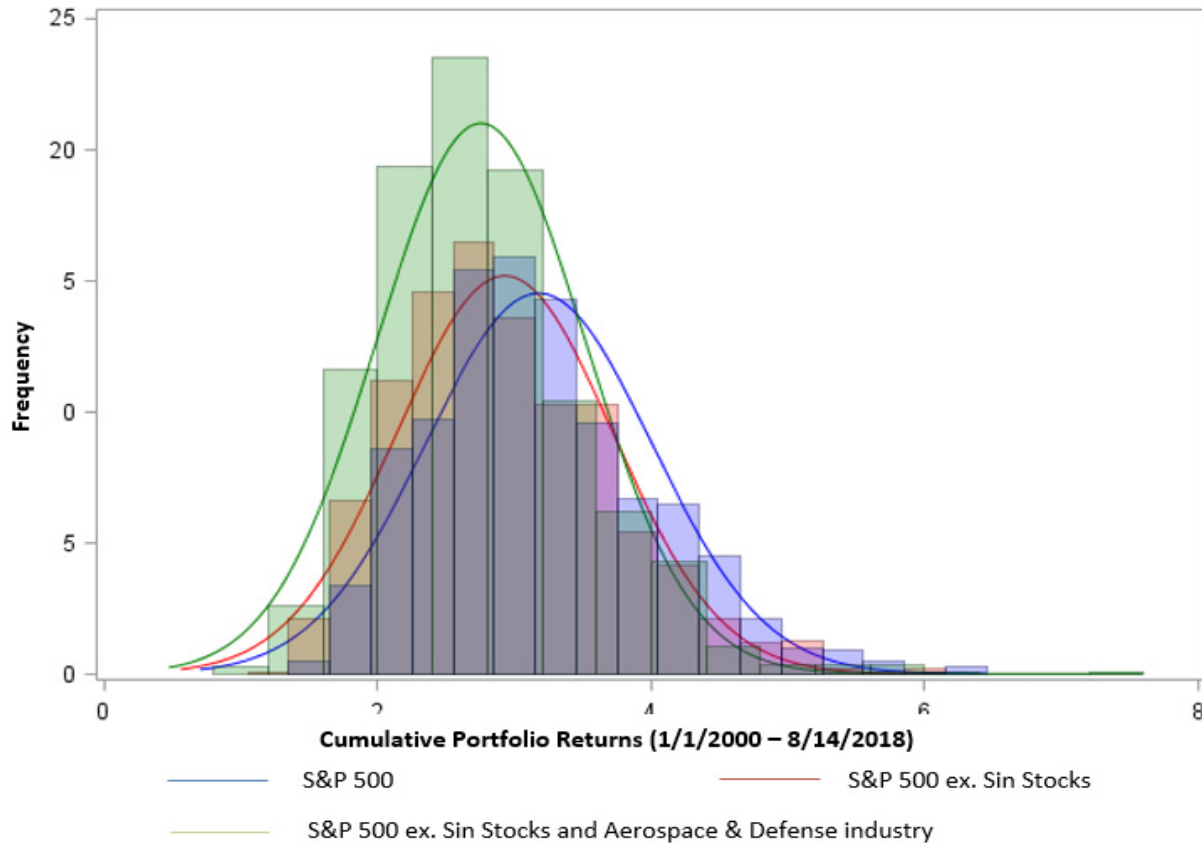
² <https://www.morningstar.com/features/esg-investing-history>

³ <https://www.forbes.com/sites/georgkell/2018/07/11/the-remarkable-rise-of-esg/#1924c5316951>

involved in weapons production and coal mining. However, our quantitative analysis shows exclusion could weigh on financial returns (see Exhibit 1).

The real breakthrough happened when investors started *integrating ESG considerations* into their fundamental research. ESG integration overtook exclusion as the most prevalent ESG strategy in 2020. Funds that employ the integration approach manage US\$25.2tn in assets, up from US\$10.4tn in 2016 (see Exhibit 2). This integrated approach opens up additional alpha-generation opportunities, especially around companies that have been laggards but are actively improving their ESG practices. As we are still in the early stage of ESG integration, the market may be slow at pricing in ESG improvement stories, which are not well captured by existing ESG scores but offer compelling alpha-generation opportunities. To take it to the next level, there are also opportunities for investors to take a more *active approach* to engage with companies to influence behaviors and drive positive changes around ESG issues.

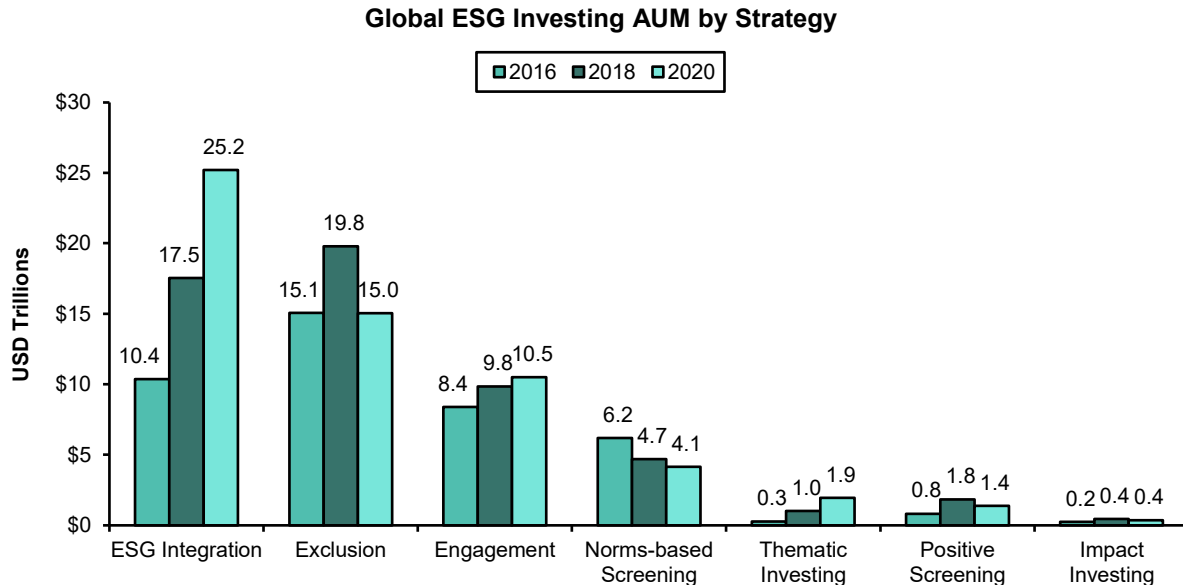
EXHIBIT 1: Our Quant team's analysis shows portfolios with a greater number of exclusions underperformed those with fewer exclusions



Note: "Sin Stocks" = Tobacco-, Alcohol-, and Gaming-related stocks

Source: FactSet, Center for Research in Security Prices (CRSP), and Bernstein analysis

EXHIBIT 2: ESG integration overtook exclusion as the most prevalent ESG strategy in 2020; funds that employ the integration approach manage US\$25.2tn in assets, up from US\$10.4tn in 2016



Note: These ESG strategies are not mutually exclusive (i.e., one fund can adopt an exclusion, ESG integration, and an engagement strategy at the same time).
 Note: **Exclusion** = the exclusion of certain sectors, companies or practices based on specific ESG criteria; **ESG integration** = the systematic and explicit inclusion of ESG factors into financial analysis; **Engagement** = the user of shareholder power to influence corporate behavior; **Norms-based screening** = screening of investments against minimum standards of business practice based on international norms (e.g., by the OECD, ILO, UN); **Positive screening** = investment in sectors, companies or projects selected for positive ESG performance; **Thematic investing** = investment in themes or assets specifically related to sustainability; **Impact investing** = investments aimed at social or environmental problems.

Source: 2020 Global Sustainable Investment Review and Bernstein analysis

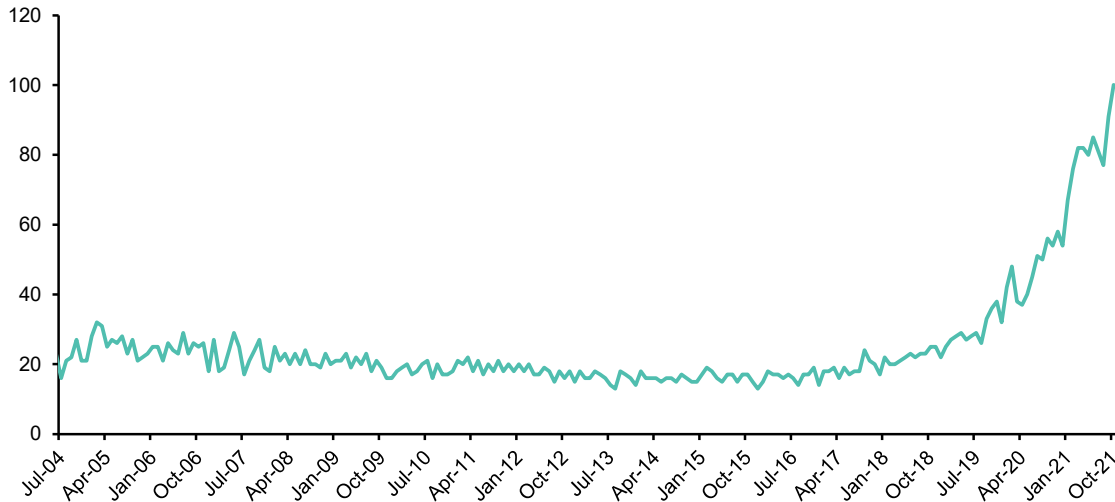
Along with the growth of the integrated ESG approach, the idea of ESG investing started picking up momentum in 2019 and had a major breakthrough in 2020 as the Covid-19 pandemic and social unrest highlighted the importance of social issues and the resilience of business models (see Exhibit 3). The UN Principles for Responsible Investment organization (PRI), founded in Europe in 2006, also experienced meaningful growth in recent years. The initiative now boasts nearly 4,000 signatories globally in 2021, including financial groups with over US\$120tn dollars of assets under management (AUM) (see Exhibit 4).

Still not convinced? Take a look at ESG fund flows. ESG equity funds have seen exponential growth in recent years, led by global and North American ESG funds (see Exhibit 5). Notably, ESG equity funds have seen US\$405bn inflows since the beginning of 2020, while non-ESG active equity funds have seen outflows of US\$520bn (see Exhibit 6). The same holds true over a longer time period. ESG equity funds have seen cumulative inflows of over US\$523bn since 2015, while non-ESG active equity funds have seen cumulative outflows of a whopping US\$2.7tn (see Exhibit 7).

Long story short, we don't think ESG investing is a fad. The concept has been in the works for over 200 years. And if the recent trajectory is any indication, ESG will be with us for the long term.

EXHIBIT 3: The idea of ESG investing started picking up momentum in 2019 and had a major breakthrough in 2020 on the back of the Covid-19 pandemic and social unrest

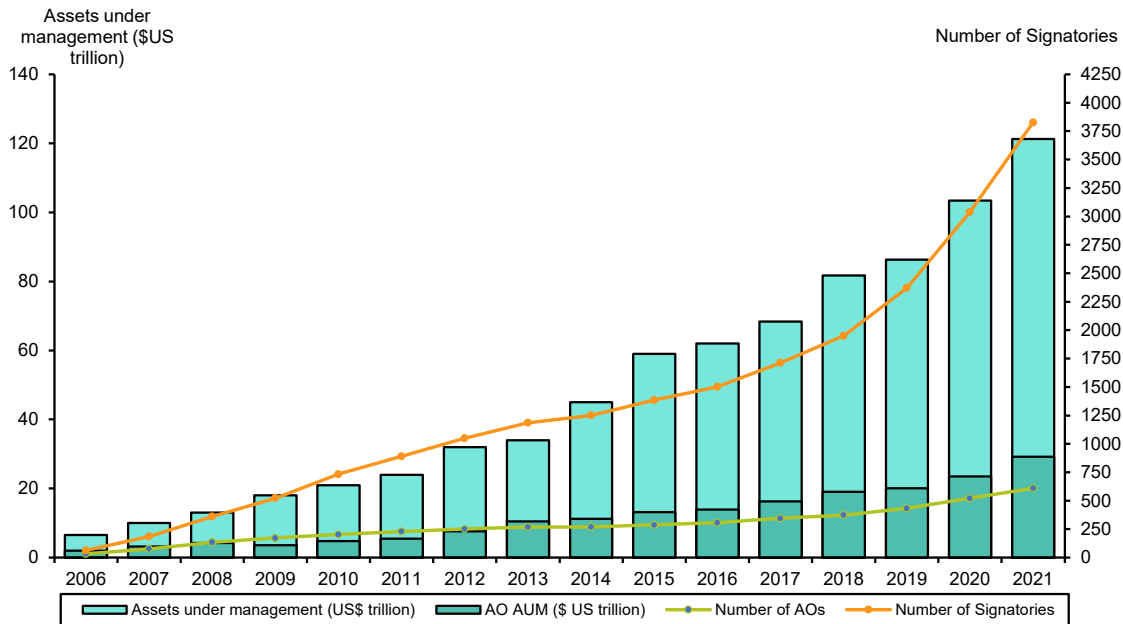
ESG Google Search Trends



Note: Google trend numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term.

Source: Google Trends and Bernstein analysis

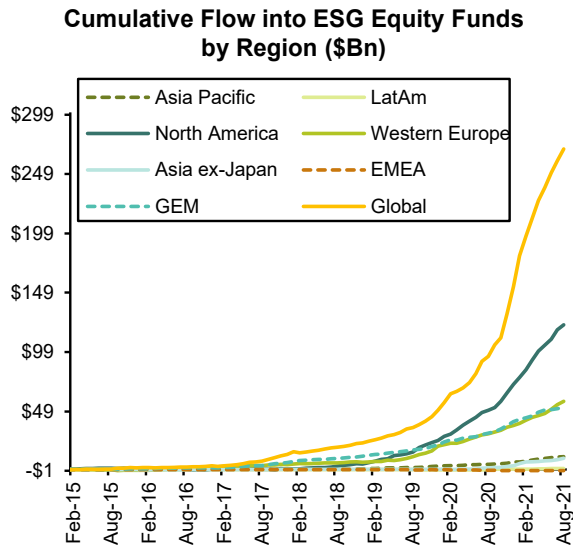
EXHIBIT 4: UN PRI was founded in 2006 and now has nearly 4,000 signatories representing over US\$120tn AUM in 2021



Note: Total assets under management (AUM) include reported AUM and AUM of new signatories provided in sign-up sheet that signed up by end of March of that year.

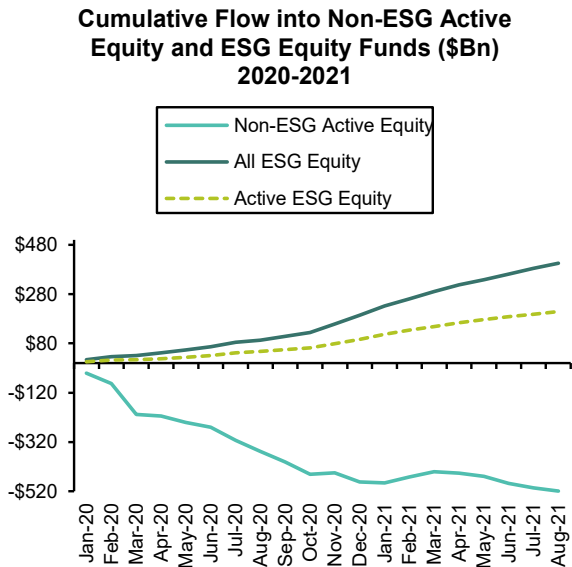
Source: UN PRI and Bernstein analysis

EXHIBIT 5: **Still not convinced? Take a look at ESG fund flows**



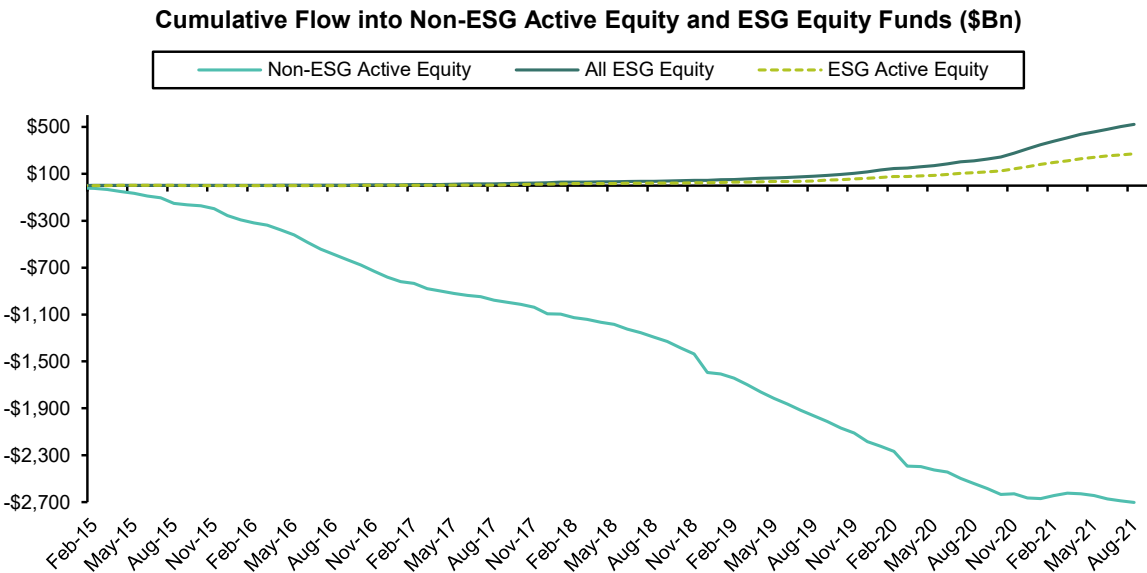
Source: EPFR Monthly Data and Bernstein analysis

EXHIBIT 6: **ESG equity funds have seen US\$405bn inflows since 2020, while non-ESG active equity funds have lost US\$520bn**



Source: EPFR Monthly Data and Bernstein analysis

EXHIBIT 7: **The same holds true over a longer time; ESG equity funds have seen cumulative inflows of US\$523bn since 2015, while non-ESG active equity funds have seen cumulative outflows of US\$2.7tn**



Source: EPFR Monthly Data and Bernstein analysis

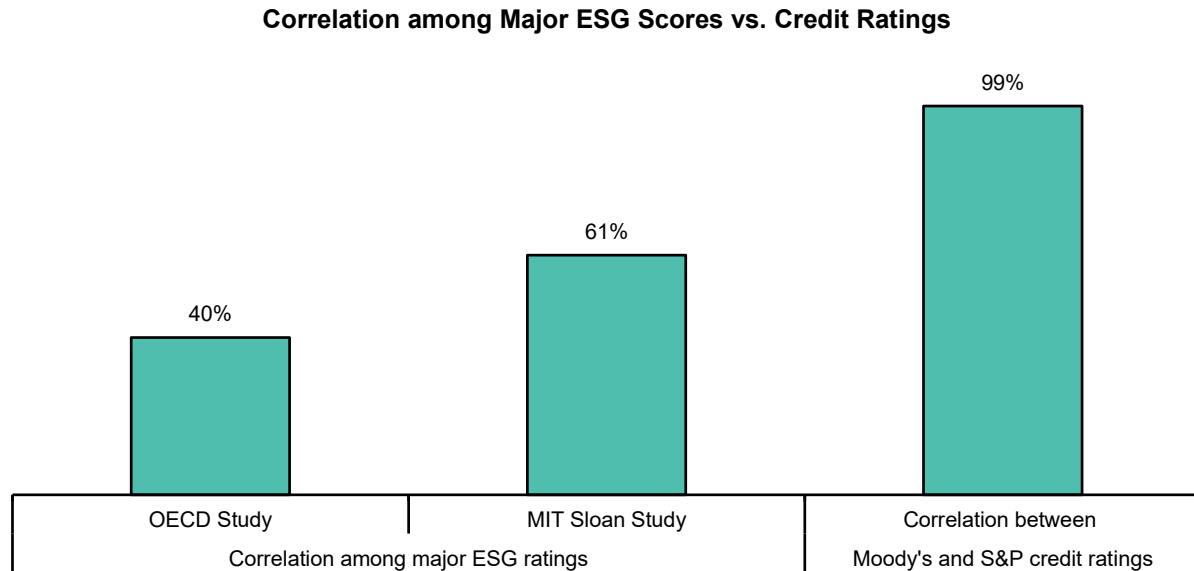
DOES ESG INVESTING
GENERATE ALPHA?

Where is the alpha? This is the question any smart asset manager should ask.

Studies on the link between ESG and alpha generation have yielded mixed results. A recent study by the NYU Stern School of Business shows ESG scores offer no positive explanatory power for returns during the Covid-19 pandemic.⁴ Our Strategy and Quant teams' work also found it difficult to establish that ESG was a source of outperformance based on ESG scores.⁵

Could ESG scores be the issue? An OECD study found an average correlation of only 0.4 among major ESG ratings (including Bloomberg, MSCI, and Refinitiv),⁶ Another study by MIT Sloan found a 0.6 correlation among KLD, Sustainalytics, Video-Eiris, Asset4, and RobecoSAM,⁷ which compares to the correlation between Moody's and S&P's credit ratings of 99% (see Exhibit 8). Said differently, these analyses suggest one company that's ranked highly by one ESG platform could be ranked poorly by another due to inconsistent methodologies and data quality issues. So perhaps it's not surprising that ESG score-based analysis has shown mixed results on ESG investing alpha generation.

EXHIBIT 8: ESG scores are inconsistent with correlations in the 40-60% range, versus the correlation of Moody's and S&P's credit ratings of 99%



Source: OECD, MIT Sloan, and Bernstein analysis

⁴ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3675920

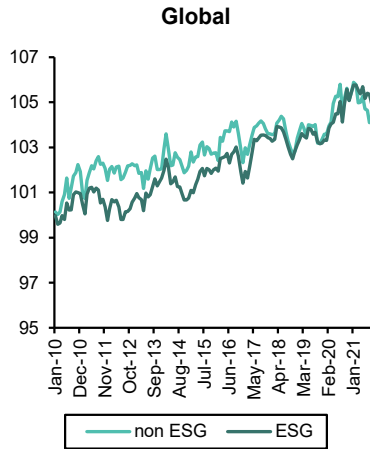
⁵ See report: [Fund Management Strategy: It's about engagement, stupid](#)

⁶ <https://www.oecd-ilibrary.org/sites/e9ed300b-en/index.html?itemId=/content/component/e9ed300b-en#section-d1e1445>

⁷ <https://mitsloan.mit.edu/ideas-made-to-matter/why-esg-ratings-vary-so-widely-and-what-you-can-do-about-it>

How about taking a look at actual ESG strategies' performance? Our Strategy team leveraged the Alphalytics fund database to show ESG strategies have outperformed non-ESG strategies since 2010, most notably in the US (see Exhibit 9 to Exhibit 11).

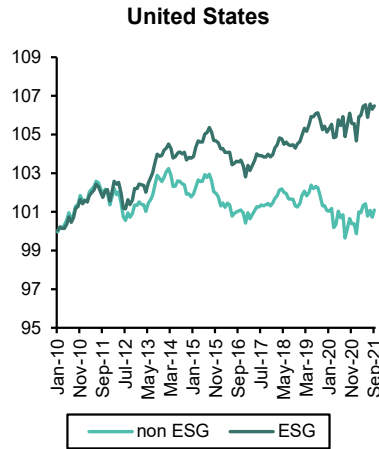
EXHIBIT 9: ESG versus non-ESG fund performance - Global



Note: Returns are in US\$, gross of fees, versus benchmarks

Source: eVestment, Morningstar, MSCI, S&P, FactSet, and Bernstein analysis

EXHIBIT 10: ESG versus non-ESG fund performance - US



Note: Returns are in US\$, gross of fees, versus benchmarks

Source: eVestment, Morningstar, MSCI, S&P, FactSet, and Bernstein analysis

EXHIBIT 11: ESG versus non-ESG fund performance - Europe

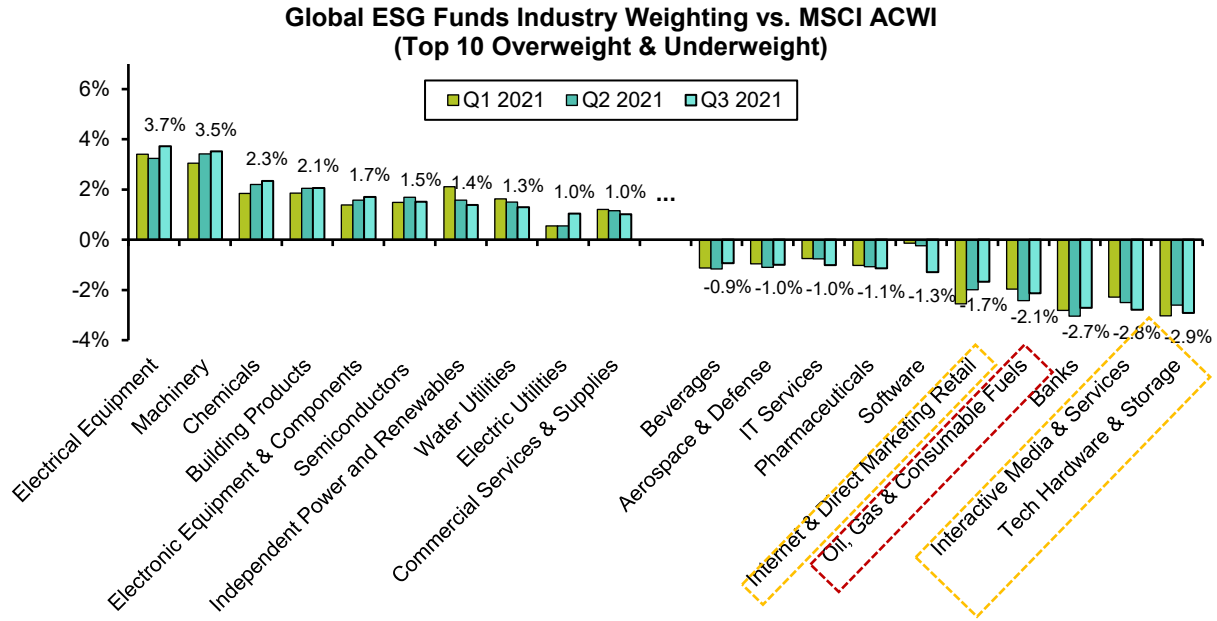


Note: Returns are in US\$, gross of fees, versus benchmarks

Source: eVestment, Morningstar, MSCI, S&P, FactSet, and Bernstein analysis

But have ESG funds outperformed because they are underweight energy and overweight technology? Not quite. We analyzed holdings of 765 global ESG funds and found although ESG funds are underweight oil & gas, they are also underweight big tech industries such as tech hardware & storage, interactive media & services, and internet & direct marketing retail (see Exhibit 12). In fact, our Strategy team's analysis shows ESG strategies generated higher idiosyncratic alpha in the US, Europe, and globally since 2010, after stripping out differences in various factor exposures (see Exhibit 13 to Exhibit 15).

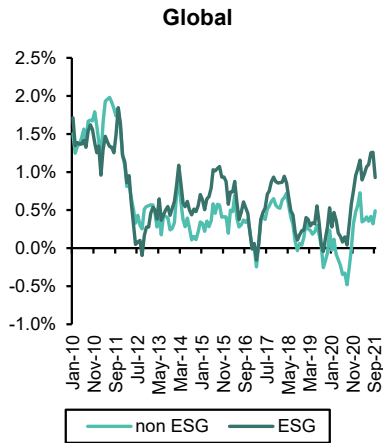
EXHIBIT 12: Have ESG funds outperformed because they are underweight energy and overweight technology? Not quite – although ESG funds are indeed underweight oil & gas, they are also underweight big tech industries



Note: Data labels included for Q3. Electrical equipment is classified in the capital goods sector, while electronic equipment & components are classified in the IT sector.

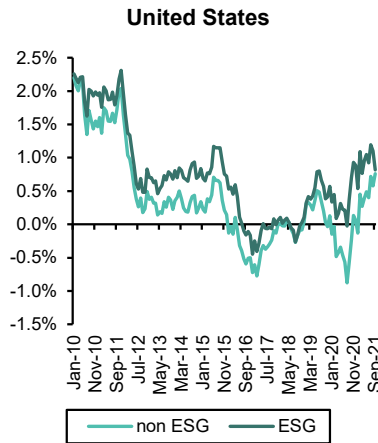
Source: FactSet, Morningstar, and Bernstein analysis

EXHIBIT 13: ESG versus non-ESG Fund Idiosyncratic Alpha – Global



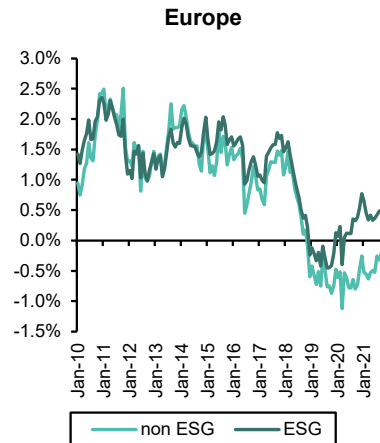
Source: eVestment, Morningstar, MSCI, S&P, FactSet, and Bernstein analysis

EXHIBIT 14: ESG versus non-ESG Fund Idiosyncratic Alpha – US



Source: eVestment, Morningstar, MSCI, S&P, FactSet, and Bernstein analysis

EXHIBIT 15: ESG versus non-ESG Fund Idiosyncratic Alpha – Europe



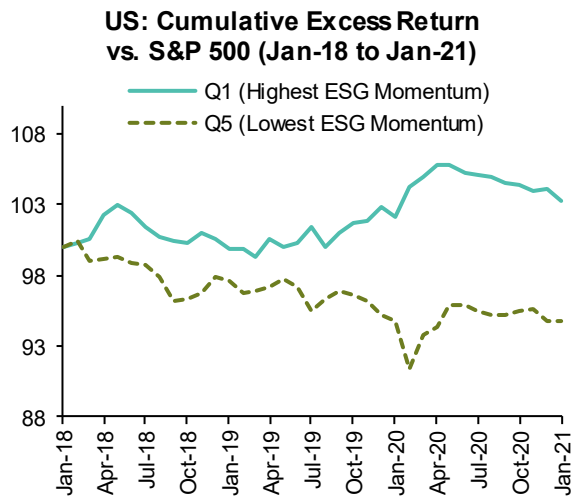
Source: eVestment, Morningstar, MSCI, S&P, FactSet, and Bernstein analysis

Where to identify alpha opportunities in ESG investing? High-ESG-scored companies are crowded in both Europe and North America. Instead, we believe ESG improvers, or companies that have had low ESG scores but are actively improving their performance, are the new source of alpha.

Our analysis shows ESG improvers have outperformed decliners by +4.0% and +4.7%, annualized since 2018 in the US and Europe, respectively (see Exhibit 16 to Exhibit 21). Notably, the outperformance of ESG improvers has been led by companies that had the lowest ESG scores a year ago but have improved their scores the most over the past year (i.e., worst offenders getting better).

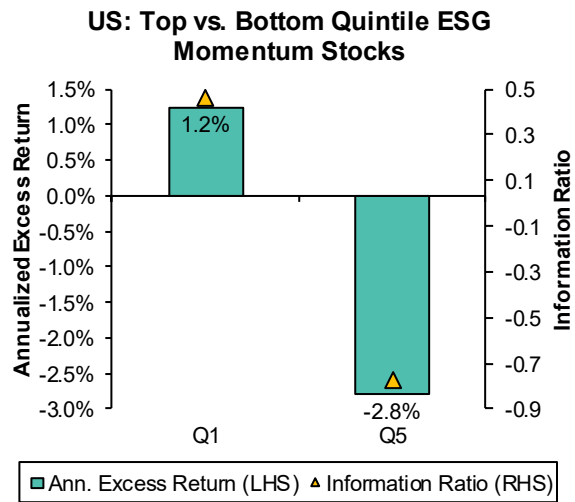
These early results look promising for ESG improvers. The better news is that alpha-generation potential is likely greater for fundamental investors who are able to identify ESG improvement stories before they are reflected in scores (note ESG scores are lagging indicators). Active investors could also take the opportunity to engage with companies and drive positive changes proactively.

EXHIBIT 16: In the US, ESG improvers (top-quintile ESG momentum) have outperformed ESG decliners (bottom-quintile ESG momentum) since 2018



Source: Sustainalytics, Bloomberg, and Bernstein analysis

EXHIBIT 17: ESG improvers have outperformed the S&P 500 by +1.2% (annualized) with an information ratio (IR) of 0.46; ESG decliners have underperformed by -2.8% with an IR of -0.78



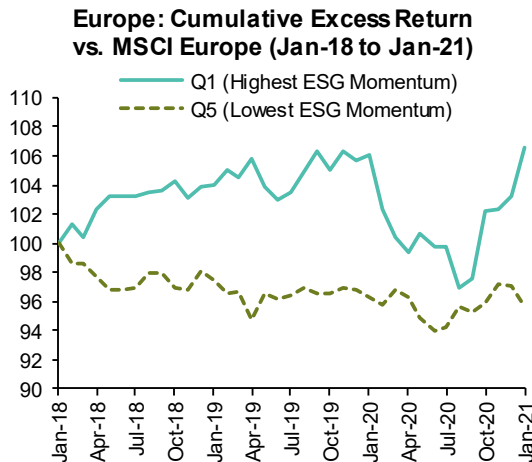
Source: Sustainalytics, Bloomberg, and Bernstein analysis

EXHIBIT 18: In the US, outperformance of ESG improvers has been led by the worst offenders getting better

Equally Weighted Average Relative Returns (USA)		ESG Momentum Quintiles				
		Q1 (Highest ESG Momentum)	Q2	Q3	Q4	Q5 (Lowest ESG Momentum)
ESG Scores (1Y Lagged)	Q1 (Highest ESG Score)	0.3%	0.9%	-4.7%	-2.4%	-5.3%
	Q2	-1.9%	3.6%	0.5%	0.2%	-2.0%
	Q3 (Lowest ESG Score)	4.3%	2.3%	2.1%	-1.5%	-1.6%

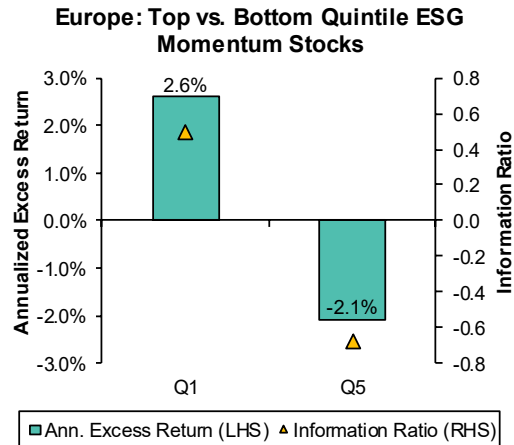
Source: Sustainalytics, Bloomberg, and Bernstein analysis

EXHIBIT 19: In Europe, ESG improvers have also outperformed ESG decliners since 2018, despite having experienced higher volatility in 2020



Source: Sustainalytics, Bloomberg, and Bernstein analysis

EXHIBIT 20: ESG improvers have outperformed MSCI Europe by +2.6% (annualized) with an IR of 0.50; ESG decliners have underperformed by -2.1% with an IR of -0.67



Source: Sustainalytics, Bloomberg, and Bernstein analysis

EXHIBIT 21: In Europe, we've also seen outperformance by the worst offenders that are getting better, although the correlation there is less strong than in the US, likely as European investors are more constrained in terms of owning some of these stocks

Equally Weighted Average Relative Returns (EUR)		ESG Momentum Quintiles				
		Q1 (Highest ESG Momentum)	Q2	Q3	Q4	Q5 (Lowest ESG Momentum)
ESG Scores (1Y Lagged)	Q1 (Highest ESG Score)	1.9%	-2.0%	0.9%	-4.1%	1.6%
	Q2	0.2%	-0.6%	1.9%	3.0%	-4.7%
	Q3 (Lowest ESG Score)	3.1%	-4.8%	4.5%	1.1%	-0.6%

Source: Sustainalytics, Bloomberg, and Bernstein analysis

HOW CAN WE HELP?

At Bernstein, we are not new to ESG. Bernstein analysts started writing about ESG issues back in the 2010s and we published our first cross-sector ESG *Blackbook*, "**ESG: Beyond Ratings and Scores**,"⁸ in 2018.

Based on investor demand for a greater focus on material ESG issues and on quantifying such ESG issues in our financial analysis, we formalized our ESG approach by introducing **Bernstein's MAQ Framework — Materiality, Analysis, and Quantification**.

We began by identifying the most material ESG issues at the sector and regional level. While many teams used the Sustainability Accounting Standards Board (SASB) materiality framework as a starting point, we overlaid our fundamental understanding to identify additional material issues or to deprioritize others. The resulting 1,143-page analysis can be found in our **ESG Materiality Matrix** Greenbook published in September 2020 (see Exhibit 22 to Exhibit 25 for a summary of material ESG issues identified by our analysts).⁹

In this *Blackbook*, we dive into a number of key ESG themes identified in our Materiality Matrix. On the environmental front, we look beyond the basics to assess life cycle environmental impacts of **EV batteries** and the **fashion supply chain**. We turn to **meat alternatives** to identify ways to alleviate the livestock industry's environmental burden. In addition to climate issues, we discuss why **biodiversity** is a risk that cannot be ignored and how **blockchain** could transform the way we think about supply chain traceability and hold companies accountable for their environmental and biodiversity footprints.

On the social front, we debate what investors should do with **sin stocks** (tobacco, alcohol, and gambling). We also try to measure the unmeasured when it comes to **modern slavery**, labor issues in the **gig economy**, **data privacy**, and **healthcare affordability**.

We conclude this *Blackbook* by looking into the future. In the final chapter, we turn to **unicorn startups** to give us an idea of the next ESG mega trends. As many of these companies disrupt existing business models and unlock new ways to address ESG issues, they will for sure keep us busy for the next decade.

VALUATION METHODOLOGY

See the Appendix to this *Blackbook* for details on the valuation methodology.

RISKS

See the Appendix to this *Blackbook* for details on the risks.

INVESTMENT IMPLICATIONS

See individual chapters for investment implications.

⁸ [ESG: Beyond Ratings and Scores](#)

⁹ [The Bernstein ESG Materiality Matrix](#)

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ESG MATERIALITY MATRIX SUMMARY

On the back of our 1,143-page ESG Materiality Matrix *Greenbook*, we summarize our analysts' in-depth analysis into four tables (see Exhibit 22 to Exhibit 25). In this exercise, we used the SASB materiality framework as a starting point and overlaid our fundamental understanding to identify additional material issues or to deprioritize others. Beyond the 26 general sustainability issues identified by the SASB, we also introduced additional sector- and region-specific ESG considerations in our materiality mapping.

In the following chapters in this *Blackbook*, we dive into 10 key ESG themes identified in our Materiality Matrix, from circular economy to biodiversity, from sin stocks to modern slavery, to showcase how we analyze their material financial, environmental, and social implications.

EXHIBIT 22: Bernstein ESG Materiality Matrix – Commodities & Industries

		High risk	Risk	Immaterial	Commodities & Industries													
Dimension	Issue Category	Global		US			Europe				Asia							
		Metals & Mining	Aero-space and Defense	US E&Ps	US Mid-stream	US Chemicals	European Utilities	European Integrated Oils	European Oil Services	European Chemicals	Airlines	China Renewables	APAC Oil	China Gas Distributors	India Autos	China Autos OEMS	China Airlines	China Express Delivery
Environment	GHG Emissions	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Resource efficiency & sustainability	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Climate transition risk	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Environmental damage (e.g., leaks)	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Waste/hazardous materials	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Product life cycle management	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Fuel costs/renewable fuels	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Energy consumption	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Ecological impact	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Incorporation of renewables in portfolio	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Social	Employee health and safety	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Community relationship / impact	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Talent management, development, morale	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Diversity and inclusion	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Fair labor practices	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Customer satisfaction	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Product safety/quality	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Security and data privacy	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Donations	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Global connectivity	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Regulated return reduction	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Phase out of connection fees	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Social insurance	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Work life balance	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
	Governance	Corporate governance	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Ethical behavior		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Regulation & politics		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Board independence		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Executive compensation		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Board diversity		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Supply chain management/sustainability		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Digitization, efficiency, innovation		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Related party transactions		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Accounting, reporting, disclosure		High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Foreign currency exposure	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	

Source: Bernstein analysis

EXHIBIT 23: Bernstein ESG Materiality Matrix – Consumer & Retail

High risk	Risk	Immaterial
-----------	------	------------

Dimension Issue Category		Consumer & Retail												
		Global				US				Europe		China		
		Global Catering	Global Hotels	Global Luxury Goods	Global Gaming	US Tobacco	US Food	US Softlines & Specialty Retail	US Restaurants	European General Retail	European Beverages	China Grocery Retail	China Beer	China Baijiu
Environment	Energy & Water Efficiency / Management													
	Carbon Footprint													
	Waste Management													
	Packaging & Recycling													
	Sustainable Sourcing													
	Pollution													
	Physical Climate Change Impacts													
Social	Labor Practices													
	Responsible Consumption & Marketing													
	Employee Incentives & Engagement													
	Health & Wellness													
	Diversity & Inclusion													
	Food/Product Safety													
	Community Impact/Engagement													
	Data Security & Privacy													
	Excise Tax													
	Supply Chain Management													
	Customer Health & Safety													
	Animal Welfare													
	Responsible Gaming													
	Trade Tariffs/Brand Boycotting													
	COVID Responses													
	Excessive Price Inflation													
	Overtourism													
Relationships with Distributors														
Governance	Corporate Governance													
	Related Party Transactions													
	Management/Board Incentives													
	Management/Board Quality, Structure, Turnover													
	Shareholder Alignment													
	Public Sector Relations / Lobbying													
	Ownership Structure													
	Ethical Business Practice / Anticorruption													
Money Laundering														

Source: Bernstein analysis

EXHIBIT 24: Bernstein ESG Materiality Matrix – Media, Telecom, & Technology

		Media, Telecom, & Technology												
Dimension	Issue Category	Global			US						Asia			Europe
		Global Software	Global Energy Storage & EVs	Global Memory & Consumer Electronics	US Cable, Telecom & Satellite	SMID-Cap Software	US Semi-conductors	U S Media	US Payments & IT Services	US IT Hardware	US Internet	Asian Industrial Technology	Asia & Europe Semis	India TMT
Environment	Energy usage & efficiency													
	Carbon footprint / environmental impact													
	Product life cycle management													
	Materials sourcing & efficiency													
	Enabling customer carbon/waste reduction													
	Battery lifetime & efficiency													
Factory location														
Social	Diversity & inclusion													
	User privacy													
	Product safety and quality													
	Customer health and safety													
	Worker health & safety													
	Talent attraction, development, retention													
	Service accessibility / affordability													
	Social participation													
	Content moderation													
	Online advertising and privacy													
	Shifting media consumption													
	Community relations													
	Workforce productivity													
	Flexibility on remote work/WFH													
	Employee compensation													
Financial inclusion														
Governance	Business model resiliency / innovation													
	Cyber security													
	Corporate governance													
	Supply chain management													
	Ethics, corruption & bribery													
	Regulations													
	Shareholder interest/rights													
	Executive compensation													
	Transparency / accounting quality													
	Cash and capital management													
	Factory automation													
	Board													
	Empire building													
	Family control/multiple share classes													
	Board diversity													

Source: Bernstein analysis

EXHIBIT 25: **Bernstein ESG Materiality Matrix – Healthcare**

Dimension	Issue Category	Healthcare					
		Global Medtech	US Healthcare Services	Asia Pacific Healthcare	India Healthcare	EU Biopharmaceuticals	China pharma & biotech
Environment	Carbon Footprint						
	Energy & Water Efficiency						
	Lifecycle Management						
Social	Product / Patient Safety						
	Access & Affordability						
	Manufacturing & Supply Chain Management						
	Ethical Marketing						
	Safety of Clinical Trial Participants						
	Safety Net Programs						
	Employee Health & Safety						
	Employee Recruitment & Retention						
	Product Efficacy						
	Customer Relationship Management						
	Market Access						
	IP Protection						
	Innovation & R&D						
	Social Determinants of Health Programs						
	Data Security & Privacy						
Counterfeit Drugs							
Governance	Corruption & Bribery						
	Business Ethics						
	Corporate Governance						

Source: Bernstein analysis

BERNSTEIN

CIRCULAR ECONOMY: EV BATTERIES

A product life cycle assessment

HIGHLIGHTS

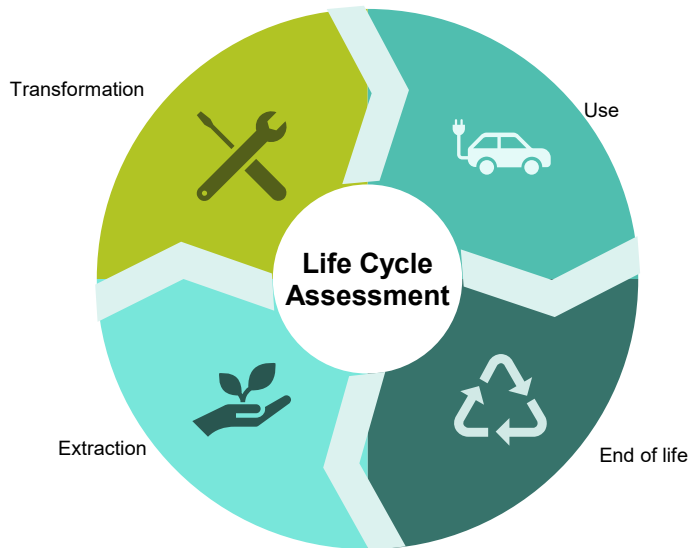
- Electric vehicles (EVs) are a key driver (pun intended) of the low carbon transition. Most consumers, however, have largely focused on the emission reduction potential of EVs in use, without paying much attention to the environmental impact during the production or end-of-life cycle recycling phases. The rise of regulatory requirements, most notably in the EU, calls for greater transparency around a product's net environmental impact across its life cycle. We conduct a life cycle analysis of EV batteries to better understand the environmental impact and risks/opportunities along the value chain.
- We find the greatest environmental impact of EV batteries during the upstream production stage. In addition to environmental impacts such as energy use and GHG emissions, hazardous waste from EV batteries could impact biodiversity by increasing marine and freshwater ecotoxicity.
- The increased focus on EVs' environmental impact could create investment opportunities from second-life applications to circular product design to supply chain traceability. In particular, we expect demand for reusing EV batteries in second-life applications (e.g., for energy storage, for a different vehicle, or for a stationary application such as a wind turbine) by refurbishing and repurposing these batteries. Although the market for a "second life" for EV batteries has not yet reached scale, the 10 million EVs on the road today will reach their end of life and enter the reuse/recycling market by 2040, which could create greater economies of scale for second-life applications.

SUPPLY CHAIN TRACEABILITY AND PRODUCT LIFE CYCLE MANAGEMENT

What is a life cycle analysis? A life cycle approach considers the spectrum of resource flows and environmental interventions associated with a product or organization from a supply chain perspective. It includes all stages from raw material acquisition through processing, distribution, use, and end-of-life, and assesses all relevant environmental impacts, health effects, resource-related threats, and burden to society (see Exhibit 26).¹⁰

¹⁰ <https://ec.europa.eu/environment/eussd/pdf/footprint/PEF%20methodology%20final%20draft.pdf>

EXHIBIT 26: A life cycle approach considers the spectrum of resource flows and environmental interventions associated with a product or organization from a supply chain perspective



Source: Carbon Footprint Ltd and Bernstein analysis

REGULATORY FRAMEWORK

Regulatory requirements are calling for greater supply chain management and traceability of products. While the EU has addressed the issue from an environmental and social angle with the introduction of the EU Taxonomy, the US Department of Energy (DOE) approaches supply chain management from a security and risk perspective.¹¹ Regardless of which way you spin it, both governments seem to have a particular focus on raw metals and materials extraction in the upstream supply chain phase, calling for greater circularity of products to better manage potential future political and supply risks. We review some of the major regulatory developments below.

EU Taxonomy

The EU Taxonomy is a major piece of regulation that establishes a framework to classify business activities or products based on their contribution to specified environmental objectives. In particular, an economic activity can only be classified as environmentally sustainable if it makes a substantive contribution to at least one of the EU Taxonomy's six environmental objectives and it also cannot do significant harm to any of the six objectives (see Exhibit 27).¹²

Among the six objectives, the climate change mitigation and adaptation objectives come into effect from January 1, 2022. An understanding of GHG emissions across the entire value

¹¹ [U.S. Department of Energy's Strategy to Support Domestic Critical Mineral and Material Supply Chains](#)

¹² https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf

chain of a product can help investors better understand how an activity complies with the first two objectives (see Exhibit 28).

The other environmental objectives in the EU Taxonomy, which will come into effect on January 1, 2023, cover pollution, biodiversity, water, and circular economy.¹³ The next wave of environmental metrics will go beyond emissions to measure the sustainability of an economic activity more comprehensively. Although not yet required, a life cycle analysis can help investors evaluate a product's environmental impact more holistically beyond GHG emissions.

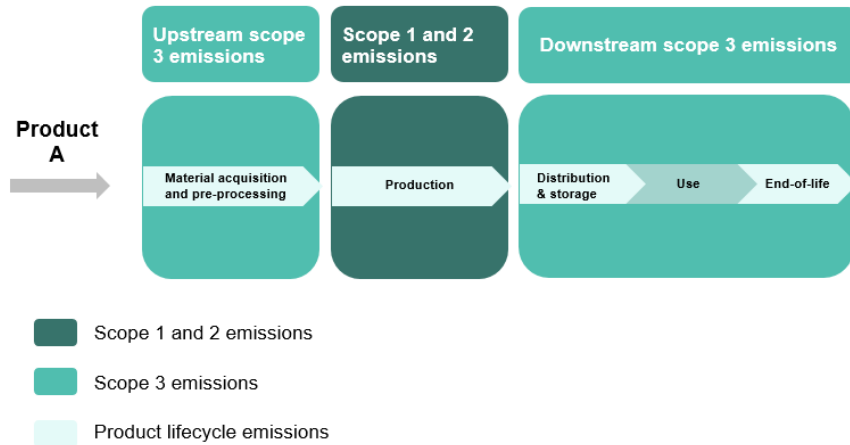
EXHIBIT 27: An activity can only be considered sustainable if it makes a significant contribution to one of the six environmental objectives under the EU Taxonomy and it also cannot do significant harm to any of the six objectives



Source: European Commission and Bernstein analysis

¹³ [The ABCs of ESG: Key Frameworks, Regulations and Disclosures](#)

EXHIBIT 28: Measuring emissions across the life cycle of a product can help investors better understand an economic activity's contribution to the climate change mitigation objective of the EU Taxonomy



Source: GHG Protocol and Bernstein analysis

Climate change mitigation and adaption of an EV

To help investors better understand the first two environmental objectives in the context of EVs, we lay out the metrics from the EU Taxonomy. Passenger light vehicles are identified in the EU Taxonomy as a potential climate change mitigation activity (i.e., due to lower emissions across the lifetime of the vehicle) or a climate change adaption activity (e.g., traditional ICE vehicles that switch to using electric power rather than using conventional fossil fuels).

Current regulations only evaluate EV emissions during the "tank to wheel" phase, or during energy conversion in the vehicle. However, the Clean Vehicles Directive acknowledges that life cycle and well-to-wheel emissions are to be addressed after 2030¹⁴, which would evaluate EVs' GHG emissions more holistically.

Climate change mitigation: Under the EU Taxonomy, zero tailpipe emission vehicles (including EVs) automatically qualify for making a substantive contribution to the climate change mitigation objective (see Exhibit 29). Vehicles with a tailpipe emission intensity of maximum 50g CO₂/km also qualify until 2025 as an interim target. From 2026 onward, only vehicles with zero emission intensity will qualify.

¹⁴ <https://eur-lex.europa.eu/eli/dir/2019/1161/oj>

EXHIBIT 29: Criteria for passenger cars to qualify for making a substantive contribution to the climate change mitigation objective under the EU Taxonomy

Mitigation criteria:	CO2 emissions per vehicle kilometre (gCO2/km).
Passenger cars and light commercial vehicles:	1) Zero tailpipe emission vehicles (incl. hydrogen, fuel cell, electric). These are automatically eligible. 2) Vehicles with tailpipe emission intensity of max 50 g CO2/km (WLTP) are eligible until 2025. 3) From 2026 onwards only vehicles with emission intensity of 0g CO2/km (WLTP) are eligible.

Source: European Commission and Bernstein analysis

Climate change adaption: Unlike the climate change mitigation objective, which sets specific quantitative metrics given its focus on emissions levels, the climate change adaption objective is context and location specific.¹⁵ Traditional passenger light vehicles making the transition from ICEs to electric or hydrogen-powered engines can be considered as adapted activities under current "tank-to-wheel" guidelines. Although the EU Taxonomy has not yet released specific metrics for contributing to the other environmental objectives, it is possible EVs could be considered as activities *enabling* the adaption, especially those that re-integrate precious metals from batteries toward "second life" applications — we will dive deeper into this analysis later in this chapter.

- Climate change adaption activities stress the need for life cycle analysis and the creation of sustainable value chains at the point of design.¹⁶ The EU Sustainable Finance Technical Expert Group indicates that for new economic activities, the DNSH criteria must be met *at the point of design and construction*. For existing activities and assets, all material physical climate risks must be assessed and adapted within a time horizon of no longer than five years.

Sustainable battery development

The EU released a [Strategic Action Plan on Batteries](#) in December 2020, aimed at making Europe a global leader in sustainable battery production and use, as part of the broader [Green Deal Circular Economy Action Plan](#).¹⁷ The Green Deal also contains a new [Eco-Design](#) directive aimed at improving the energy efficiency and sustainability of products in various phases of their life cycle.¹⁸ In the context of batteries, the directive specifies sustainability requirements in terms of sustainable sourcing (e.g., supply chain due diligence), internal storage, energy efficiency, and other requirements (see Exhibit 30).

¹⁵ [EU Taxonomy Technical Annex](#)

¹⁶ [EU Taxonomy Technical Annex](#) (pg. 29-33).

¹⁷ https://ec.europa.eu/transport/sites/transport/files/3rd-mobility-pack/com20180293-annex2_en.pdf

¹⁸ https://ec.europa.eu/growth/industry/sustainability/product-policy-and-ecodesign_en

EXHIBIT 30: The EU has proposed ways to make batteries more sustainable, including higher resource efficiency and energy density, implementing supply chain due diligence, and allowing greater recyclability and reusability



Source: European Commission and Bernstein analysis

US Executive Order 13817 — A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals

While the EU sets the gold standard in terms of sustainability and environmental regulation, US Executive Order 13817 — A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals — was passed in 2017 and addresses the issue from a national security angle. The US DOE sets strategic goals in the context of critical mineral and material supply chains, including developing technology to ensure greater supply chain resilience, supporting private sector adoption and capacity for sustainable domestic supply chains, fostering new capabilities to mitigate future supply chain challenges, and coordinating efforts with international partners.¹⁹

Although the US strategy lacks the same level of outward environmental objectives as the EU, the DOE's proposal discusses the development of circular battery value chains to retain the supply of critical minerals and metals. The strategy states that the DOE is well positioned to transform linear supply chains to fully realize opportunities for circularity and efficiency. Focus will be placed on connecting supply chains and fostering collaboration with industry and municipal waste management to integrate recycling and reuse strategies into supply chains.²⁰ The US DOE's ReCell center established a US\$5.5mn Battery Recycling Prize in 2019 (the same year the center was established) to incentivize the

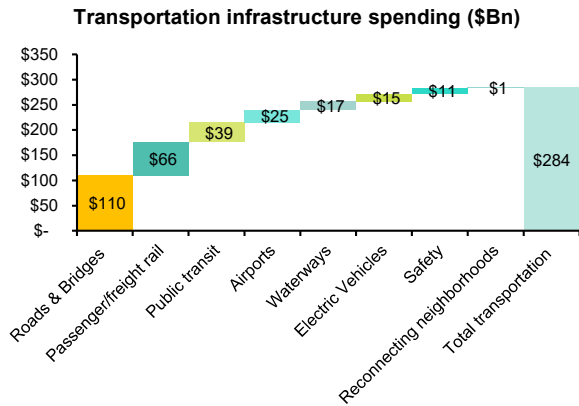
¹⁹ [U.S. Department of Energy's Strategy to Support Domestic Critical Mineral and Material Supply Chains](#)

²⁰ [U.S. Department of Energy's Strategy to Support Domestic Critical Mineral and Material Supply Chains](#) (pg. 21).

development of innovative ideas that will enable collection of 90% of all end-of-life lithium-ion batteries in the US for recycling.²¹

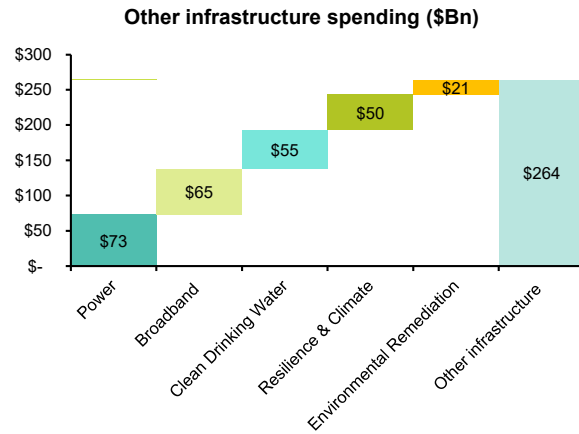
Lastly, in addition to the executive order on critical materials, the US government's more recent infrastructure bill proposed in 2021 also has a particular focus on the transportation sector, including a US\$15bn investment in EVs, as well as scaling up the power and clean energy infrastructure (see Exhibit 31 and Exhibit 32).²²

EXHIBIT 31: As part of the transportation infrastructure category, the bill proposes a US\$15bn investment in EVs...



Source: National Public Radio (NPR) and Bernstein analysis

EXHIBIT 32: ...as well as investments focused on power, clean energy, and electricity, all of which will require critical materials for electrification



Source: NPR and Bernstein analysis

LIFE CYCLE ANALYSIS OF EV BATTERIES

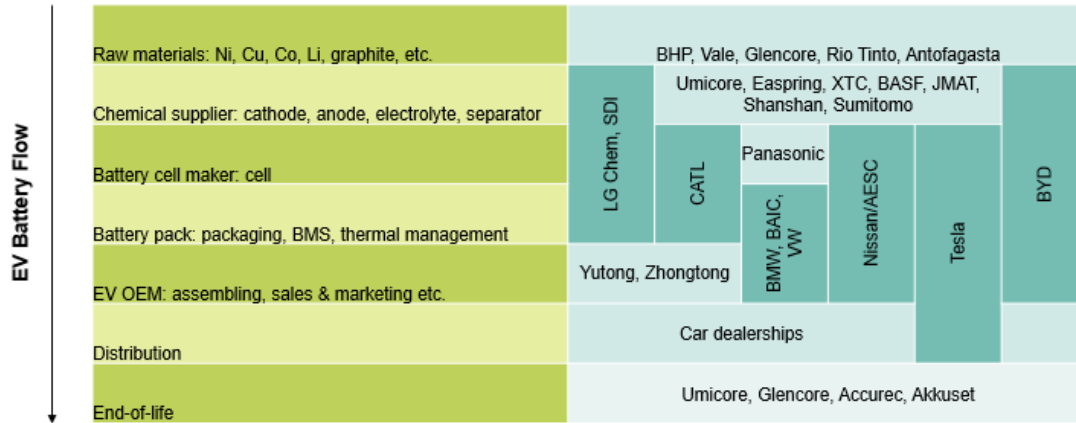
The key players in the EV supply chain consist of raw materials and mining companies, battery assembly & manufacturing companies, OEMs, and recycling companies at end of life²³ (see Exhibit 33).

²¹ Gaines et al. 2021. Direct Recycling R&D at the ReCell Center, *Recycling*. MDPI.

²² [Net Zero 101: Climate summit, Biden infrastructure bill, investor sentiment poll... all you need to know in one place](#)

²³ [Electric Revolution 2020: Supercharging the Next Decade \(Part 9\). Catalysts - How viable will EV battery recycling become?](#)

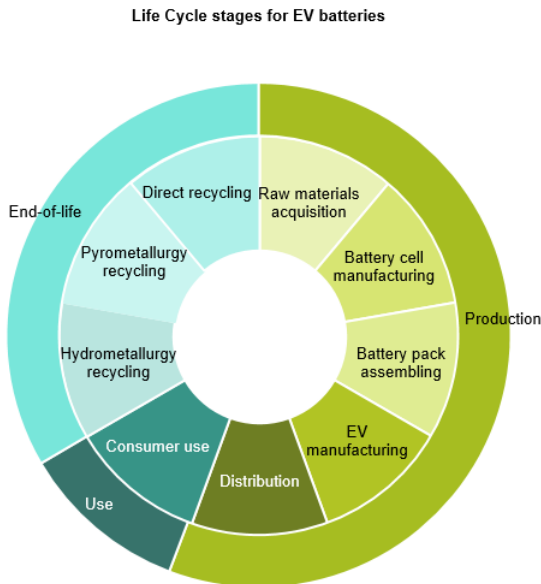
EXHIBIT 33: Key players in the EV battery supply chain as well as emerging players in the end-of-life phase



Source: World Economic Forum, Kelleher Research Study on Reuse and Recycling of Batteries, and Bernstein analysis

A life cycle analysis of an EV measures its environmental impact throughout the value chain. Although an entire life cycle analysis of an EV is not yet required from a regulatory perspective, we expect more regulatory focus on this issue and believe companies and investors should be prepared for more disclosure requirements down the road. Exhibit 34 shows a step-by-step diagram of each piece in the life cycle. While many studies have assessed the impacts of the production stage of EV batteries, there is a lack of research focusing on other stages, such as the end-of-life phase.

EXHIBIT 34: Relevant life cycle stages for EV batteries



Source: European Commission: Follow-up feasibility study on sustainable batteries and Bernstein analysis

Raw materials acquisition

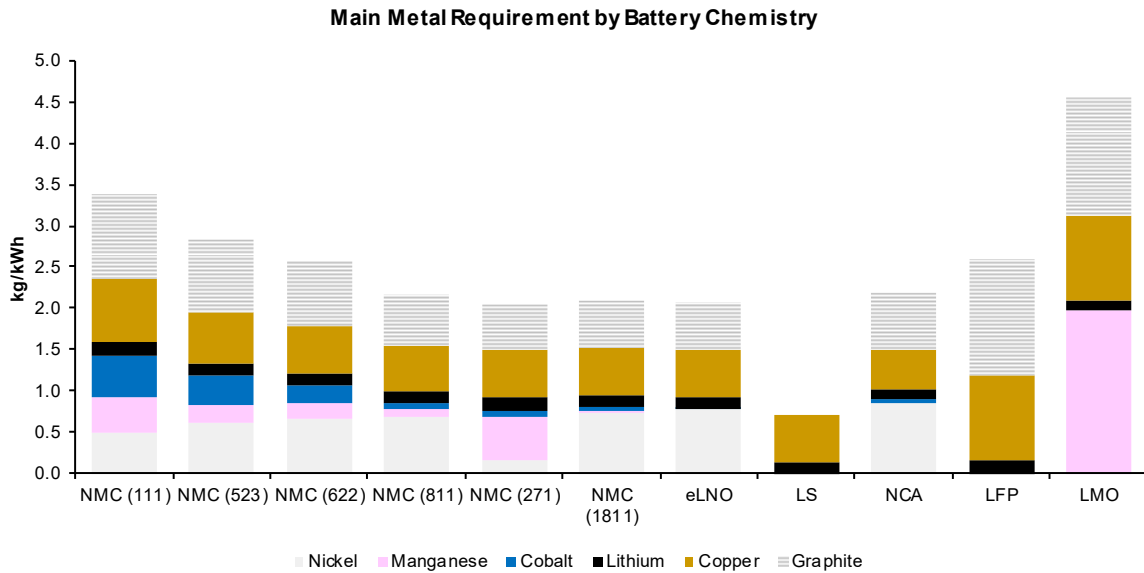
The first phase of a life cycle assessment analyzes the upstream production stage. A lot of focus in the EV market has shifted toward lithium-ion batteries, in particular nickel, manganese, cobalt (NMC) batteries because they feature higher energy density compared to batteries previously used in EV production.²⁴

During the upstream raw material sourcing stage, the transportation of batteries also has environmental impacts due to the areas they are typically sourced from, such as Congo, and the areas they are typically manufactured in, such as China. In addition, the current modes of transport (truck, tanker, and rail) are typically powered by oil or diesel, causing GHG emissions during the upstream transportation stage.

Exhibit 35 color codes the metals roughly by their native state and shows requirements by chemistry. Note copper is present in all batteries (and in the stator, inverter, and charger as well). Other metals vary in terms of dominance by chemistry type.

Said another way, battery chemistries can be found without cobalt, or without manganese, or without nickel, or with variable amounts of lithium and copper (but will always need some). Not all batteries are created equal in terms of commerciality, performance, safety, etc. But to the extent that batteries are substitutable, the cost of raw materials will influence decisions.

EXHIBIT 35: If we concentrate on the "metal/graphite" mass requirements, we see variation in mass needed and in composition depending on which chemistry technology wins; a 50kWh battery for a single EV requires <50kg to >200kg of these materials...

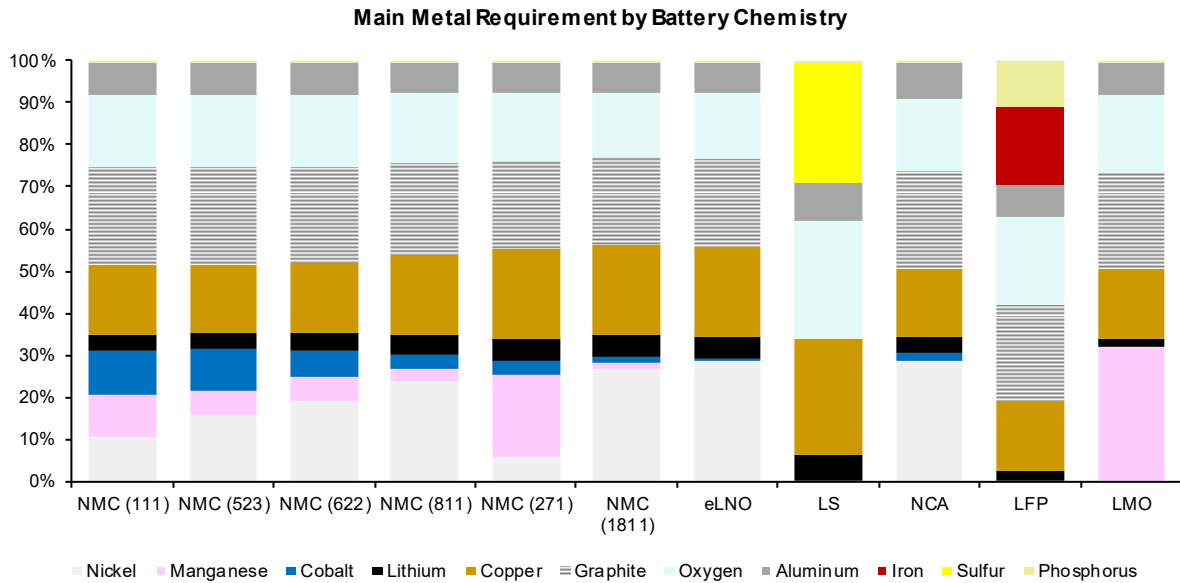


Source: Bernstein estimates (all data) and analysis

²⁴ Antonella Accardo, Giovanni Dotelli, Marco Luigi Musa and Ezio Spessa. 2021. "Life Cycle Assessment of an NMC Battery for Application to Electric Light-Duty Commercial Vehicles and Comparison with a Sodium-Nickel-Chloride Battery," *Journal of Applied Sciences*.

Exhibit 36 shows the complete chemistry, which allows the reader to guess the mnemonics of the battery chemistry: N = Nickel, M = Manganese, C = Cobalt, A = Aluminum, S = Sulfur, F = (F)errous Iron, P = Phosphorus. Numbers, of course, correspond to ratios (NMC523 is 5 parts Nickel, 2 parts Manganese, and 3 parts Cobalt).

EXHIBIT 36: ...shown as 100% of mass (including low-cost components)

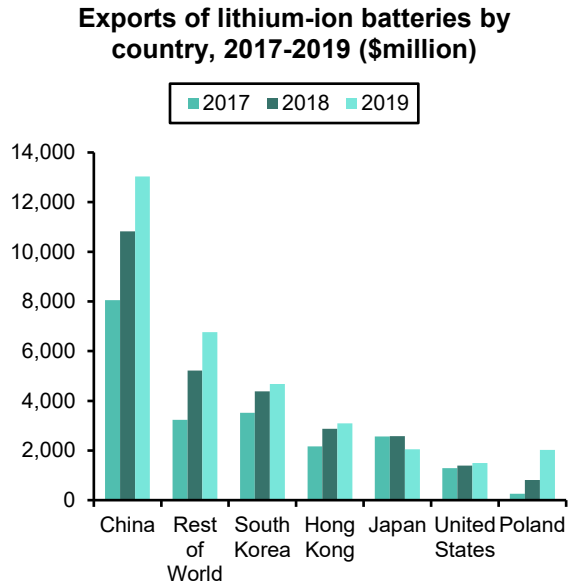


Source: Bernstein estimates (all data) and analysis

Distribution

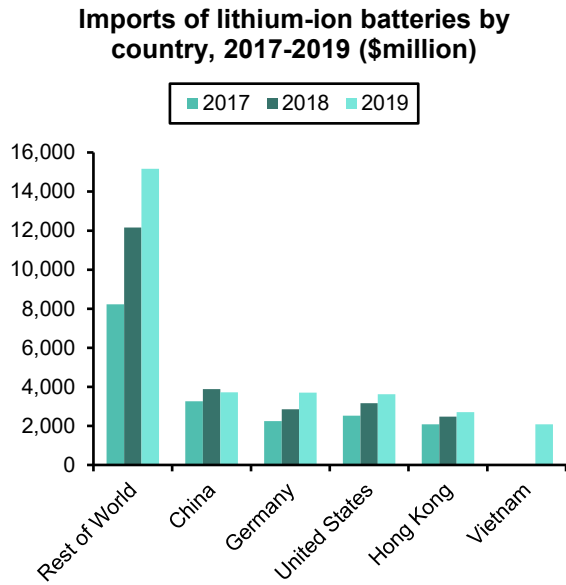
In addition to the emissions and environmental impact at the raw materials sourcing stage, the life cycle analysis also includes emissions during the distribution stage (from the battery manufacturer to the OEM). As shown in Exhibit 37, the main battery manufacturing and assembly companies such as LG Chem, Panasonic, and SDL are largely based in China. China (excluding Hong Kong) continues to lead the way in lithium-ion battery exports, while major importers of Li batteries are more fragmented (see Exhibit 37 and Exhibit 38). It's worth noting, however, that China cannot export cathode material to Europe due to Free Trade Agreements requiring 55-60% of the value of an EV to be produced locally. The cathode, which is likely to come from China, is the most valuable part of the battery. This has been a key issue for the cathode market in China, causing a supply glut in the market during the peak of the Covid-19 pandemic.

EXHIBIT 37: **China (excluding Hong Kong) continues to lead the way in Li battery exports...**



Source: United States International Trade Commission and Bernstein analysis

EXHIBIT 38: **...while major importers of Li batteries are more fragmented**

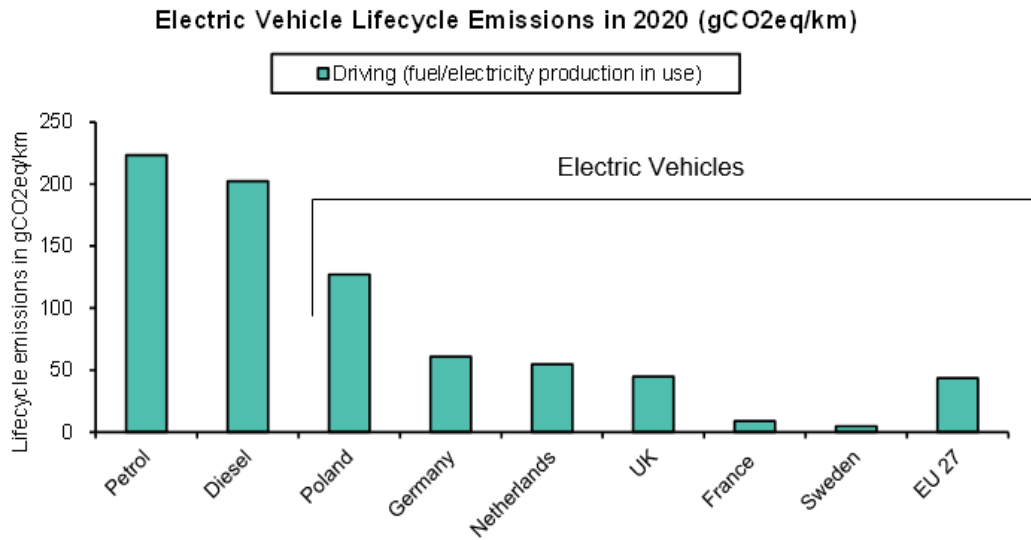


Source: United States International Trade Commission and Bernstein analysis

Use stage

The use stage is when the vehicle leaves the manufacturer and is transferred to the hands of the consumer. Although EVs have an environmental footprint during the beginning-of-life and end-of-life stages, their emissions during the use stage are lower than those of vehicles with petrol and diesel-based engines (see Exhibit 39). That said, emissions depend on the power mix in the local electricity grid. EVs in Poland, for example, where coal is a higher proportion of the power mix, generate much more emissions than EVs in Sweden.

EXHIBIT 39: EVs have a lower environmental impact during the "tank to wheel" phase compared to vehicles with petrol- and diesel-based engines



Note: Emissions based on EU electricity grid mix

Source: European Federation for Transport & Environment and Bernstein analysis

End of life

The end-of-life stage begins when the product is discarded by the user and ends when the product is returned to nature as a waste product or enters another product's life cycle (as a recycled input).²⁵ The typical recycling process involves smelting batteries in a furnace where the high-temperature process recovers an alloy of copper, cobalt, nickel, and iron but cannot recover graphite, electrolyte, or plastic materials (because they are burned)²⁶ (see Exhibit 40).

²⁵ <https://ec.europa.eu/environment/eussd/pdf/footprint/PEF%20methodology%20final%20draft.pdf>

²⁶ Accardo, Dotelli, Musa, Spessa. 2021. "Life Cycle Assessment of an NMC Battery for Application to Electric Light-Duty Commercial Vehicles and Comparison with a Sodium-Nickel-Chloride Battery." *Journal of Applied Sciences*.

EXHIBIT 40: **Recycling process for electric batteries**

Materials	Fate
Active Cathode Materials	Recycled
Graphite	Burned
Copper	Recycled
Aluminum	Landfill
Plastics	Burned
Lithium	Landfill
Carbon black	Burned
PVDF	Burned

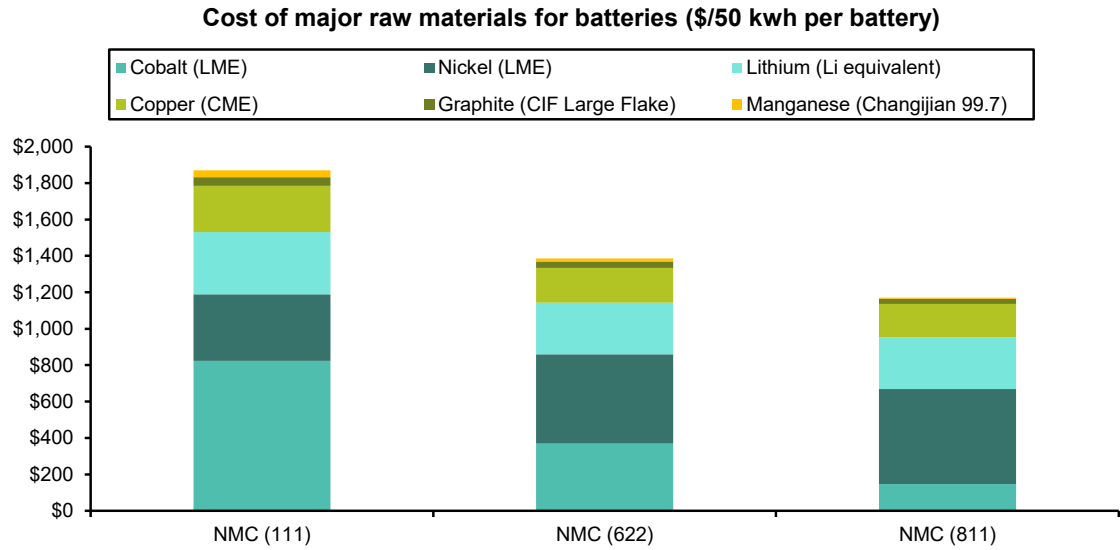
Source: "Life Cycle Assessment of an NMC Battery for Application to Electric Light-Duty Commercial Vehicles and Comparison with a Sodium-Nickel-Chloride Battery," *Journal of Applied Sciences* and Bernstein analysis

As mandatory recycling regulations have come into effect in the EU, interest has grown in the recovery of materials. Materials make up over half of the initial cell cost, and cathode materials are the largest contributor to the overall material cost; so, there is a financial incentive to recover cathode materials.²⁷ Cathode materials typically consist of cobalt (Co) as well as lithium (Li), nickel (Ni), and manganese (Mn). Our Global Metals & Mining team provides an analysis of the cost of raw materials in batteries,²⁸ showing the largest financial incentive in recovering the cobalt, nickel, and lithium that make up the cathode. The cathode metals range from US\$1,567 in NMC111 batteries to US\$1,160 in NMC622 batteries and US\$959 in NMC811 batteries. Outside of the cathode, copper is also typically recycled and makes up a solid portion of the cell cost — ranging from US\$255 in NMC111 to US\$191 in NMC622 and US\$183 in NMC811 batteries (see Exhibit 41).

²⁷ Lithium-Ion Battery Recycling Processes: Research towards a Sustainable Course
<https://www.osti.gov/servlets/purl/1558994>.

²⁸ [Climate Change Scenarios: What does battery metal demand look like in a 1.8 degree world?](#)

EXHIBIT 41: Given the high cost of raw materials for batteries, once recycling reaches scale, the market could make economic sense for OEMs



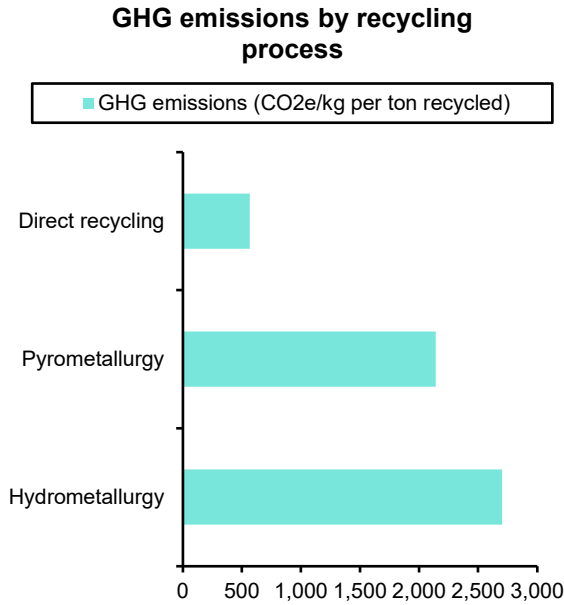
Source: Bernstein estimates (all data) and analysis

Direct recycling of lithium-ion batteries has lower environmental impacts compared to traditional recycling methods and is a promising method from a sustainability standpoint (see Exhibit 42 and Exhibit 43). Direct recycling is the recovery, regeneration, and reuse of battery components directly without breaking down the chemical structure. By maintaining the chemical structure of the original battery components, a lower-cost reconstructed material can be sold to battery manufacturers. This will, in turn, help reduce the cost of EV batteries and drive up the value of recycling EV batteries.²⁹ Moreover, various studies have discussed ways in which direct recycling is more effective than traditional methods because it recovers the cathode particle without decomposing it into substituent elements (see Exhibit 44).³⁰

²⁹ <https://recellcenter.org/>

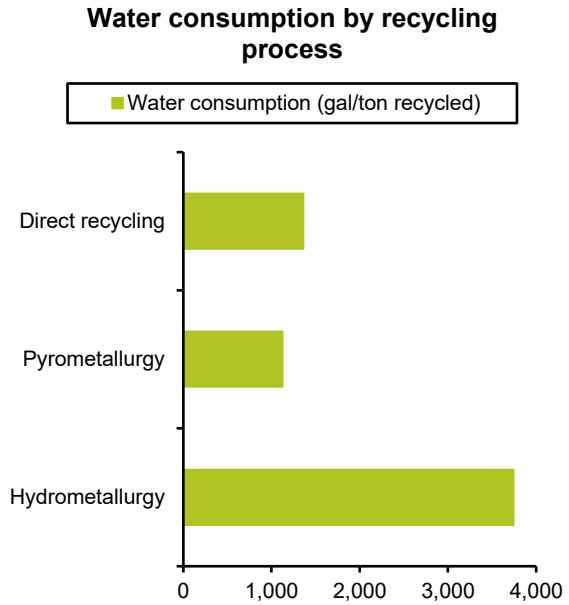
³⁰ <https://www.sciencedirect.com/science/article/pii/S2214993718300599>

EXHIBIT 42: **Direct recycling produces lower GHG emissions compared to other forms of recycling**



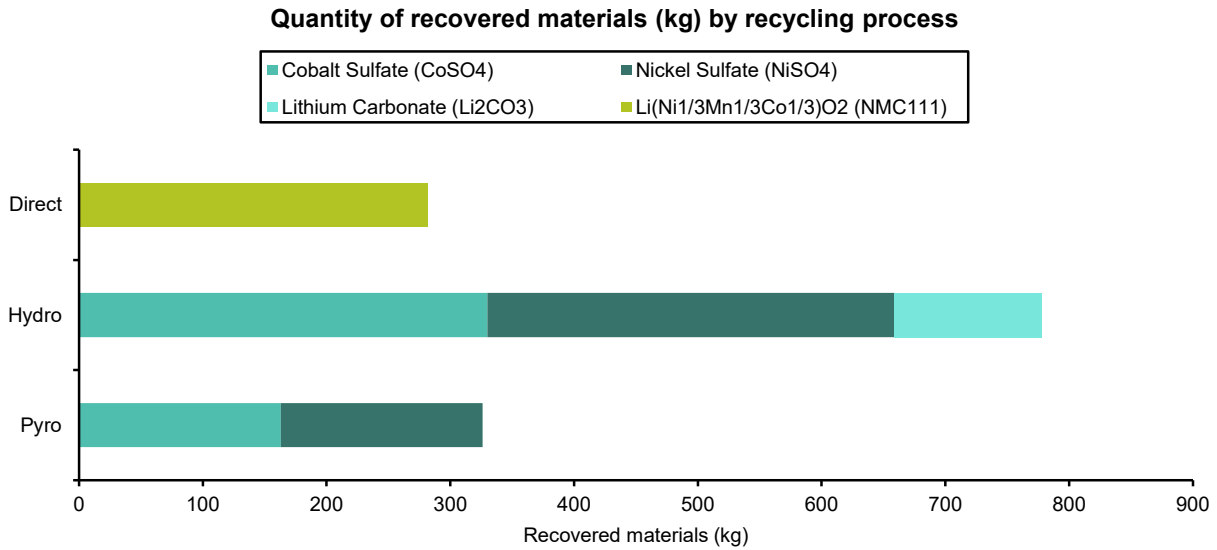
Source: Argonne National Laboratory and Bernstein analysis

EXHIBIT 43: **However, all three forms of recycling use a meaningful amount of water**



Source: Argonne National Laboratory and Bernstein analysis

EXHIBIT 44: **Direct recycling recovers less materials than hydrometallurgy but recovers more components of the NMC111 battery used in EVs**



Source: Argonne National Laboratory and Bernstein analysis

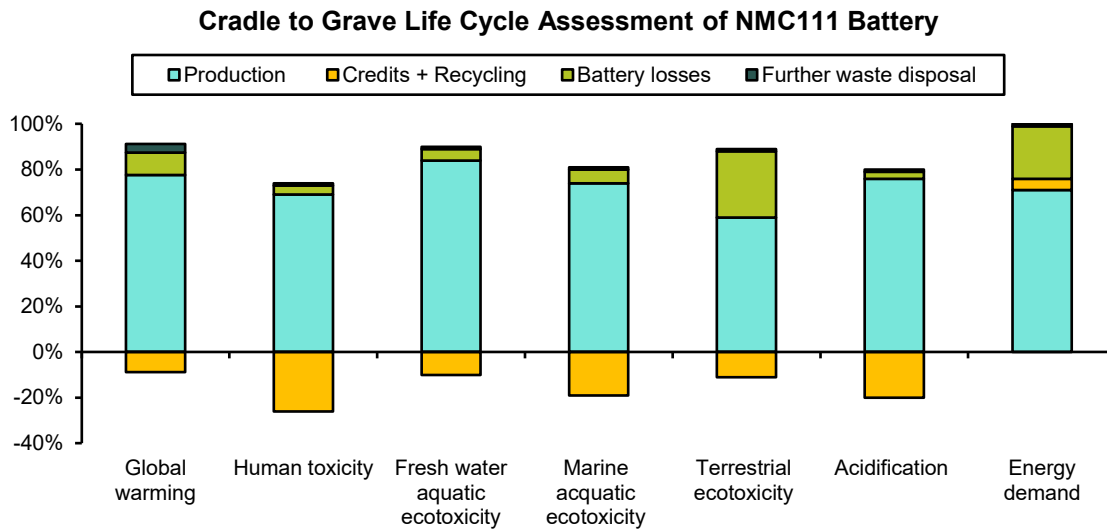
NET ENVIRONMENTAL AND BIODIVERSITY IMPACTS

We find the production and battery manufacturing stage of EV components has the greatest impact during the life cycle. Most previous studies focus on batteries' energy use and emissions in the life cycle analysis. We add to the discussion by looking at other

implications, such as biodiversity impacts of the EV battery chain, using a reference study from the *Journal of Applied Sciences*.³¹

For example, the analysis finds recycling of batteries (e.g., avoidance of virgin materials) helps lower marine and freshwater ecotoxicity, which is damaging to organisms and human health, given the concentration of metals as hazardous waste in coastal areas.³² Recycling also lowers the impact of acidification of oceans, where rising acidity causes bleaching of coral reefs, destroying natural ecosystems for many marine organisms³³ (see Exhibit 45).

EXHIBIT 45: The production and battery manufacturing stage of EV components has the greatest impact during the life cycle



Note: Transport refers to the collection and transport of used batteries; further disposal refers to the landfilling and incineration of materials; battery loss refers to the amount of electricity lost during the recharging phase over the lifespan of the battery; net recycling impact refers to the impact of the recycling process minus credits obtained by replacing virgin materials with recovered materials.

Source: *Journal of Applied Sciences* and Bernstein analysis

³¹ Accardo et al. 2021. "Life Cycle Assessment of an NMC Battery for Application to Electric Light-Duty Commercial Vehicles and Comparison with a Sodium-Nickel-Chloride Battery," *Journal of Applied Sciences*.

³² <https://scialert.net/fulltext/?doi=jas.2004.1.20>

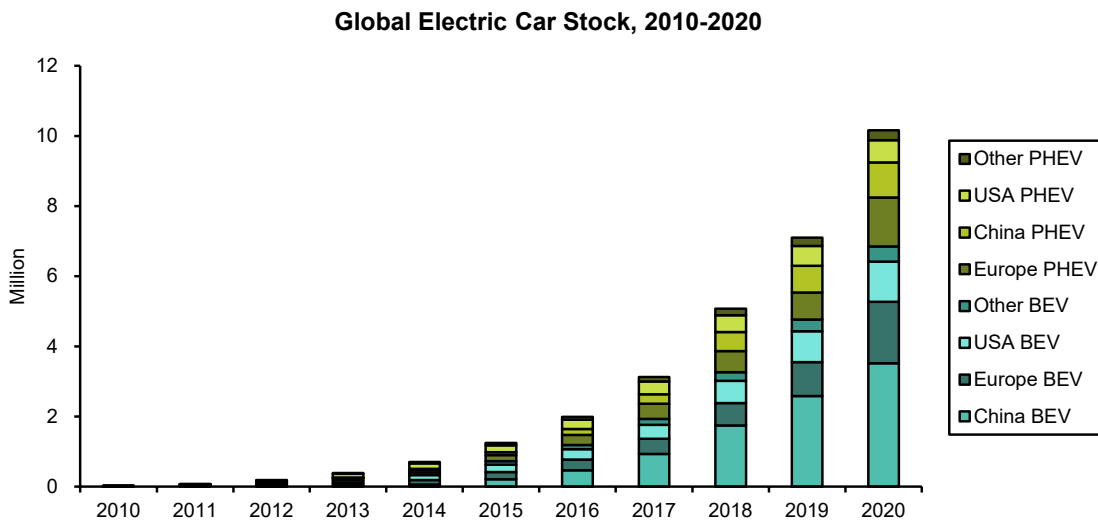
³³ <https://www.who.edu/press-room/news-release/scientists-identify-how-ocean-acidification-weakens-coral-skeletons/#:~:text=The%20rising%20acidity%20of%20the,corals%20to%20build%20their%20skeletons.&text=Corals%20grow%20their%20skeletons%20upward,thicken%20them%20to%20reinforce%20them.>

"SECOND-LIFE": CLOSING THE LOOP ON EV BATTERIES

Battery production has not yet reached the scale required for recycling to become economical.³⁴ The amount of recycling happening today is mostly due to regulatory requirements in the EU. In addition, there is only a small number of EVs reaching the end-of-life phase today, limiting the number of batteries available for recycling and re-manufacturing.

The average life of an EV is estimated to be ~13-20 years. Considering there were ~1.2 million EVs on the road in 2015, those EVs will reach the end-of-life stage by 2035. By 2040, the 10 million EVs on the road in 2020 will reach their end of life (see Exhibit 46). Although battery recycling hasn't reached the scale needed to be economical today, it could become a meaningful market down the road. The average life of an EV battery is about 8-10 years,³⁵ so demand for replacement batteries means recycling could reach scale for batteries sooner than for all other EV components.

EXHIBIT 46: More than 1 million EVs were on the road in 2015, and more than 10 million in 2020, with BEVs driving the expansion



Note: BEVs = battery electric vehicles. PHEVs = plug-in hybrid electric vehicles.

Source: IEA Energy Outlook 2021 and Bernstein analysis

CIRCULAR EV BATTERY VALUE CHAIN

Although EV batteries are currently recycled, it is still a highly fragmented process and not yet cost efficient.³⁶ But the question is when — not whether — battery recycling will become economical, and the timeline hinges mostly on when large battery packs in EVs will start to

³⁴ <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/second-life-ev-batteries-the-newest-value-pool-in-energy-storage>

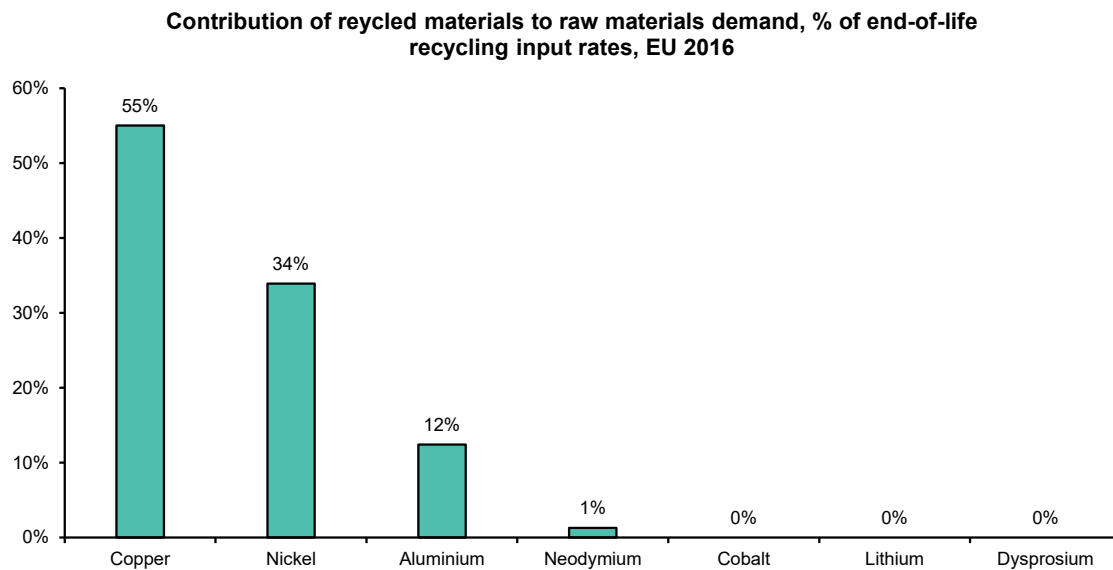
³⁵ Bernstein estimates and analysis — Global Autos, European Industrial & Consumer Chemicals.

³⁶ National Renewable Energy Laboratory (NREL).

enter the reuse/recycling market.³⁷ High-performance recycling of EV batteries could provide approximately 10% of key battery materials, which would be worth approximately US\$10bn, based on current value. This value is predicted to grow fourfold until 2040. Ultimately, most batteries will need to be recycled for regulatory and environmental reasons in major markets.³⁸

Recycled copper contributed to 55% of the EU's raw material demand in 2016, with nickel following at 34%. Other materials used in the EV battery (lithium and cobalt) contributed to 0% of recycled inputs. Other recycled rare earth metals used in EV electric motors, such as neodymium, contributed to 1% of raw metal demand (see Exhibit 47).

EXHIBIT 47: In 2016, recycled copper contributed to 55% of the EU's raw material demand, with nickel following at 34%; other materials used in the EV battery (lithium and cobalt) contributed to 0% of recycled inputs



Source: Eurostat Data and Bernstein analysis

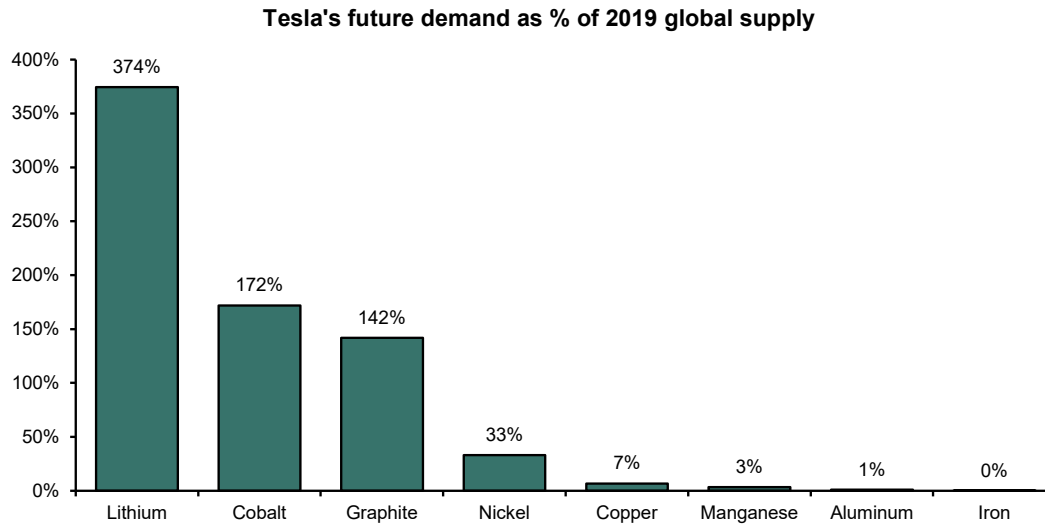
While lithium and cobalt currently contribute to 0% of recycled inputs, demand is expected to increase most significantly for these two metals. Our Global Metals & Mining team's analysis of Tesla's future demand is a small snapshot of what the future demand could look like.³⁹ Tesla would need nearly four times as much lithium as is currently produced globally, and twice as much cobalt (see Exhibit 48). This is just our forecast for one company — it doesn't account for demand from other OEMs as well as other sectors where battery is a key input. If anything, we need more recycled materials in the supply chain to meet the increasing demand.

³⁷ <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/second-life-ev-batteries-the-newest-value-pool-in-energy-storage>

³⁸ World Economic Forum. Framework for Global Batteries.

³⁹ [TSLA: Who could/should Tesla buy, if anyone? An OEM, battery maker, miner...?](#)

EXHIBIT 48: Tesla's future metal demand is one small indicator of the potential future demand for lithium and cobalt, calling for more recycled materials to be used in the battery supply chain



Source: Bernstein estimates (all data) and analysis

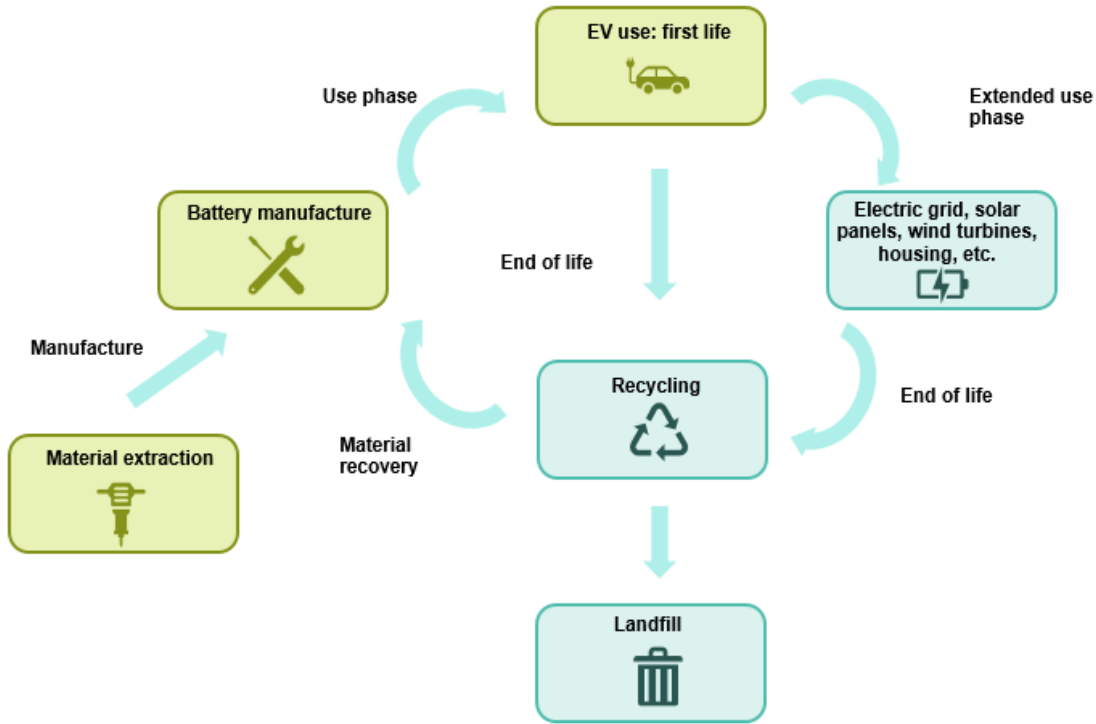
How would a circular supply chain work in practice?

Reuse of batteries in EVs or other second-life applications. In practice, after the first life, the battery's health and capacity are checked to see if it can: (1) be used in a different vehicle (going through the recycling and remanufacturing phase), or (2) be used in a stationary application (to be used in another electric product such as a wind turbine), or (3) if it needs to be recycled directly. If a second life is possible, the battery is refurbished.⁴⁰ The repurposing of used EV batteries (for second life in stationary applications) could provide 60GWh/year by 2030 and up to 6% of stationary power storage capacity demand globally in 2030.⁴¹ A circular value chain will require thinking outside the box to make a product compatible with mass electrification at large (see Exhibit 49).

⁴⁰ Olsson et al., 2018. "Circular Business Models for Extended EV Battery Life," *Batteries*.

⁴¹ World Economic Forum – Global Battery Framework.

EXHIBIT 49: There are various possible pathways for EV batteries after the "first life," including reuse in another EV, secondary application for different equipment, and/or recycling



Source: "Enabling sustainable critical materials for battery storage through efficient recycling and improved design: A perspective," *MRS Energy & Sustainability* and Bernstein analysis

Research carried out by NREL in 2015 suggests EV batteries could last an additional 10 years in energy storage applications after first life, 30 years in power support for EV charging stations, 12 years in home energy storage, and 6-12 years in grid-oriented service (see Exhibit 50).

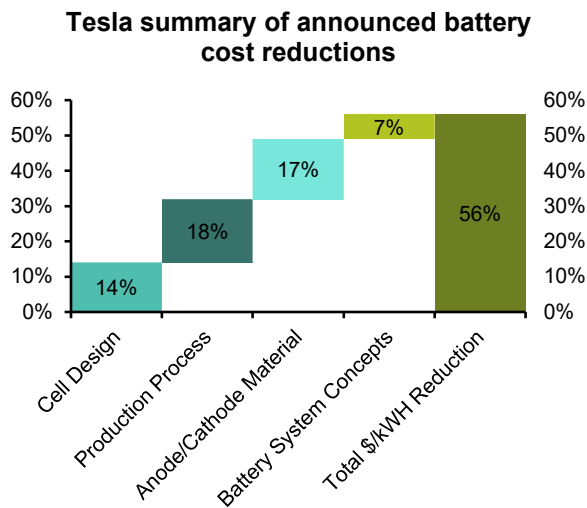
EXHIBIT 50: Lifespans reported for EVs in reuse applications

Second Life Application of EV Battery	Additional Years of Lifespan After First Use in EV
Energy Storage Systems (ESS)	EV batteries lose an additional 15% of capacity after an additional 10 years of use
Power support to fast EV charging stations	30 years
Home Energy Storage	12 years
Grid oriented service (area regulation and transmission deferral)	6-12 years
Miscellaneous applications	3-15 years and 8-20 years depending on application

Source: Kelleher Research Study on Reuse and Recycling of Batteries, NREL, and Bernstein analysis

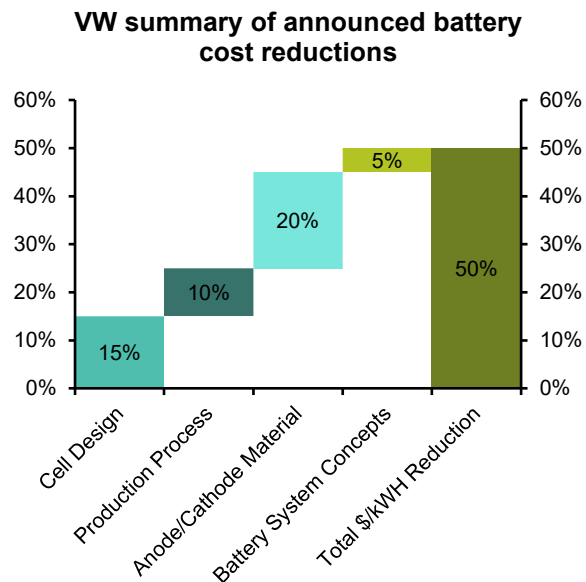
Circular design. A current structural challenge for battery recycling and reusability is the variety of EV models on the market. To recirculate a battery into the supply chain, the end product at end-of-life must be compatible with the product at beginning-of-life. A circular business model requires more thoughtful planning at the product design stage. Both Tesla (covered by Bernstein's US Electric Vehicles analyst Toni Sacconaghi) and Volkswagen (covered by Bernstein's European Autos analyst Arndt Ellinghorst) are adopting a circular design mindset, which could unlock meaningful cost-saving opportunities (see Exhibit 51 and Exhibit 52).⁴²

EXHIBIT 51: Tesla announced battery cost reductions at the design (14%), production (18%), and material stages (17%)



Source: Company report and Bernstein analysis

EXHIBIT 52: Volkswagen pledged 15% cost reduction in design, 10% reduction in production process, and 20% reduction in material



Source: Company report and Bernstein analysis

Enhanced communication. Another key factor for a circular EV battery chain is greater communication across the supply chain – starting from the upstream phase all the way to the end-of-life phase. In the past, individuals collecting materials at the end-of-life stage did not have a great understanding of how to dismantle or refurbish a product, not to mention potential safety issues. However, greater communication can enable better coordination across the value chain.

EU's new Ecolabel initiative develops product sustainability standards, and the proposals on sustainable batteries include requirements for providing information about batteries and cells to allow repair, reuse, and remanufacturing.⁴³ The proposal is that the individual battery should carry at all levels (battery system, battery pack, and module) a bar code or a QR code with a European Article Number (EAN) and serial number. This code provides access to a central European database with information on batteries and cells. It's the

⁴² [TSLA Battery Day vs VW Power Day: Comparing and Contrasting the Two EV Heavyweights](#)

⁴³ <https://ecodesignbatteries.eu/documents>

manufacturer's or supplier's responsibility to provide and update the information in this database, including:

- Level 1: Public access
 - Carbon footprint information in CO₂ equivalent terms
 - Battery manufacturer, battery type, and chemistry
 - Percentage of recycled materials used in the cathode and anode material
 - Reference to a recycling method that can be used
- Level 2: Data available to third-party accredited professionals
 - Performance data
 - Battery Management System (BMS)-related data
 - Repair and dismantling information
- Level 3: Compliance (information available for market surveillance authorities only, protected access for intellectual property reasons)

Battery passports. In addition to enhanced technologies around battery traceability, existing research also discusses the introduction of a battery passport to increase supply chain transparency. A battery passport would be linked to the physical battery as it moves through its first life into potential second-life applications until the battery or its component parts reach the end of life and are transferred to high-value recycling. Such a digital product passport would allow such information to be stored and shared with multiple actors and facilitate accurate categorization of potential reuse, repurposing, and recycling of EV batteries.⁴⁴

Working with standardization institutions to develop standards for what constitutes a circular product or service and how to assess it, incorporating the product design and business model perspective.⁴⁵

- **International Organization for Standardization (ISO):** The ISO sets the benchmark for conducting life cycle analysis. The ISO International Standards support sustainable industrialization through internationally agreed upon specifications that meet quality, safety, and sustainability requirements.⁴⁶ ISO 14001 specifies requirements for an environmental management system that an organization can use to enhance its environmental performance. Other standards in the framework focus on specific approaches such as audits, communications, labeling, and life cycle analysis, as well as environmental challenges such as climate change.⁴⁷ ISO 14001 certification is also included in the Task Force on Climate-Related Financial Disclosures (TCFD), which requires companies to disclose their number of ISO 14001 certified sites. At the company level, Volkswagen leads auto producers with 107 production sites that are

⁴⁴ World Economic Forum. Framework for Global Batteries.

⁴⁵ <https://pacecircular.org/sites/default/files/2021-04/cep-roadmap.pdf>

⁴⁶ <https://www.iso.org/sdg/SDG09.html>

⁴⁷ <https://www.iso.org/iso-14001-environmental-management.html>

ISO certified (out of a total 118 production plants),⁴⁸ while BMW has 29 out of a total 31 production sites.⁴⁹

Circularity is at the heart of the proposal on sustainable products. As seen in the life cycle analysis, the environmental impact of batteries is larger in early stages of their life cycle, namely the extraction of materials and the manufacturing process. Higher material efficiency of battery value chains will lead to reduced extractive activities and an overall reduction of the environmental impact.⁵⁰

SECTOR IMPLICATIONS

GLOBAL AUTOS

Repurposing EV batteries for a second life

BEVs promise zero tailpipe emissions, but considering the emissions and resource impact of battery production, it has become increasingly important for OEMs to reflect on the environmental impact that comes with EV batteries (see Exhibit 53). For OEMs, there is an increased focus on repurposing EV batteries after their useful lives.

Generally, the lifespan of an EV battery is 8-10 years, and it is considered beyond its useful life when it no longer meets EV performance standards, which typically include: (1) maintaining at least 80% of total usable capacity; and (2) achieving a resting self-discharge rate of less than 5% over 24 hours. During their in-car tenure, however, EV batteries live a tough life, facing extreme operating temperatures, hundreds of partial cycles, and changing discharge rates. This results in EV batteries degrading quickly in the first five years of operation. That said, EV batteries aren't worthless once their time in a vehicle is up. While optimal battery performance is a major issue in-car, OEMs can often repurpose used EV batteries for less demanding applications such as stationary energy storage services.

Broadly, we've identified three main ways to repurpose EV batteries:

- **Grid-scale, Commercial & Industrial (C&I), or residential energy storage:** Decommissioned EV batteries can be used as backup power supply to support the grid, C&I purposes, or even at home as part of larger energy storage systems. Batteries can also be combined in large quantities to produce load-leveling for inherently inconsistent renewable energy sources such as PV solar/wind turbines, which makes them more viable while reducing the environmental impact of the battery's original manufacturing process from end to end.
- **Power support to EV fast-charging stations:** A significant amount of power is required for fast charging, especially if multiple vehicles are being charged simultaneously. This typically requires fast-charging stations to be supported by actual distribution grids.

⁴⁸ <https://www.volkswagenag.com/en/group/portrait-and-production-plants.html>

⁴⁹ <https://www.bmwgroup-werke.com/en.html>

⁵⁰ https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_2311

Used EV batteries can be installed as auxiliary power supply in charging stations to support the grid during high peak power demands.

- **Other less strenuous applications:** Some OEMs have remanufactured EV batteries for less critical applications such as for use in battery-powered forklifts, golf carts, and street lamps.

Exhibit 54 showcases how some OEMs are repurposing EV batteries.

What about recycling? Current regulation puts more pressure on battery manufacturers

As OEMs ramp up volumes *en masse* and race toward electrification, it will be important to take measures to avoid shortages of key metals such as cobalt, nickel, manganese, and rare earth elements used in the production of EV batteries as well as electric motors. Some vehicle manufacturers have made claims about either the elimination or reduction of rare earth element content in their electric motors.⁵¹ Recycling is another option. However, currently, this area is primarily policy-driven and focused on the concept of extended producer responsibility (EPR), i.e., making the battery manufacturer responsible for waste management. While there are key pieces of legislation already in place, the latest regulatory developments suggest a renewed interest in addressing second-life use cases (see Exhibit 55).

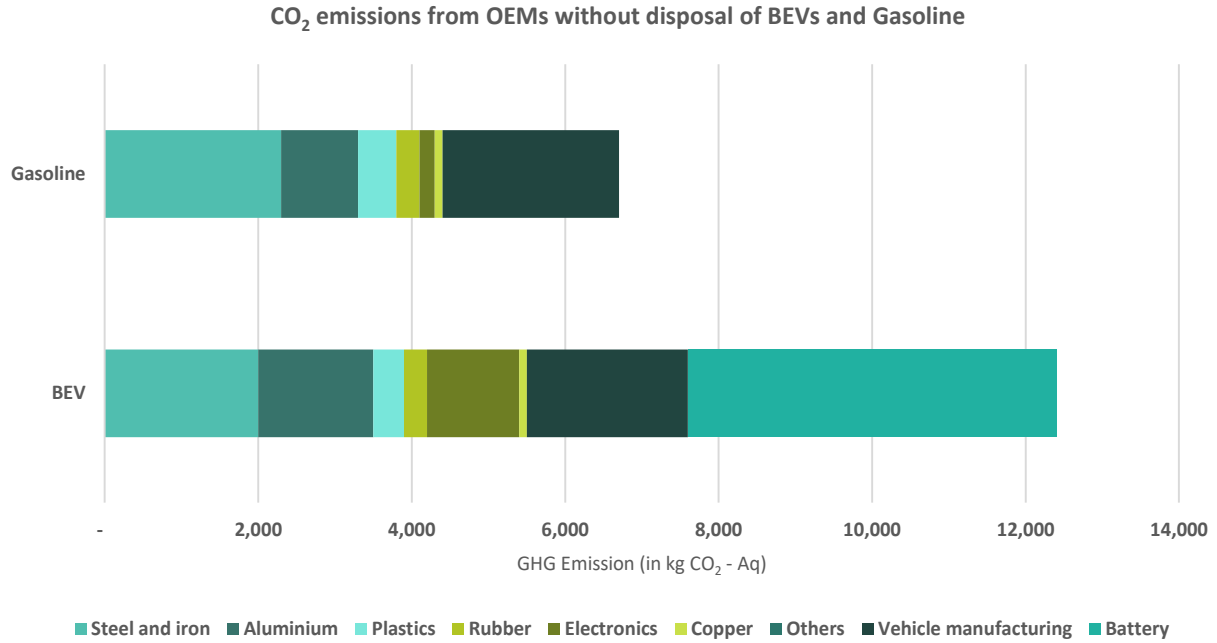
- **Europe:** In December 2020, the European Commission proposed a comprehensive regulatory framework to replace the existing Battery Directive. Importantly, the new proposal covers: (1) **second life of batteries** as a waste treatment operation; (2) **recycling efficiency rates** of 65% by 2025 and 70% by 2030; and (3) **mandatory declaration of levels of recycled content** in batteries by 2024, and **mandatory levels of recycled content** by 2030, to name a few.
- **China:** More focused on recycling to reduce import reliance for lithium and other materials. The Ministry of Industry and Information Technology (MIIT) and six other authorities jointly issued the Interim Measures for the Management of Recycling and Utilization of Power Batteries of New Energy Vehicles in January 2018 (Interim Measures), which require battery manufacturers to establish: (1) battery recycling channels (as they are responsible for recycling used batteries); and (2) recycling service outlets, which are responsible for collecting used power storage batteries. This mirrors the EPR regime in the EU.
- **US:** A recent federal proposal seeks to facilitate reuse of EV batteries after they are removed from vehicles and before they are discarded. While there is currently a lack of action at the federal level, piecemeal state-wise frameworks are in place, with states such as California, Texas, and Wisconsin having battery disposal/recycling laws on the books, while Florida, New York, Minnesota, and New Jersey have enacted EPR laws shifting the cost of waste management/recycling back to battery producers.

Unsurprisingly, Europe has done most work in terms of regulation over the full value chain. However, part of the problem is that most emissions don't originate in the EU but in Asia

⁵¹ For further reading: [Industrials and Materials Blast: How Rare Earth Elements Impact Electric Vehicles](#).

and Africa, and the EU only accounts for a fraction of global auto sales. Concerted efforts on a global level are important to lower environmental impact meaningfully across the EV life cycle.

EXHIBIT 53: Well-to-wheel CO₂ emissions of different powertrains; BEVs consume materially more CO₂ in the manufacturing process, and the bulk of it is attributed to the battery



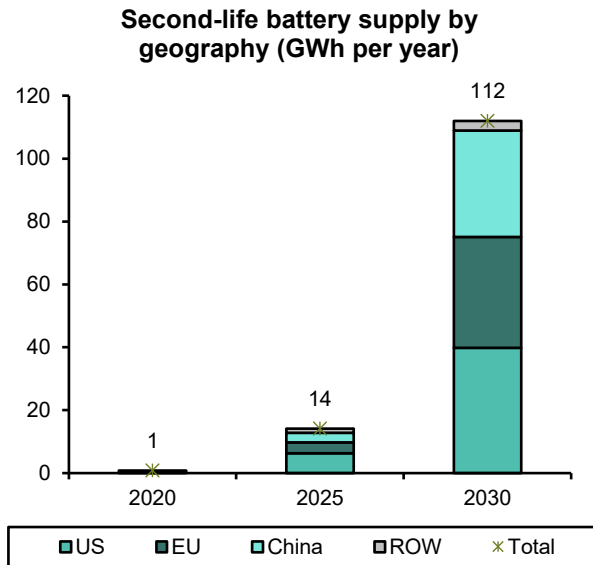
Source: Aurora Verkehrswende and Bernstein analysis

EXHIBIT 54: **Examples of how OEMs are repurposing EV batteries**

OEM	Re-use and second life applications
Audi	<ul style="list-style-type: none"> • Energy storage test installation at EUREF research campus • Berlin 'Audi Brand Experience Centre' at Munich airport uses old Audi EV batteries for energy storage
BJEV	<ul style="list-style-type: none"> • EV-charging, backup power
BMW	<ul style="list-style-type: none"> • Grid-scale energy storage • EV-charging • BMW re-purposes EV batteries at many global plants
BYD	<ul style="list-style-type: none"> • Grid-scale energy storage, backup power
Changan	<ul style="list-style-type: none"> • Backup power
Daimler	<ul style="list-style-type: none"> • Grid-scale energy storage, C&I energy storage
General Motors	<ul style="list-style-type: none"> • Remanufacturing
Great Wall Motor	<ul style="list-style-type: none"> • Backup power
Honda	<ul style="list-style-type: none"> • Renewable energy storage partnership in Europe with Societe Nouvelle d'Affinage des Metaux (SNAM)
Hyundai	<ul style="list-style-type: none"> • Grid-scale energy storage, C&I energy storage
Renault Nissan Mitsubishi	<ul style="list-style-type: none"> • C&I energy storage, residential energy storage, grid-scale energy storage • EV-charging • Nissan-Sumitomo Corporation JV with 4R Energy Corporation for re-use or less critical applications such as forklifts, golf carts and streetlamps • Energy storage project with Smarthubs/Connected Energy in the UK • Energy storage project with Advanced Battery Storage in France • Nissan repurposes batteries at North American facilities
PSA	<ul style="list-style-type: none"> • C&I energy storage
SAIC	<ul style="list-style-type: none"> • Backup power
Toyota	<ul style="list-style-type: none"> • C&I energy storage, grid-scale energy storage (NiMH)
VW Group	<ul style="list-style-type: none"> • C&I energy storage
Volvo	<ul style="list-style-type: none"> • Residential energy storage • Energy Storage project with Volvo Buses in partnership with Stena Recycling subsidiary Batteryloop • Energy Storage with Volvo Buses and Stena Fastigheter

Source: Automotive from Ultima Media and Bernstein analysis

EXHIBIT 55: With rapid rise of EV production, second-life lithium-ion battery supply is expected to be 100-200GWh/year by 2030, with broadly even split between the US, China, and Europe



Source: McKinsey estimates and Bernstein analysis

GLOBAL METALS & MINING

In terms of metals & mining, we argue that while a circular economy and recycling of battery components will compete for mined metals in the long run, these overall trends are bullish in the short run. Given typical mine lives of, say, 20-40 years, one could accurately state that the mines which will compete with metals from a circular economy have not yet even been found. In the meantime, strong price signals for "green" metals provide attractive returns for existing mines.

We have discussed in detail two metals — copper and nickel (given their relative importance as well as the ability to find equity exposure) — but acknowledge further work could be done on lithium and graphite, for example. For details, see:

[Global Metals & Mining: Green copper demand to rise faster than we originally forecast](#)

[Global Metals & Mining: King Copper once and future](#)

[Global Metals & Mining Primer: Nickel is a first class ticket to the EV revolution](#)

EUROPEAN INDUSTRIAL & CONSUMER CHEMICALS

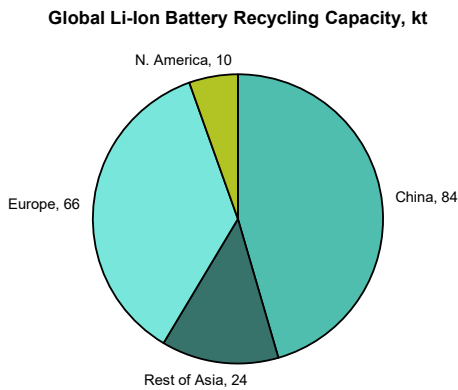
What's the opportunity for European chemicals?

Catalyst manufacturers are acutely aware of the opportunity in EV recycling and the environmental benefit, but also see it as a way to ensure security and price stability to their supply of rare earth metals. IEA estimates global recycling capacity for Li-ion batteries to be ~180kt p.a., with China having the largest share at 84kt, closely followed by Europe with 66kt, North America with 10kt, and Rest of Asia with 24kt (see Exhibit 56). It is possible,

however, that China may have more unreported EV recycling facilities, and therefore, this number could be even larger.

Umicore's 7kt battery recycling facility – a measure of weight broken down into dismantled EVs and electronics to cell level – is one of the largest in Europe to recycle EVs, alongside Glencore (covered by Bernstein's Global Metals & Mining team), which has a 7kt cell capacity facility based in Switzerland (see Exhibit 57). We believe **Johnson Matthey (JMAT)** is also well positioned for growth in this market due to its position as the world's largest platinum group metals (PGM) metal refiner. Although it has not announced plans to build a recycling facility, it signed an MoU in April 2021 with Stena Recycling group, a Swedish industrial recycler, to develop a European EV recycling value chain. In March 2020, **BASF** signed a letter of intent with Fortum and Nor Nickel to plan a battery recycling cluster in Harjavalta, Finland, specifically for the EV market using hydrometallurgical processing. The company also announced this year that it would build a battery recycling prototype plant at their cathode plant in Germany.

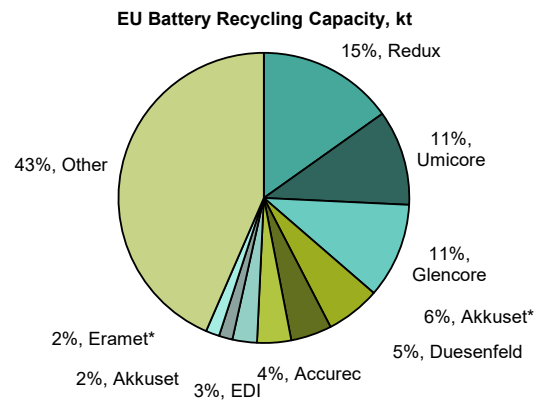
EXHIBIT 56: **China dominates battery recycling capacity**



Note: Data is installed and due to come online in 2021

Source: IEA estimates and Bernstein analysis

EXHIBIT 57: **Redux, Umicore and Glencore are the largest players in the EU**



*Akkuset Oy has 4kt (6%) which can recycle only NiCd, NiMH and Zn alkaline. 1kt (4%) can recycle Li-ion batteries. Assumes Eramet 20kt has only 5% Li-Ion recycling capacity.

Source: Kelleher Research, University of Warwick, and Bernstein analysis

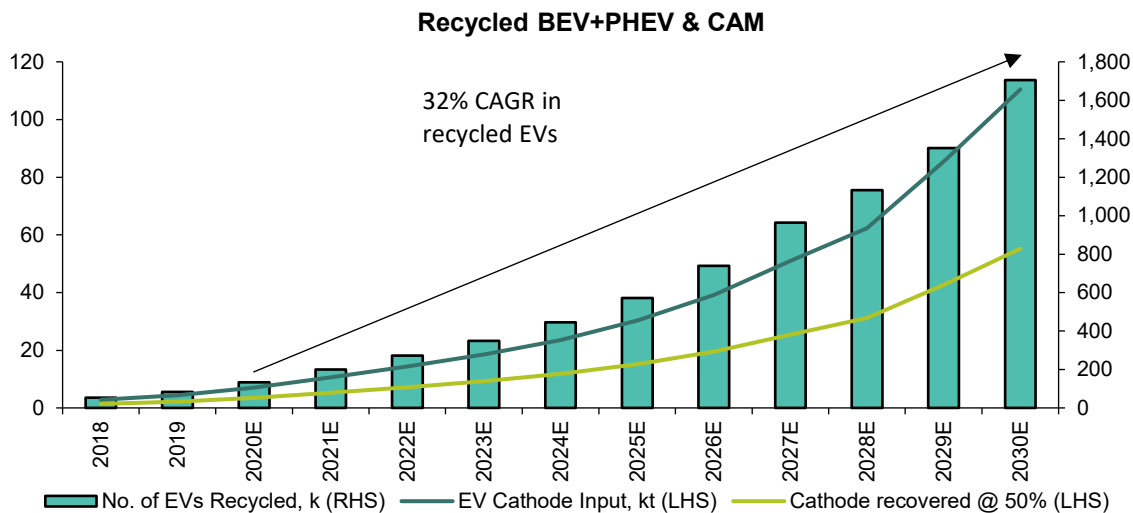
Recycling capacity needs to grow ~3x globally by 2030 to meet demand

As outlined earlier, automotive OEMs consider EV batteries beyond their useful life when they: (1) no longer maintain at least 80% of total usable capacity; and (2) show a resting self-discharge rate of more than 5% over 24 hours. Typically, they last 8-10 years depending on driving habits and environment. Circular Energy Storage, a battery recycling consultancy, estimates that by 2030, 24% of EVs will have reached their end of life and will be available for recycling, with the remaining 76% going to either second-life uses (predominantly home energy storage) or to scrap. Based on their estimates and forecasts for EV evolution, this would mean ~340kt of EV battery cells will be available for recycling by 2030 (we estimate this to be equivalent to ~1.7 million EVs), and therefore recycling capacity would need to globally increase by ~2x.

To estimate the equivalent cathode active material (CAM) obtained from these batteries, we assumed end-of-life batteries were 10 years old and, therefore, lagged the energy density (average across BEVs and PHEVs) of cathodes and cells by 10 years, to infer the quantity of CAM input. Based on this, we estimate **CAM available for recycling will reach 110kt in 2030 equivalent to ~1.7 million EVs.**

The amount of CAM recovered depends on the process used and the type of chemistry of cells recycled. Fortum estimates recovery rates of 50-80% for hydrometallurgical recycling; however, startups with innovative technologies, such as American Manganese (not covered), estimate their hybrid direct-hydrometallurgical can recover 99.8% in testing. Conservatively assuming 50% is recovered by 2030, this could imply 55kt of available CAM (see Exhibit 58).

EXHIBIT 58: Recycled EVs will reach ~1.7 million EVs by 2030 and supply 55kt of CAM, assuming a 50% recovery rate



Note: Cathode input lags energy density and battery size by 10 years.

Source: Circular Storage estimate (for recycled cells), and Bernstein estimates (for cathode and number of EVs) and analysis

Proposed EU regulation

The European Commission proposed an amendment to the Battery Directive in December 2020. This included mandatory recycling requirements for all batteries produced in and imported into the EU as well as minimum content of recycled materials, carbon footprint disclosure, performance and durability labeling, and collection and recycling efficiency targets.

- **Mandatory share of EV metal content from recycling.** The proposal is for EV active material to contain 12% cobalt, 4% lithium, and 4% nickel from recycled sources by 2030, increasing to 20%, 10%, and 12%, respectively, by 2035. This suggests only 5% of NMC622 cathode, and 4% of NMC811 (Umicore chemistries), eLNO (JMAT's chemistry), and NCA (BASF's main chemistry) must come from recycled material,

increasing to 11% for NMC622 and 811, and 12% for NCA and eLNO 2035 (see Exhibit 59). For LFP, the rules are negligible due to low lithium content.

- **Other targets:** Recycling rate targets of 65-75% (versus 24% assumed in our model), potential mandatory collection rates and mandatory metal recovery rates of 90% (35% of lithium) by 2025, increasing to 95% (70% of lithium) by 2030 have also been proposed. This compares to recovery rates estimated at 40-80% estimated from current technology. Mandatory carbon footprint disclosures and supply chain diligence will also support recycling.

The intention of the regulation is to ensure security of supply within Europe. However, as we have seen, recycling capacity is very small in Europe, and Asia is likely in a better position to provide these recycled metals. Furthermore, having targets 10-15 years out are unlikely to provide incentive for cathode manufacturers now. Instead, the intention to establish a closed loop is likely to drive a higher share of cathode from recycled metals.

EXHIBIT 59: Minimum recycling rates imply a very small share of the cathode needs to come from recycled materials; "closed loop" targets will drive demand above this level

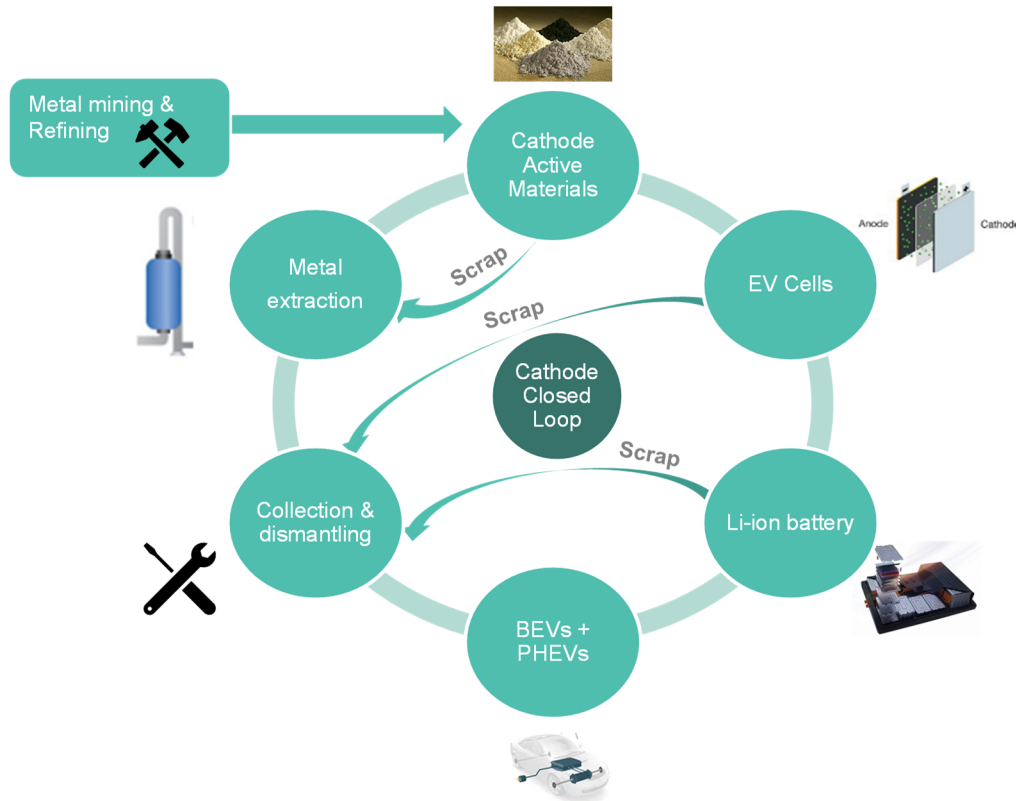
% metal from recycled in cathode	% metal in cathode active material					% of cathode active material from recycled metal					
	NMC622	NMC811	NCA	LFP	eLNO	NMC622	NMC811	NCA	LFP	eLNO	
2030											
Cobalt	12%	18%	8%	5%	0%	1%	2%	1%	1%	0%	0%
Lead	85%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lithium	4%	12%	14%	11%	8%	16%	0%	1%	0%	0%	1%
Nickel	4%	53%	68%	83%	0%	82%	2%	3%	3%	0%	3%
Total		82%	91%	98%	8%	99%	5%	4%	4%	0%	4%
2035											
Cobalt	20%	18%	8%	5%	0%	1%	4%	2%	1%	0%	0%
Lead	85%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lithium	10%	12%	14%	11%	8%	16%	1%	1%	1%	1%	2%
Nickel	12%	53%	68%	83%	0%	82%	6%	8%	10%	0%	10%
Total							11%	11%	12%	1%	12%

Source: European Commission, and Bernstein estimates (all data) and analysis

What does a cathode "closed loop" mean for cathode manufacturers?

Closed loop is also a form of hedging. Umicore and BASF see EV recycling as a fully "closed loop" supply of metals to their cathode manufacturing process, allowing them to reduce reliance on scarce metals such as cobalt, lithium, and nickel, and protect against rising and volatile prices — thus acting as a form of hedging as well as reducing emissions in the value chain. At each stage of the manufacturing process, scrap materials are fed back into the system, so critical metals can be extracted and reused in cathode manufacturing (see Exhibit 60).

EXHIBIT 60: Cathode "closed loop" process



Source: Umicore and BASF presentations, and Bernstein analysis

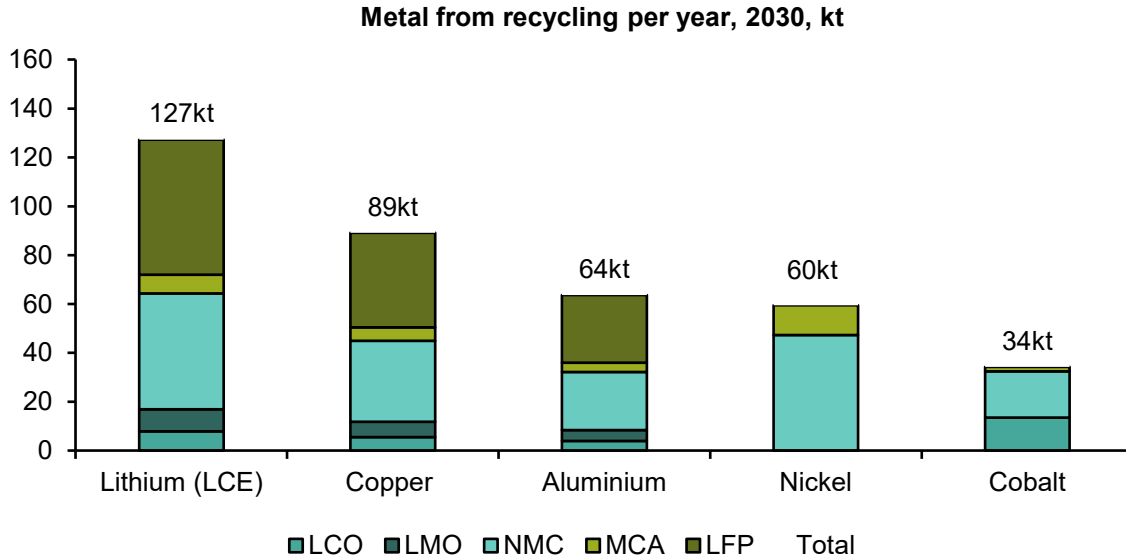
Recycling will supply a large amount of lithium to the market. Circular Storage estimates 127kt would be available by 2030, assuming 50% recycling rates across all batteries and 24% for EVs. However, only 34kt cobalt will be supplied to the market. NMC batteries, estimated at 37% of all batteries available for recycling in 2030, will likely provide a large proportion of the nickel coming from recycling, contributing 47kt to the market and 19kt of cobalt (see Exhibit 61).

Given Umicore's position and expertise in complex metal recycling, and its established customer relationships as evidenced by recycling agreements with Tesla and Toyota, we estimate Umicore will gain a 25% share of the global recycling market. JMAT does not have a meaningful recycling business now. However, as it starts to commercialize its eLNO material, it aims to develop an EV recycling business alongside. We assume, therefore, that by 2030 it will account for 5% of the market, and the same for BASF.

Assuming Umicore's and JMAT's recycling technology has recovery rates in line with the market, we estimate Umicore will obtain 100% of its lithium, 49% of its cobalt, and 11% of its nickel from recycling — assuming production is 100% NMC811 chemistry. JMAT could obtain all its cobalt needs from recycling, given the low proportion (~1%) of cobalt in eLNO. It could secure 79% of its lithium and 7% of its nickel from recycling. BASF could secure 39%, 25%, and 2% of lithium, cobalt, and nickel, respectively, from recycling (see Exhibit 62).

These proportions could change depending on: (1) recycling rates for EVs, (2) shifts in the battery mix, and (3) extension to useful life of the battery. For example, more LFP batteries are now being manufactured for use in micro EVs in China. Therefore, in 10 years, there will likely be more LFP batteries and fewer other chemistries being recycled. This would mean less cobalt and less lithium will be available from recycling. Furthermore, energy density is increasing and more EVs are being sold for short distances (e.g., micro EVs in China), which could mean fewer cycles and longer battery life.

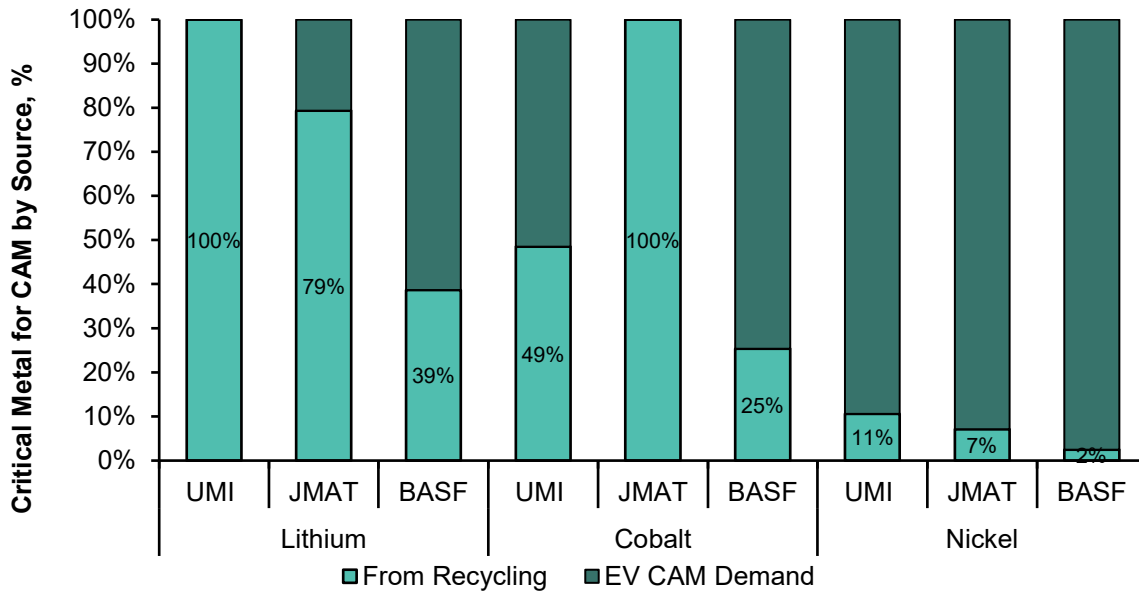
EXHIBIT 61: **By 2030, lithium and copper will likely see the largest supply from EV recycling, and cobalt the least**



Note: This is for batteries from all applications and assumes a 50% recycling rate across all batteries.

Source: Circular Storage estimates and Bernstein analysis

EXHIBIT 62: Umicore could obtain 100% of its lithium and 49% of its cobalt from recycling by 2030; recycling will supply little of the nickel demand by 2030



Note: This assumes UMI has a 25% share of the recycling market, JMAT 5%, and BASF 5%. It assumes 100% NMC811 for UMI, 100% eLNO for JMAT, and 100% NCA for BASF (2030 CAM demand is based on planned capacity for 2025). Assuming their recovery rates are in line with the market.

Source: Circular Storage, and Bernstein estimates (all data) and analysis

+ INVESTMENT IMPLICATIONS

Global Autos

We rate Renault SA, BMW, Daimler, Great Wall Motor and Volvo Outperform; and Volkswagen and SAIC Market-Perform.

European Industrial and Consumer Chemicals

We rate BASF and JMAT Outperform; and Umicore Market-Perform.

EXHIBIT 63: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price
BAS.GR	O	EUR	58.74	114.00
JMAT.LN	O	GBp	2,133.00	4,100.00
UMI.BB	M	EUR	43.07	53.00
VOLVB.SS	O	SEK	198.32	240.00
BMW.GR	O	EUR	86.16	120.00
DAI.GR	O	EUR	83.26	116.00
600104.CH (SAIC)	M	CNY	19.95	18.00
2333.HK (Great Wall-H)	O	HKD	32.60	38.00
VOW.GR	M	EUR	255.20	237.00
RNO.FP	O	EUR	29.15	42.00
MSDLE15			1,856.96	
MXAPJ			624.39	

Source: Bloomberg, and Bernstein estimates and analysis

Zhihan Ma, CFA	zhihan.ma@bernstern.com	+1-212-969-6744
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CIRCULAR ECONOMY: FASHION

Circular fashion is the new black

HIGHLIGHTS

- **Circular is the new black:** The fashion industry today follows a linear "take," "make," and "waste" model. Adopting a circular mindset is critical for the industry to reduce its environmental footprint. The vision for a more circular textiles industry is one that is restorative and regenerative, where brands design high-quality and durable products that can reenter the market after use as secondhand products. We also expect brands to leverage alternative materials to reduce pollution and waste.

How are companies responding to these challenges and opportunities?

- **In Global Luxury Goods, companies reduce their environmental impact in two ways:** (1) reducing impact per unit produced, and (2) increasing the number of uses per unit produced. Mega-brands have a material advantage to reduce their environmental footprint. First, they have materially higher full-price sell-through, limiting end-of-season inventory. Second, they hold value in the secondhand market. Third, they have scale, which enables them to develop and adopt more sustainable raw materials. Lastly, they have higher levels of upstream integration. As such, we believe high "structural appeal" companies in our coverage — such as **Hermès and LVMH** — stand tall ahead of peers in this realm.
- **In European Chemicals, there are high-growth opportunities for companies to address both the "take" and "waste" part of the textile lifecycle.** Specialty chemicals companies: (1) provide additives and cleaning ingredients to established mechanical recycling markets, (2) innovate in the nascent chemical recycling market, and (3) provide ready-to-use solutions to improve wash cycles, and offer green detergents. Revenues from additives for mechanical recycling are currently small but growing for our coverage companies. BASF and Evonik are well positioned to lead in the fast-growing plastic recycling market; Novozymes is the dominant market leader in enzymatic washing detergents, ahead of IFF.

THE DEVIL WEARS (UNSUSTAINABLE) PRADA: THE CURRENT TAKE-MAKE-WASTE MODEL

Over the past 30 years, the fashion industry has undergone a dramatic transformation, facilitated by innovation in global supply chains, lean retailing, digitization, and direct-to-consumer online retailers, making fast fashion the dominant mode of production and consumption today.⁵² In this chapter, we take a closer look at rising ESG concerns in the fashion industry and highlight investment opportunities to make the fashion supply chain more circular and sustainable.

The vision for a more circular textiles industry is one that is restorative and regenerative by design and provides benefits for business, society, and the environment. In such a system, clothes, textiles, and fibers are kept at their highest value during use and reenter the economy after use, never ending up as waste.⁵³ However, the fashion industry today, as with most other economic activities, follows a linear model comprising three key stages: take (the harvesting of raw materials), make (the production of garments), and waste (the wearing and subsequent disposal of garments).⁵⁴

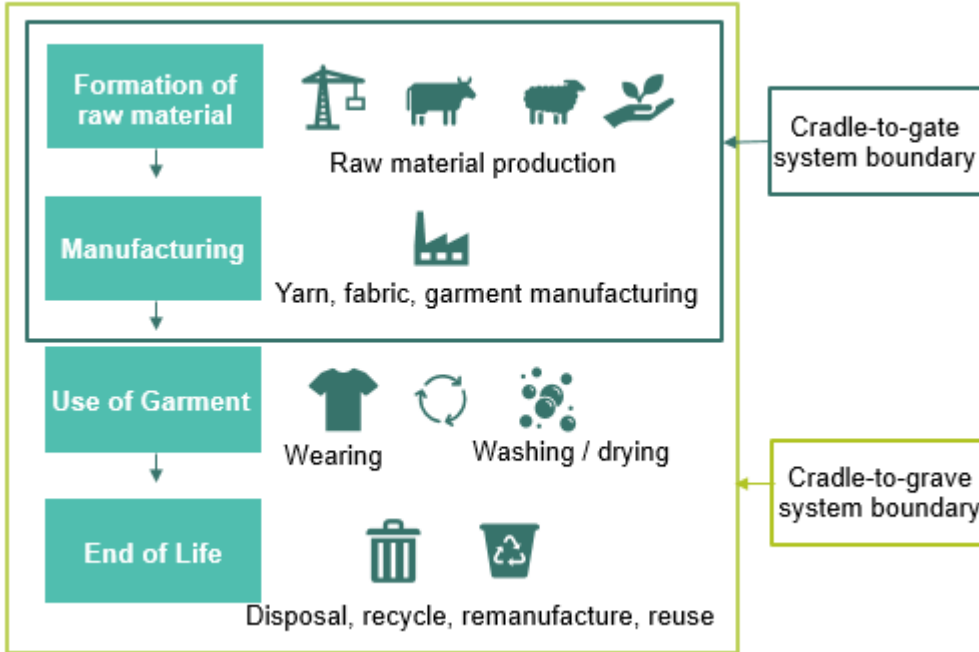
In order to mitigate risks and identify opportunities along the value chain, we must first define the system boundaries for the life cycle of a garment. A **life cycle approach** considers the spectrum of resource flows and environmental interventions associated with a product or organization from a supply chain perspective (see Exhibit 64). The overall life cycle impact for materials in the textiles industry can vary depending on the type of life cycle analysis used (e.g., *cradle to gate* or *cradle to grave*).

⁵² Brydges (2021). "Closing the loop on take, make, waste: Investigating circular economy practices in the Swedish fashion industry," *Journal of Cleaner Production*, 293.

⁵³ Ellen MacArthur Foundation, "A New Textiles Economy".

⁵⁴ Ellen MacArthur Foundation, 2017.

EXHIBIT 64: Life cycle analysis can be leveraged to understand the environmental impact of the textiles industry as well as opportunities to reduce its environmental footprint along the value chain



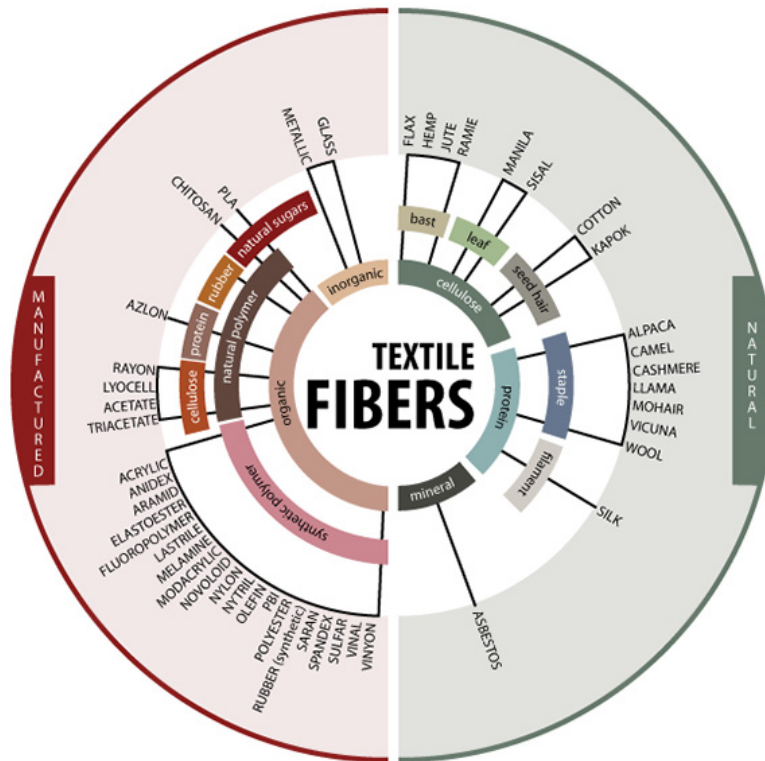
Note: A *cradle-to-gate* system boundary encompasses the raw material and manufacturing stages, leaving out the use stage and the end-of-life stage, whereas a *cradle-to-grave* system boundary encompasses all four life cycle stages (raw material acquisition, manufacturing, use, and end-of-life).

Source: Watson & Wiedemann and Bernstein analysis

TAKE & MAKE STAGE: RAW MATERIALS ACQUISITION AND MANUFACTURING

The textiles industry utilizes a variety of both natural and manufactured materials to produce clothing (see Exhibit 65). As mentioned previously, the environmental impact of a material varies depending on which stages of the life cycle are considered in the analysis.

EXHIBIT 65: **The textiles industry utilizes a variety of both manufactured and natural materials to produce clothing**



Source: Behance and Bernstein analysis

Upstream environmental impacts of fabrics: The Higg Materials Sustainability Index (MSI) is a quantitative assessment of apparel and footwear impacts from the extraction or production of raw materials, manufacturing, and finishing up to the point where the material, trim/component, or packaging is ready to be assembled into a final product.⁵⁵ However, the Higg MSI does not address the impacts of apparel, footwear, or home textiles products themselves once in use. Therefore, the Higg MSI has been criticized by environmentalists and academia for focusing solely on the *cradle-to-gate* phases of the life cycle (or only the first two phases shown in Exhibit 64) rather than the entire life cycle a material goes through, including the downstream impacts of the product.^{56,57} The exclusion of the use phase and end-of-life phase could be problematic as garment use has substantial environmental impacts due to laundering and the fact that most clothing, even recycled clothing, ultimately ends up in landfills, which has a long-term impact on the environment.⁵⁸

⁵⁵ <https://howtohigg.org/wp-content/uploads/2020/07/Higg-MSI-Methodology-July-31-2020.pdf>

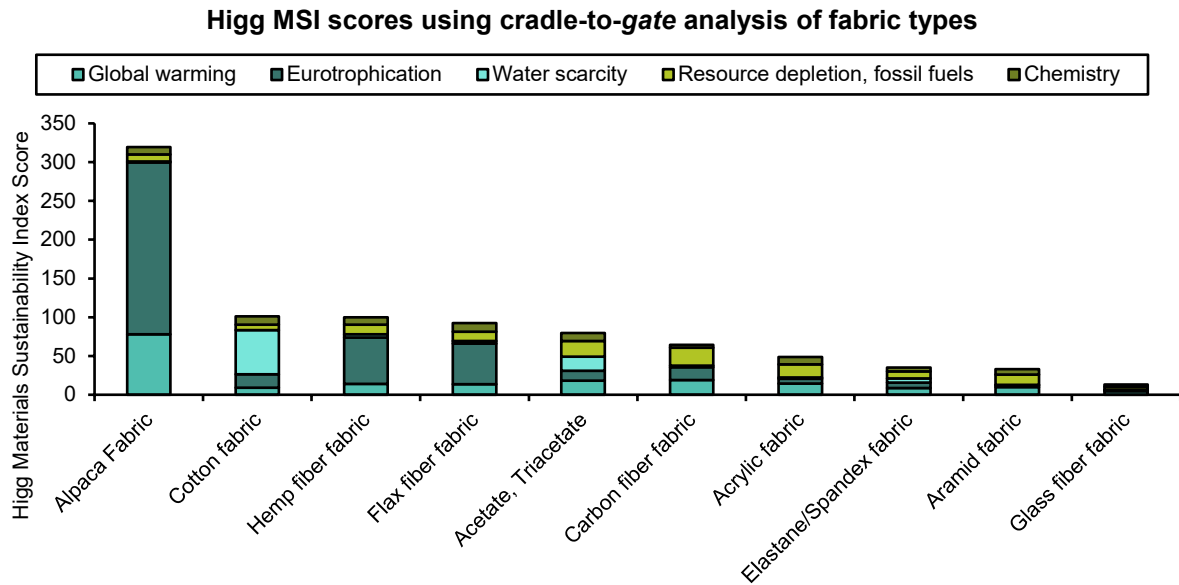
⁵⁶ <https://howtohigg.org/wp-content/uploads/2020/07/Higg-MSI-Methodology-July-31-2020.pdf>

⁵⁷ Watson & Wiedemann (2019). "Review of Methodological Choices in LCA-Based Textile and Apparel Rating Tools: Key Issues and Recommendations Relating to Assessment of Fabrics Made From Natural Fibre Types," *Sustainability*.

⁵⁸ <https://greenbusinessbureau.com/industries/fashion/what-is-toxic-fast-fashion-and-how-does-it-impact-the-environment/>

The Higg MSI finds natural materials, such as alpaca wool, cotton, and hemp-based fabric to have environmental impacts during the *upstream* phase as they are reliant on agricultural production and are, therefore, more resource heavy compared to synthetic materials (see Exhibit 66). For example, cotton production requires water and fertilizer for crops, and alpaca fabric results in eutrophication (waste runoff) due to the reliance on animals. However, this analysis should be taken with a grain of salt as it does not consider all phases of the life cycle, the lifetime of a product, or downstream impacts. Additionally, this is not to say that synthetic materials do not have environmental impacts. Rather, it is more likely that the impacts of synthetic materials are not covered by the below categories and/or they take place in *downstream* phases of the life cycle (e.g., use and end-of-life) that are not included in this analysis.

EXHIBIT 66: In the upstream raw materials extraction and manufacturing phases, natural fabrics are given higher environmental impact scores; however, this analysis does not consider the environmental impacts during the use phase and the end-of-life phase



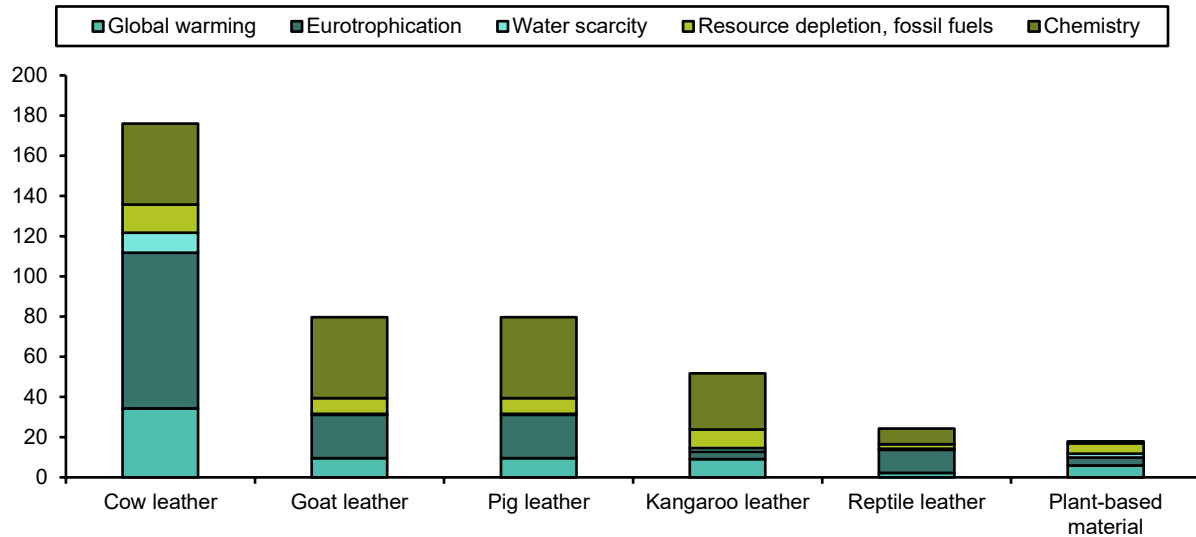
Note: The Higg MSI creates scores for each environmental impact based on internal methodology. A *cradle-to-gate* system boundary encompasses the raw material and manufacturing stages, leaving out the use stage and the end-of-life stage, whereas a *cradle-to-grave* system boundary encompasses all four life cycle stages (raw material acquisition, manufacturing, use, and end-of-life).

Source: Higg MSI and Bernstein analysis

Upstream environmental impacts of leather: The Higg MSI also examines the upstream environmental impacts of leather, and finds plant-based materials to be less environmentally harmful than cow leather, given the land use and emissions impacts of livestock farming (see Exhibit 67).

EXHIBIT 67: Plant-based leather could be a more sustainable alternative to animal-based leather from an upstream perspective; however, the use and end-of-life impacts are not included in this analysis

Higg MSI scores using cradle-to-gate analysis of leather types



Note: A *cradle-to-gate* system boundary encompasses the raw material and manufacturing stages, leaving out the use stage and the end-of-life stage, whereas a *cradle-to-grave* system boundary encompasses all four life cycle stages (raw material acquisition, manufacturing, use, and end-of-life).

Source: Higg MSI and Bernstein analysis

Upstream environmental impacts of cotton: A life cycle analysis by Cotton Incorporated⁵⁹ examines the life cycle impacts of cotton production, including the raw materials (agriculture) phase, the manufacturing phase, and the use and end-of-life phases (cut-and-sew, use, and disposal).⁶⁰ Water consumption is the primary environmental impact during the raw materials phase due to the reliance on irrigation to grow crops. The manufacturing phase incurs the highest amount of eutrophication (excess nutrient releases to water during the dyeing and finishing process), acidification (emissions from energy and electricity usage that cause acidifying effects to the environment, such as acid rain), and water usage (water required primarily for electricity generation during the spinning process) (see Exhibit 68).

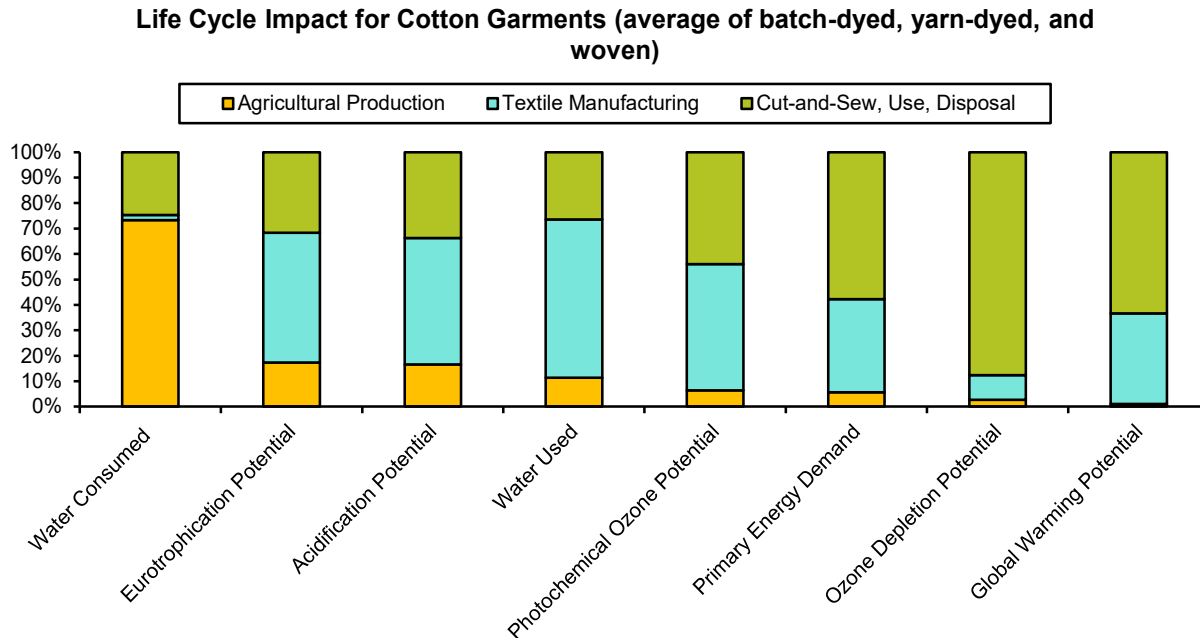
- Sustainability issues have become more top of mind for brands, given shifting consumer preferences and regulatory requirements. However, managing the environmental impact of the supply chain is no small task, especially as many brands outsource production to emerging markets such as Bangladesh, China, and Poland. Many outsourced manufacturers may not have the right skillset to introduce sustainable production practices and may not be subject to the same level of regulatory scrutiny.

⁵⁹ <https://cottoncultivated.cottoninc.com/wp-content/uploads/2015/06/2012-LCA-Full-Report.pdf>

⁶⁰ The use and end-of-life phases were combined for this study since most of the impact takes place during the use phase and the end-of-life phase is not that significant.

- Beyond environmental considerations, the textile manufacturing industry has also been plagued with social issues (e.g., modern slavery at the raw material sourcing and production stage), which is an issue we have written extensively about (see chapter "Supply Chain Labor"). We expect brands to adopt stricter policies and procedures to better monitor and manage their supply chain environmental and social impacts over time.

EXHIBIT 68: For cotton, the raw materials stage sees the greatest environmental impact in terms of water consumption for agriculture, while the manufacturing stage has the greatest environmental impact in the form of water pollution, high energy, and water usage



Note: Shows the average environmental impact for each category of cotton garment used in the study (batch-dyed, yarn-dyed, and woven). **Water used (WU)** refers to all of the water involved, both directly and indirectly, in any phase of a product's life. It can be considered the *gross* amount of water used. **Water Consumed (WC)** also consists of both direct and indirect water and is defined as the water that leaves the watershed from which it was drawn. In cases where water is returned to the same watershed, such as for treated wastewater from textile processes and consumer laundering, a credit is applied. WC can be thought of as the *net* amount of water used.

Source: Cotton Incorporated and Bernstein analysis

The textiles industry is reliant on fossil fuels and plastics for raw materials. Synthetic materials such as polyester, acrylic, and nylon represent about 60% of the clothing material worldwide, with polyester being the most frequently used. Polyester is made via a chemical reaction between ethylene glycol and terephthalic acid, and these chemicals are derived from petroleum, air, and water.⁶¹ These man-made materials are highly popular and usually preferred by the fashion industry because of their availability, durability, resistance, and affordability.⁶² While synthetic materials may have lower environmental impacts in the upstream phase, there are risks associated with these materials from a pollution and circular economy perspective during the downstream stages, including the use and end-

⁶¹ <https://ecocult.com/exactly-polyester-bad-environment/>

⁶² <https://www.oceancleanwash.org/>

of-life phases. Nonetheless, there are emerging solutions and investment opportunities to tackle these issues, such as biodegradable plastics, recycled plastics, and more efficient laundering systems, which we discuss later in the chapter.⁶³

USE PHASE: FAST FASHION IS A PROBLEM

Fast fashion is a design, manufacturing, and marketing method focused on rapidly producing high volumes of clothing. Garment production utilizes trend replication and low-quality materials in order to bring inexpensive styles to the public. As a result, we're seeing an industry-wide movement toward overconsumption and underutilization.

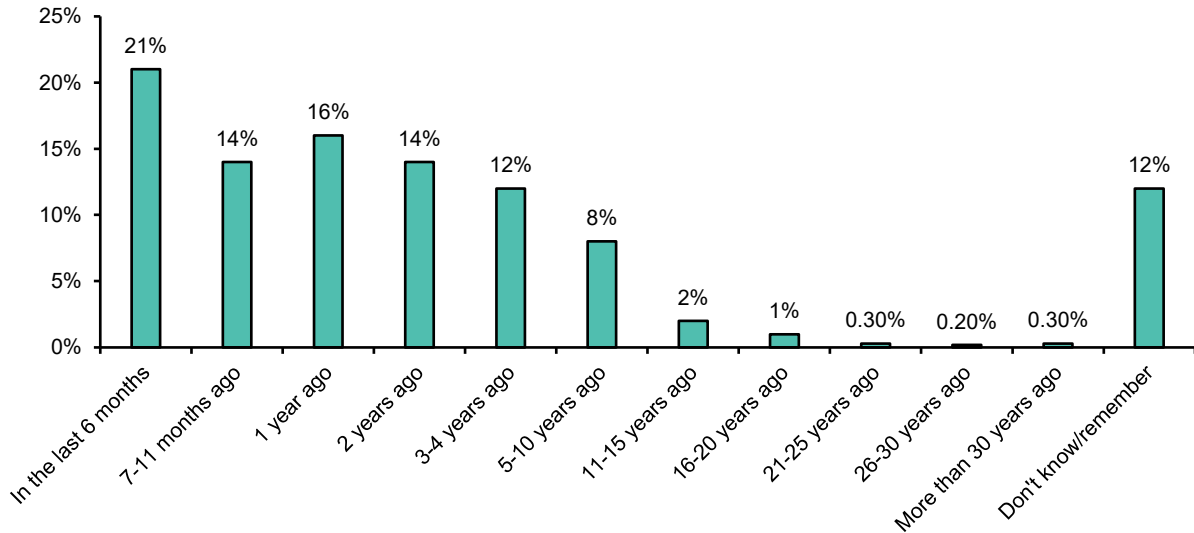
- **Clothing is massively underutilized:** Worldwide, clothing utilization — the average number of times a garment is worn before it ceases to be used — has decreased by 36% compared to 15 years ago. While many low-income countries have a relatively high rate of clothing utilization, the rate is much lower elsewhere. In the US, for example, clothes are only worn for around a quarter of the global average. The same pattern is emerging in China, where clothing utilization has decreased by 70% over the last 15 years.
- **Garment life and purchase frequency reflect fast fashion trends among consumers:** Most of the clothing in consumers' closets comes from relatively recent purchases rather than staple, quality items that have lasted for years. Dispose-and-replace cycles are a result of fast fashion trends. The study "Clothing Lifespans: What Should Be Measured and How" published in the journal *Sustainability* in 2020 asked consumers to indicate how long they have owned a piece of clothing (e.g., when they purchased the clothing). 65% of garments in an average consumer's closet were purchased in the past two years, while only 4% of garments had been owned for 11-30 years+ (see Exhibit 69).⁶⁴

⁶³ [European Industrial Chemicals: Sizing the opportunity in Bioplastics](#)

⁶⁴ Klepp et al. (2020). "Clothing Lifespans: What Should Be Measured and How," *Sustainability*: <https://www.mdpi.com/2071-1050/12/15/6219/htm>.

EXHIBIT 69: 65% of clothing in an average consumer's closet was purchased in the past two years, while only 4% of garments have been owned for 11-30 years+

How long have you owned this garment?



Note: The time the user has owned the garment in months or years (current possession span) (N = 53,461 garments)

Source: Klepp et al. (2020) and Bernstein analysis

- **We can't keep up with all these trends:** Fast fashion uses innovative production and distribution models to dramatically shorten fashion cycles, sometimes getting a garment from the designer to the customer in a matter of weeks rather than months. The number of fashion seasons has increased from two a year – spring/summer and fall/winter – to as many as 50-100 microseasons (see Exhibit 70).⁶⁵

EXHIBIT 70: The number of fashion seasons has increased from two per year – spring/summer and fall/winter to as many as 50-100 microseasons

Traditional Fashion: 2 Cycles Per Year



Typical Fast Fashion: 50 Cycles Per Year



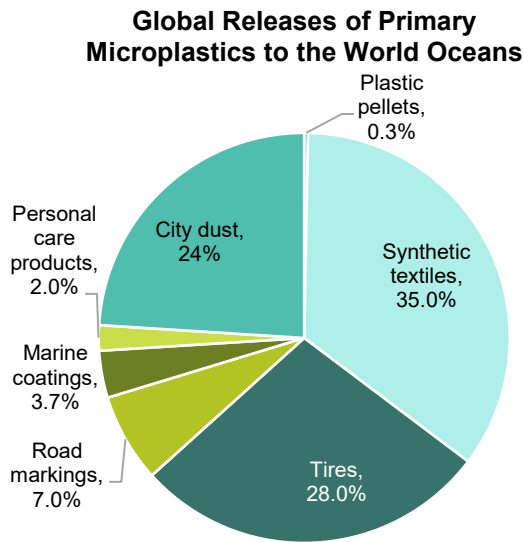
Source: True Cost, World Resources Institute, and Bernstein analysis

⁶⁵ <https://www.wri.org/insights/apparel-industrys-environmental-impact-6-graphics>

The use phase of textiles has environmental impacts due to lower quality and durability, shorter product life, and frequent washing of the material. One area of growing concern in textiles is the consequences of primary microplastics, which are small plastic particles (<5mm size) directly released into the environment.

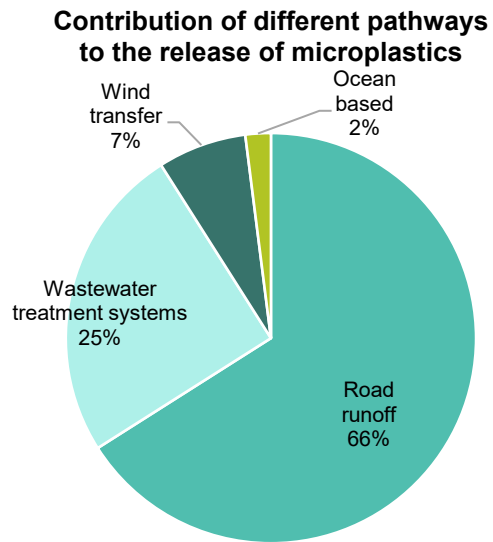
Textiles contribute to the release of primary microplastics through the laundering of synthetic clothing materials (see Exhibit 71). When manufactured, washed, and worn, clothes made out of synthetic materials lose tiny plastic fibers that end up in wastewater treatment systems and are then released into the ocean (see Exhibit 72).⁶⁶ These microfibers have been found in fish, plankton, chicken, sea salt, beer, honey, and tap and bottled water,⁶⁷ meaning that eventually microplastics could make their way into the human body via the food chain (see Exhibit 73).

EXHIBIT 71: 35% of the release of primary microplastics to the ocean is from the manufacturing and use of synthetic textiles, particularly through washing...



Source: International Union for Conservation of Nature (IUCN), Food and Agriculture Organization (FAO), and Bernstein analysis

EXHIBIT 72: ...which are then released to wastewater treatment systems after laundering

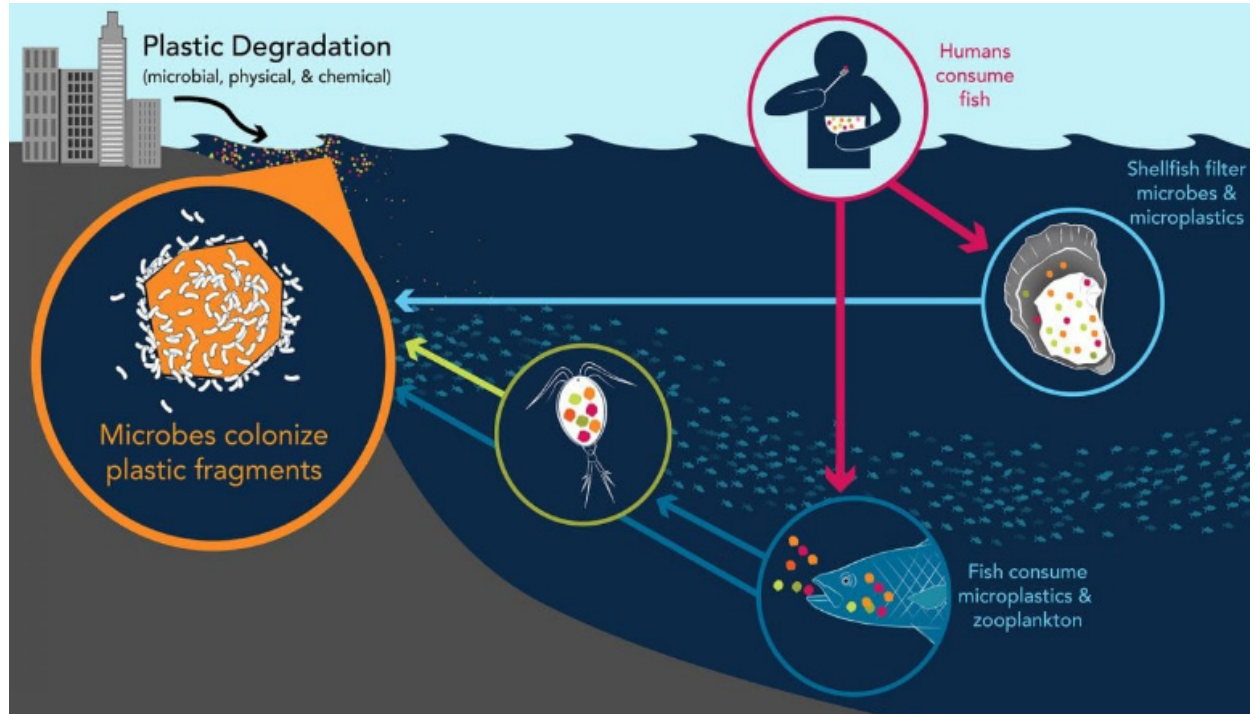


Source: IUCN, FAO, and Bernstein analysis

⁶⁶ <https://www.nature.com/articles/s41598-019-43023-x>

⁶⁷ <https://www.oceancleanwash.org/>

EXHIBIT 73: Release of microplastics is a growing environmental and health concern as they eventually make their way into the human body via the food chain after being released into the ocean

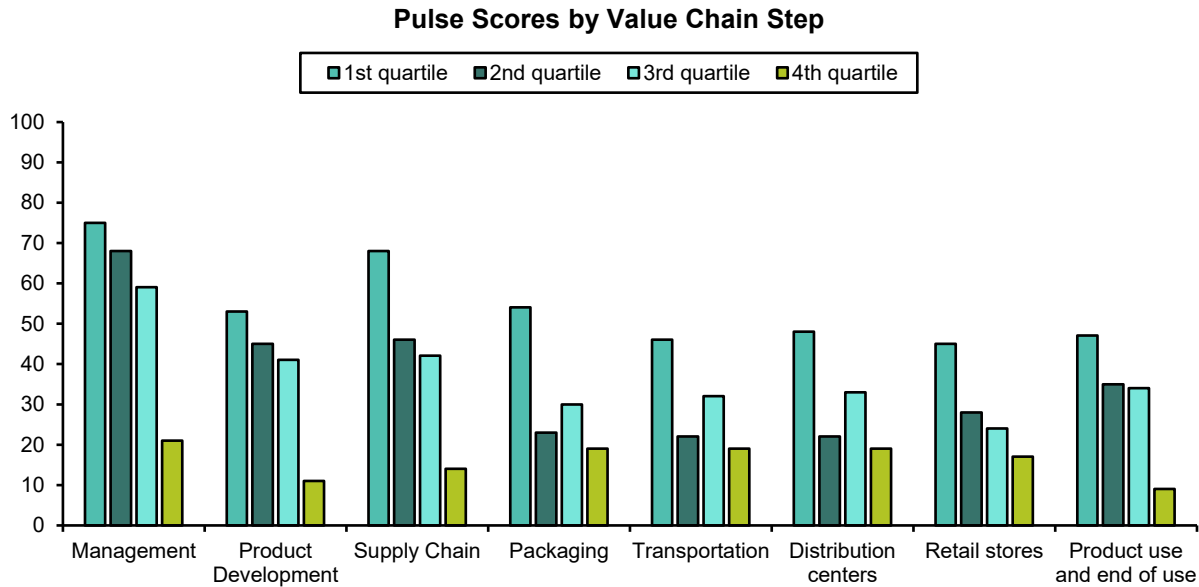


Source: Woods Hole Oceanographic Institution and Bernstein analysis

END-OF-LIFE STAGE

Brands have not done a great job managing their products' environmental impacts at the end-of-life stage: The Pulse of the Fashion Industry report scores companies (from 0-100) on various sustainability metrics. In aggregate, companies (even those in the first quartile or the highest-performing segment) score poorly at the product use and end-of-life phase compared to other value chain stages, suggesting room for improvement (see Exhibit 74). Under the current linear fashion system, brands are not responsible for the recycling of garments. This will need to change for brands to be held accountable for their life cycle environmental impacts and to start designing textiles with circularity in mind.

EXHIBIT 74: Brands have not done a great job managing their products' environmental impacts at the product use (durability and quality) and end-of-life stage (recyclability, reusability, etc.)



Note: Scores are out of 100. Companies in the first quartile are in the highest-performing segment; companies in the fourth quartile are in the lowest-performing segment.

Source: Pulse of the Fashion Industry 2019 Report and Bernstein analysis

After-use clothing collection varies globally: Around 25% of garments are collected through reuse and recycling via a variety of systems.⁶⁸ There are large regional differences in collection rates; e.g., in Germany around 75% of discarded garments are collected, while in the US and China the ratio is 10-15%. Many countries, particularly in Asia and Africa, have no collection infrastructure at all. This is relevant as clothes collected for reuse in high-income countries are mainly exported to these parts of the world. Most of these clothes end up in landfills or are cascaded to lower-value applications. Ultimately, at the end-of-life stage, the vast majority of clothes (87%) are discarded as waste.^{69,70}

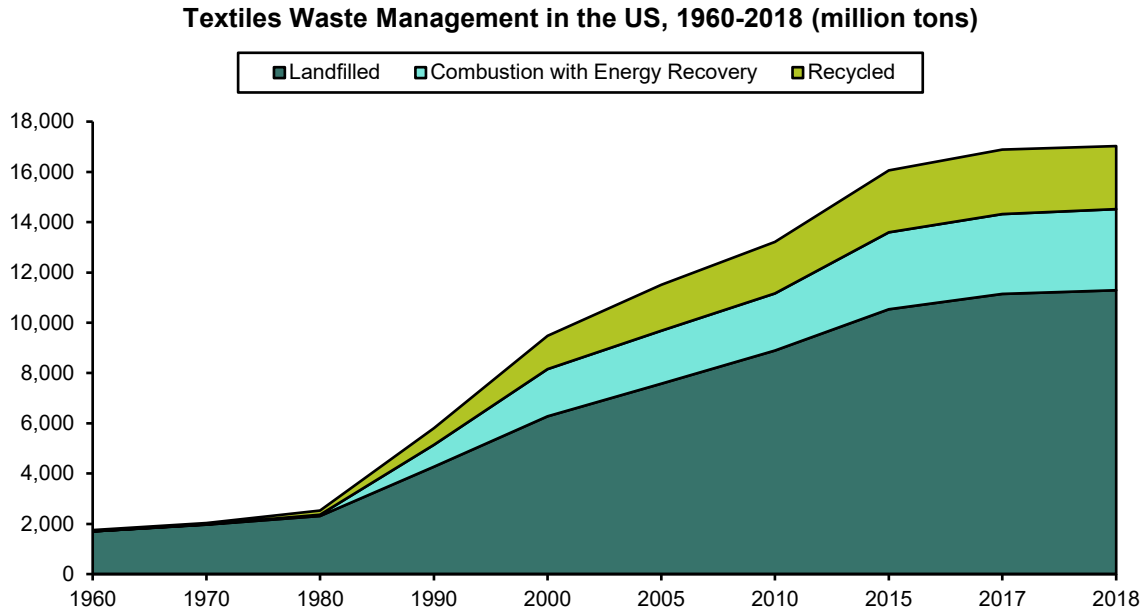
In the US, the management of textile waste has not improved much over the last 20 years. While the proportion of waste that is recycled increased from 1960 to 2000 (see Exhibit 75), the percentage has been stagnant since 2000 (see Exhibit 76 and Exhibit 77).

⁶⁸ Ellen MacArthur Foundation, A New Textiles Economy.

⁶⁹ Ellen MacArthur Foundation, A New Textiles Economy.

⁷⁰ Watson, D., et al., *Exports of Nordic used textiles: Fate, benefits and impacts* (2016), p.67.

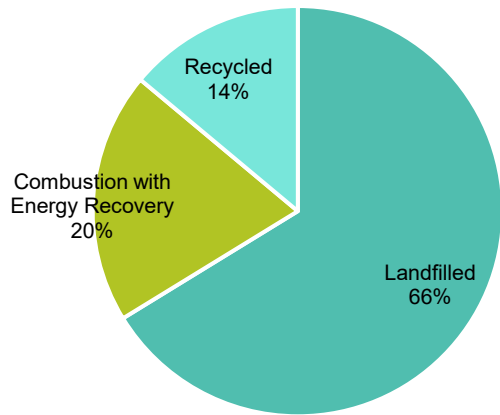
EXHIBIT 75: Proportion of waste recycled increased from 1960 to 2000, but the percentage has been stagnant since 2000



Source: Environmental Protection Agency (EPA) and Bernstein analysis

EXHIBIT 76: In 2000, 14% of textile waste was recycled...

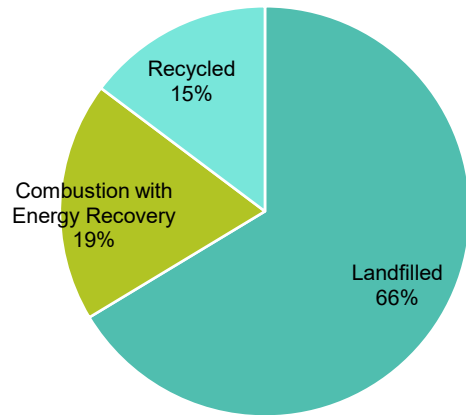
Textiles Waste Management in the US, 2000 (tons)



Source: EPA and Bernstein analysis

EXHIBIT 77: ...compared to 15% in 2018

Textiles Waste Management in the US, 2018 (tons)

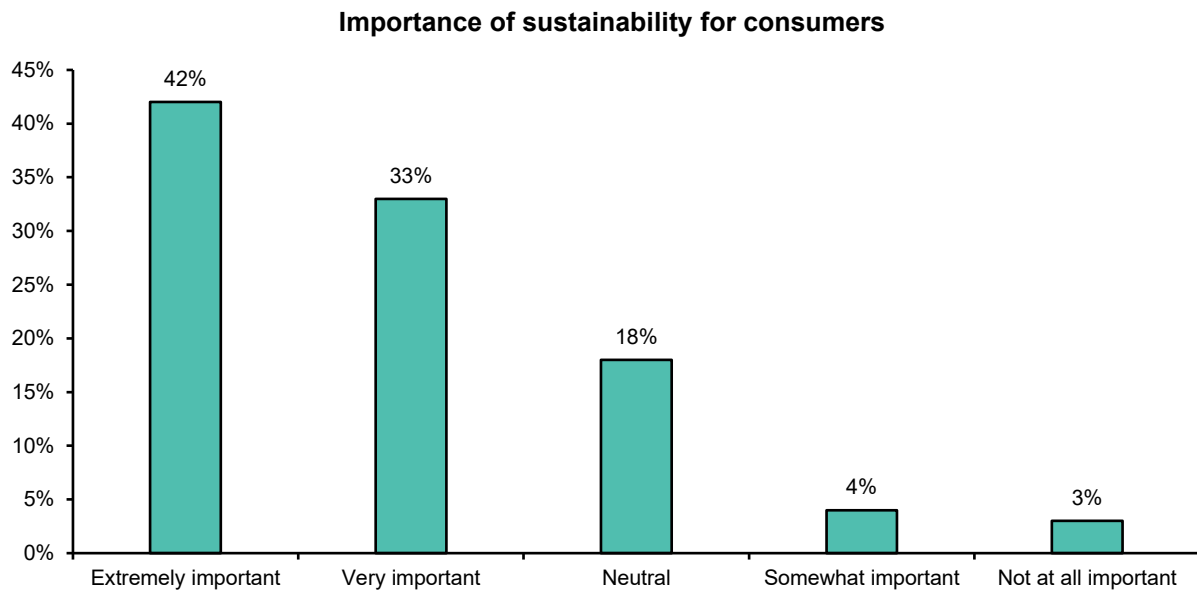


Source: EPA and Bernstein analysis

+ CONSUMERS: IS SUSTAINABLE FASHION IDEALISTIC OR REALISTIC?

While consumers view sustainable fashion as increasingly important (see Exhibit 78), these views do not directly translate into purchasing behaviors as many consumers lack sufficient information/knowledge or do not want to pay a premium for sustainable clothing.

EXHIBIT 78: 75% of consumers in five countries (US, Canada, UK, France, and Brazil) view sustainability as extremely or very important

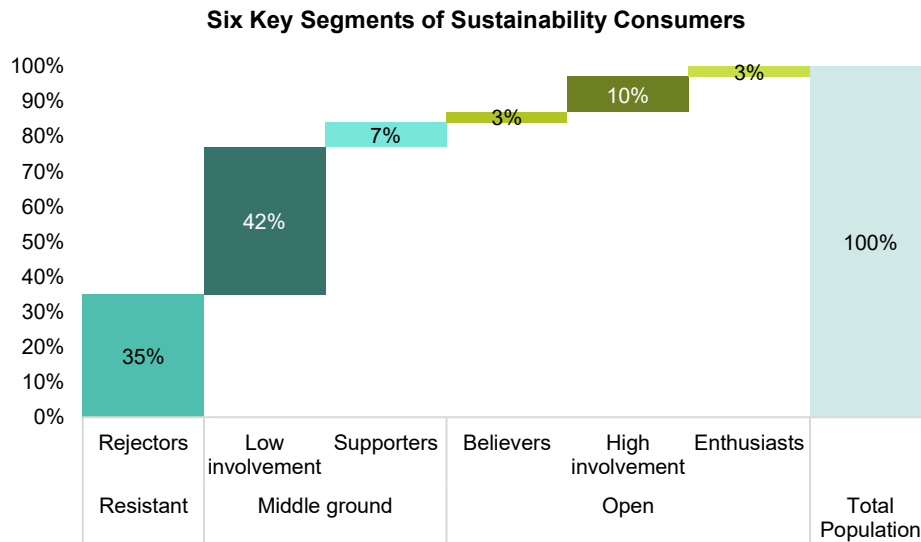


Source: BCG Sustainability Survey March 2019, N = 703 (US); 703 (UK); 529 (FR); 514 (CN); 523 (BR), and Bernstein analysis

According to a 2019 survey by BCG, the majority of consumers fall into the rejector (35%) or low involvement (42%) categories, neither of which consider sustainability when making purchasing decisions. Only 16% of consumers (believers, high involvement, and enthusiasts) consider sustainability when making purchasing decisions (see Exhibit 79).⁷¹

⁷¹ [2019 Pulse of the Fashion Industry, BCG](#)

EXHIBIT 79: The majority of consumers fall into the rejector (35%) or low involvement (42%) categories, neither of which consider sustainability when making purchasing decisions; only 16% of consumers (believers, high involvement, and enthusiasts) consider sustainability when making purchasing decisions



Note: **Rejectors** are not interested in sustainability in fashion; price is first purchasing criterion; may be deterred from products marked as more responsible, given expectations of higher costs. **Low involvement** consumers have a mild interest in sustainability in fashion and in other categories and pay attention without concretely supporting it. **Supporter** consumers have a mild interest in sustainability in fashion and support it, but do not consider it upon purchase. **Believers** have an interest in sustainability in fashion and in other categories and consider sustainability in purchasing decisions. **High involvement** consumers have an interest in sustainability in fashion and in other categories, have chosen brands in the past based on sustainability and will continue to do so in the future, and sustainability plays a major role in purchasing decisions. **Enthusiast** consumers make sustainability a key driver when choosing products, overindex in sustainability over all other categories.

Source: BCG Sustainability Survey March 2019, N = 703 (US); 703 (UK); 529 (FR); 514 (CN); 523 (BR), and Bernstein analysis

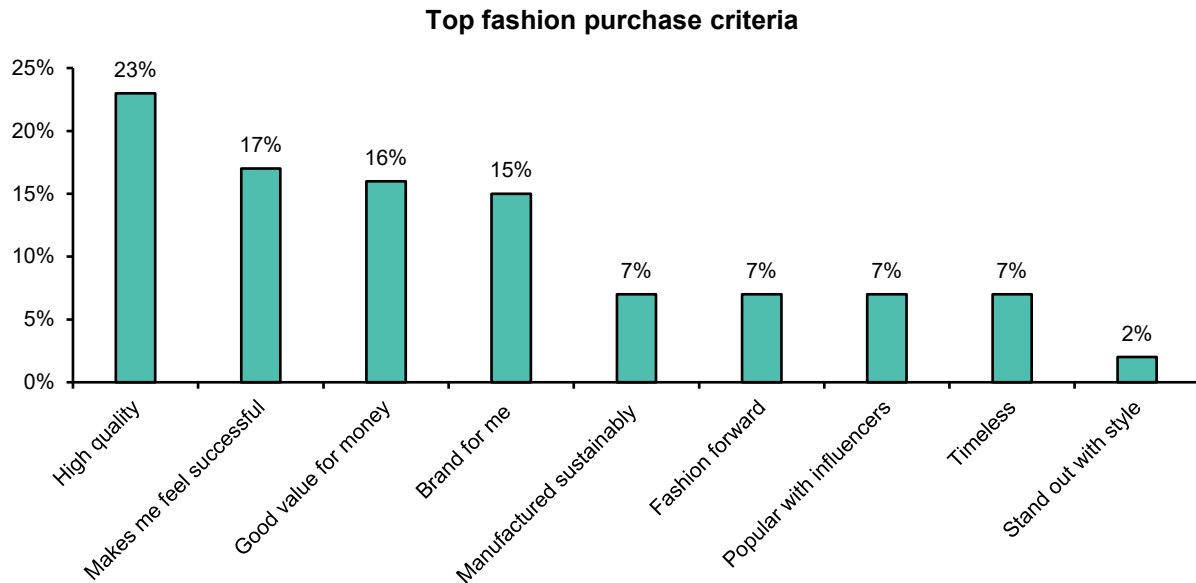
Consumers want high-quality products: Sustainable production isn't the most popular reason behind a purchase decision for consumers, but high quality is an important part of the decision-making process (see Exhibit 80). While high quality and sustainability are often thought of separately, the two could ultimately be connected as sustainability can be tied to better materials and greater care in the design phase to ensure a longer lifespan. Brands could focus less resources on designing for fast fashion trends and greater resources toward designing for durability and quality, which could mitigate both the social and the environmental harm associated with fast fashion practices.

Designing for longevity and durability: An existing research study in the *Journal of Cleaner Production* published in 2021⁷² interviewed brand managers in the Swedish fashion industry on sustainable and circular practices. One of the participants stated, "With seasonal collections, fashion is about constant renewal and novelty. You need to produce more and more. We wanted to create what we couldn't find: garments free of compromise when it comes to design, quality, durability and fit. With a permanent collection, we spend more time working on each garment: finding fabrics, designing, and learning about the complexities of our supply chains." As this description reveals, designing permanent

⁷² Brydges, 2021. "Closing the loop on take, make, waste: Investigating circular economy practices in the Swedish fashion industry." *Journal of Cleaner Production*.

collections offers an added benefit. The brand can spend less time coming up with new designs and more time addressing other supply chain management issues.

EXHIBIT 80: **Top purchasing criteria for consumers is high quality**



Note: Totals add up to 101% due to rounding.

Source: BCG Sustainability Survey March 2019, N = 703 (US); 703 (UK); 529 (FR); 514 (CN); 523 (BR), and Bernstein analysis

Beyond consumer preferences, more recent policy initiatives — most notably in the EU⁷³ (e.g., initiatives around circular economy, see Exhibit 90) — and greater incentives for brands (e.g., resell and upcycling, see Exhibit 100) can hold brands more accountable for their environmental impacts and also provide alternative revenue-generation channels. Additionally, digitization and technology can increase efficiency in second-life clothing markets, improve consumer experience, and increase access to sustainable fashion products.

CIRCULAR IS THE NEW BLACK

The overarching vision of a "new textile economy" is that it is aligned with the principles of a circular economy: one that is restorative and regenerative by design and provides benefits for business, society, and the environment. In this idealized system, clothes, textiles, and fibers are kept at their highest value during use and reenter the economy after use, never ending up as waste.⁷⁴ The core components of a circular textiles industry are:

- High quality, affordable, individualized;

⁷³ <https://circulareconomy.europa.eu/platform/en/news-and-events/all-news/eu-strategy-sustainable-textiles>

⁷⁴ Ellen MacArthur Foundation: A New Textiles Economy.

- Captures full value during and after use;
- Runs on renewable energy;
- Reflects the true cost (environmental and societal) of materials and production processes in the price of products;
- Regenerates natural systems and does not pollute the environment; and
- Distributive by design.

What are the rising opportunities when it comes to circular fashion?

SUBSCRIPTION-BASED
CLOTHING

Consumer preference for subscription-based products is on the rise.⁷⁵ Clothing subscriptions/rental (e.g., Rent the Runway) provides an alternative to making the apparel supply chain more circular (see Exhibit 81). However, a recent study shows renting a pair of jeans might actually result in greater emissions compared to wearing them and throwing them away, given all the last-mile delivery involved in the rental process. Although it feels good as a consumer to be renting rather than buying clothes, the actual environmental benefit may not be what we expect. Over time, the environmental impact could be reduced with more scale and more efficient ways of last-mile delivery.

In the interim, introducing a shared economy mindset to specific segments (e.g., baby/toddler clothing, maternity clothing, or special occasion clothing such as formal wear and luxury items) could make sense, as many garments in these segments are only intended to be used once or during a specific timeframe.

⁷⁵ [Sign me up! Why consumers are increasingly subscribing rather than buying](#)

EXHIBIT 81: Clothing rental provides an alternative for making the apparel supply chain more circular; however, the environmental impact from transport, shipping, and logistics needs to be carefully considered

Access Model Type	Description	Examples	Clothing Segment
Rental subscription	Customers pay a monthly fee to have a fixed number of garments on loan at any one time and get frequent outfit change	Ycloset, Kleiderei, Gwunnie Bee, Rent the Runway	Fast fashion' items, all types of clothing
Short-term rental	Customers rent garments for one-off occasions and needs	Occasion wear hire, Vigga, Rent the Runway	Baby and children's clothes, maternity wear, formalwear, sportswear, luxury wear
Sale of highly durable clothes	Customers specifically select high-quality, durable garments that come with a warranty, and increased personalization, and that can be easily repaired	Patagonia, Houdini, MUD Jeans	Staples, non-seasonal styles, workwear, intimate wear
Resale	Customers buy garments that have been used by others beforehand and could have been refurbished/renewed	Renewal Workshop, Filippa K, ThredUp, second-hand stores	All types of clothing

Note: An access model is considered here as a business model for people to get access to clothes. Non-exhaustive illustration.

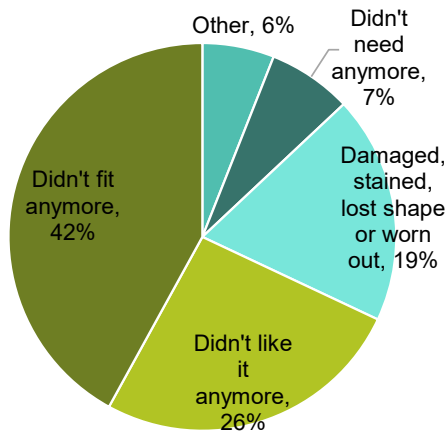
Source: Circular Fibers Initiative Research, Ellen MacArthur Foundation, and Bernstein analysis

REUSE/RESELL MARKETS

There are a number of reuse/resell marketplaces for secondhand clothing. Most consumers dispose of clothing because the clothing doesn't fit anymore (42%) or because they don't like the garment anymore (26%), not because it is unwearable (19%) (see Exhibit 82). Additionally, for clothing that's designed to be more durable and higher quality, brands could take advantage of these reuse/resell markets to capture additional value at the end of a product's life cycle.

EXHIBIT 82: Most consumers dispose of, donate, or sell their clothing because it doesn't fit anymore (42%) or they don't like it anymore (26%)

Reasons for Disposal, Donation, or Sale of Clothing in the UK



Source: WRAP Sustainable Clothing Action Plan (SCAP) textiles tracker survey and Bernstein analysis

Consumer-based platforms: There are emerging consumer-based platforms that allow individuals to directly sell their used clothing at a discount to secondary buyers.

- **Vestiaire Collective** is a global marketplace enabling people to buy and sell luxury and pre-owned fashion products.⁷⁶ According to Crunchbase, it has received a total funding amount of US\$662mn since being founded in 2009.
- **ThredUp** is a fashion resale marketplace that enables individuals to buy and sell clothing for women and children. The company IPO'd in March 2021.⁷⁷

Company- and brand-led initiatives: Some brands have developed in-house clothing rental and/or resale programs, while others are considering partnerships with emerging secondhand businesses. Although it is likely a logistics challenge to collect garments after use from consumers, these initiatives mean the company is able to recapture the residual value at the end of a garment's lifecycle.

- **Recurate** is a full-service re-commerce partner that enables a used product to be sold directly on a brand's eCommerce store. For example, the company would partner with a brand to improve the "secondhand" or "resell" experience and allow it to recapture that resale value at the end of a product's life.⁷⁸ This could be enticing for consumers as the company is responsible for collecting the garment from users, gathering information about quality, and reselling the item, allowing the consumer purchasing the item secondhand to feel more comfortable rather than purchasing it from

⁷⁶ <https://us.vestiairecollective.com/>

⁷⁷ <https://www.thredup.com/>

⁷⁸ See example for New York brand La Ligne with launch of Re Linge ("pre-loved" items): <https://lalignenyc.com/pages/pre-loved>.

someone else. According to Crunchbase, the company has received funding of US\$3.4mn since being founded in 2020.

NEW AND INNOVATIVE MATERIALS

Brands are also experimenting with new and innovative materials such as banana, cork, hemp, or even apple leather. Additionally, recycled versions of conventional cotton and wool are also seen as environmentally friendly (see Exhibit 83). The use of natural, plant-based materials, such as banana fibers, could also contribute to circular methods of design and use, given natural items are biodegradable and, therefore, would have less harmful impacts at end of life compared to materials that end up in landfills and don't decompose for hundreds of years.

However, it's unlikely that we will all be wearing banana fibers anytime soon, as many of these companies are still very early stage. In the interim, while traditional plastics are not seen as the most environmentally friendly option today, the investment opportunity in biodegradable and recycled plastics could alleviate some environmental concerns (see Exhibit 107).

EXHIBIT 83: Natural and plant-based materials, which are biodegradable, could contribute to circular economy goals at end-of-life

Material	Natural Resource Use			Pollution & Long-Term Impact				
	Water	Land	Energy	Water Pollution	Soil Pollution	Air Pollution	Renewable Resource	Biodegradability
Banana	Green	Green	Green	Yellow	Green	Green	Green	Green
Cork	Green	Green	Yellow	Green	Green	Green	Green	Green
Hemp	Green	Green	Green	Yellow	Green	Green	Green	Green
Jute	Green	Green	Green	Yellow	Green	Green	Green	Green
Linen	Green	Green	Green	Yellow	Green	Green	Green	Green
Nettle	Green	Green	Green	Yellow	Green	Green	Green	Green
Recycled Cotton	Green	Green	Yellow	Green	Green	Green	Green	Green
Recycled Wool	Green	Green	Yellow	Green	Green	Green	Green	Green
Sisal	Green	Green	Green	Yellow	Green	Green	Green	Green
Spanish Broom	Green	Green	Green	Yellow	Green	Green	Green	Green
Abaca	Green	Yellow	Green	Green	Green	Green	Green	Green
Crab Shell	Green	Green	Yellow	Green	Green	Green	Green	Green
Lyocell	Green	Yellow	Green	Green	Green	Green	Green	Green
Coconut Coir	Yellow	Green	Green	Green	Green	Green	Green	Green
Kapok	Green	Yellow	Green	Green	Green	Green	Green	Green
Organic Cotton	Yellow	Green	Green	Green	Green	Green	Green	Green
Ramie	Green	Green	Yellow	Green	Green	Yellow	Green	Green
Polyactic Acid	Green	Yellow	Green	Green	Yellow	Green	Green	Green
Silk	Yellow	Green	Green	Green	Green	Green	Green	Green
Alpaca	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Cashmere	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Down (feathers)	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Orange Fiber	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Apple Leather	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Bamboo	Green	Green	Yellow	Red	Green	Red	Green	Green
Grape Leather	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Pineapple Leather	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Soy bean	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Wool	Yellow	Green	Green	Green	Green	Yellow	Green	Green
Acetate	Green	Yellow	Green	Red	Green	Red	Green	Green
Modal	Green	Yellow	Green	Red	Green	Red	Green	Green
Rubber	Yellow	Green	Green	Red	Green	Yellow	Green	Green
Angora	Yellow	Green	Red	Green	Green	Yellow	Green	Green
Mohair	Yellow	Green	Red	Green	Green	Yellow	Green	Green
Viscose	Green	Yellow	Green	Red	Green	Red	Green	Green
Casein (Milk)	Red	Yellow	Green	Yellow	Red	Red	Green	Green
Cotton	Red	Red	Yellow	Red	Red	Red	Green	Green
Cow Leather	Red	Red	Yellow	Red	Red	Red	Green	Green
Recycled Nylon	Green	Green	Yellow	Red	Red	Red	Red	Red
Acrylic	Green	Green	Yellow	Red	Red	Red	Red	Red
Elastothane	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Polyamide	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Polyamide: Nylon	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Polyester	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Polyethylene	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Polypropylene (PVC, Synthetic Leather)	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Polytrimethylene	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Polyurethane	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Teraphthalate	Yellow	Yellow	Red	Red	Red	Red	Red	Red

Note: Green indicates best performer in environmental impact category. Yellow indicates average performer in environmental impact category. Red indicates worst performer in environmental impact category. (See online version for colors.)

Source: Amberoot and Bernstein analysis

How are companies responding to these new ideas?

- **Bananatex** is a plant-based materials innovator company that has created the world's first durable, waterproof fabric made purely from banana plants. Cultivated in the Philippines within a natural ecosystem of sustainable forestry, the plant requires no chemical treatments. Its self-sufficiency has made it an important contributor to reforestation of areas once eroded by palm plantations, while enhancing the prosperity of local farmers.⁷⁹ The company has already partnered with other large

⁷⁹ <https://www.bananatex.info/index.html>

brands to supply materials, including the release of a shoe collection with London-based footwear brand Good News, and H&M.^{80,81}

- **Vegea** creates biomaterials for fashion, furniture, packaging, and automotive & transportation,⁸² turning waste from wine-making such as grape skins as well as vegetable oils and natural fibers from agriculture into an alternative to fully petroleum-based or animal-based leather.⁸³
- **Piñatex** produces natural leather using leftover pineapple leaves, which is used in shoes, bags, clothes, and home furnishing products.⁸⁴
- **MycoWorks**, with celebrity backing from John Legend and Natalie Portman, produces materials from mycelium, or root-like threads grown by various types of fungi.⁸⁵ Its fine mycelium materials represent an improvement from traditional mushroom leather and are being used by luxury brands such as Hermès (see Exhibit 84).

EXHIBIT 84: Hermès launched a vegan leather version of its classic Victoria bag, which should be available by the end of 2021



Source: MycoWorks, BoF, and Bernstein analysis

⁸⁰ https://www.bananatex.info/products_EN.html#hundm

⁸¹ <https://www.hm.com/by/3103b-good-news-x-hm/>

⁸² <https://www.vegeacompany.com/>

⁸³ <https://www.reuters.com/article/us-global-social-finance/companies-trying-to-do-good-face-stiff-competition-from-each-other-idUSKCN1SG2D3>

⁸⁴ <https://www.ananas-anam.com/products-2/>

⁸⁵ <https://www.mycoworks.com/>

SECTOR ANALYST PERSPECTIVES: OPPORTUNITIES AT THE STOCK LEVEL

GLOBAL LUXURY GOODS

Luxury goods companies have two major ways to reduce their environmental impact:

- (1) Reducing impact per unit produced ([Climate Change Scenarios: What does Luxury look like in a 1.8 degree world?](#)); and
- (2) Increasing the number of uses per unit produced.

Alternative raw materials and more sophisticated manufacturing processes support point (1). In parallel, a number of business developments are converging to improve performance on point (2):

- (a) **Professionalization of secondhand.** Consumers' major concern when buying secondhand is authenticity. The advent of professional players in this area and, even more importantly, the creation of authenticity standards based on blockchain technology are contributing to expanding the "second life" market. Second life will mean products will be used more often. Here too, it is conceivable that a more functional secondhand market will also result in higher volumes, as it would free up more spending capacity as consumers monetize their unused wardrobes (see Exhibit 85 to Exhibit 89).

EXHIBIT 85: LVMH is at the forefront of product traceability through blockchain, creating the platform AURA; such incentives will give validity to secondhand platforms as consumers' major concern when buying secondhand is authenticity



In May 2019, LVMH partnered with ConsenSys and Microsoft to create AURA, a platform to track and trace (product history, proof of authenticity from raw material to PoS and second-hand market) products based on Ethereum blockchain and using Microsoft Azure.

Source: Company reports and Bernstein analysis

EXHIBIT 86: **Companies already leverage technology to trace their products through the supply chain****Technologies leveraged and skins traceability engagement****Hermes RFID chips on exotic skins**

RFID chips the finished leathers, the areas in the country of collection (Malaysia) or the origin farms (Vietnam) can be traced back, as well as the different stages of animal transport or transit.

Kering – Bottega traceable engagement

Full traceability of its leather supply chain ensures a reduced environmental impact while unveiling the full story of the products

Kering - Saint Laurent traceability engagement

Traceability system to track leather purchase from all product categories at least from the country of origin

In 2019, Saint Laurent launched 2 innovative pilot projects around traceability. For leather, in South Africa, leather lamb skins are traced from farms to finished goods thanks to the laser technology. For mohair, also in South Africa, blockchain is used to trace back the main mohair purchases and farm origin is checked through unique product fingerprint technology.

Burberry

- Trace to their country of origin and address issues based on risks by region, not yet to slaughterhouse and farm level
- Burberry will not knowingly use leather from cattle raised in the Amazon Biome

Source: Company reports and Bernstein analysis

EXHIBIT 87: Two-sided marketplaces dominate the secondhand market, focusing on the online channel and providing consumers with a place where they can consign and buy pre-owned items at the same time



Source: ThredUp, company websites, and Bernstein analysis

EXHIBIT 88: Luxury brands are slowly embracing the trend with partnerships and initiatives; however, Chanel is still resisting the change

Stella McCartney x The RealReal

\$100 voucher to spend at Stella McCartney when you consign any Stella McCartney item

Burberry x TheRealReal

Upon consigning a Burberry item you receive a personal styling appointment and British High Tea at a Burberry store.

Ralph Lauren x Depop

Re/Sourced was launched in October 2019 and allowed customers to buy a curated selection of Ralph Lauren vintage products from Depop in a pop-up Space at the Ralph Lauren flagship store in London.

Reformation x ThredUp

Reformation is giving customers store credit whenever customers consign a product from the brand via ThredUp.

Anna Wintour, editor-in-chief of Vogue, '[It's all about] talking to our audiences, our readers, about keeping the clothes that you own, and valuing the clothes that you own and wearing them again and again, and maybe giving them on to your daughter, or son, whatever the case may be.' (December 2019)

Neiman Marcus has acquired a minority stake in online consignment site **Fashionphile**, while **Richemont** acquired **Watchfinder**.

BUT,

Chanel filed lawsuits against **TheRealReal** (in November 2018) and What Goes Around Comes Around for trademark infringement, false endorsement and unfair competition.

Source: The RealReal, company websites, and Bernstein analysis

EXHIBIT 89: In October 2019, Vestiaire Collective opened its first permanent boutique in Selfridges as the department store is embarking on a mission to change the way we shop



Source: Bernstein photography

- (b) **Creation of higher-quality off price.** Legislation preventing brands from destroying end-of-season unsold products and the emergence of quality off-price players such as Value Retail have created a perfect context for brands to increase uses per unit. As end-of-season units find buyers, this is less damaging for brand equity than traditional factory outlets (see Exhibit 90 to Exhibit 92).

EXHIBIT 90: European countries are moving toward sustainability in textiles: France has introduced a ban on the destruction of unsold fashion goods

EU	France	Germany
<ul style="list-style-type: none"> • Clothing accounts for 2-10% of the environment impact of EU consumption • In 2018, the EU adopted a circular economy package that will, at the insistence of the European Parliament, for the first time ensure that textiles are collected separately in all Member States, by 2025 at the latest • The European Parliament has for years advocated promoting the use of ecological and sustainable raw materials and reuse and recycling of clothing 	<ul style="list-style-type: none"> • In June 2019, France introduced a ban on the destruction of unsold fashion goods • The ban is to be implemented by 2023 • Once in force, the plan would see manufacturers obliged to turn the stock over for reuse or recycling • Special arrangements were anticipated for the luxury sector. Products that were not usable after a certain date would have exceptions • The move was the first of its kind in the world on a national level 	<ul style="list-style-type: none"> • The German government in September 2019 unveiled the "Green Button" • It is the world's first government-sustainable textile label • Products with the Green Button must fulfill minimum 26 social and environmental standards • The environmental criteria revolve around requirements in textile finishing such as dyeing procedures or the chemical retrofitting of clothing

Source: <http://www.europarl.europa.eu/>, Forbes, the Guardian, company websites, and Bernstein analysis

EXHIBIT 91: Quality off-price players such as Value Retail are less damaging for brand equity than traditional factory outlets and a perfect context to increase uses per unit

	Average factory outlet mall	Value Retail Village
Brand mix curation	★	★ ★ ★
Retail/Store management	HANDS OFF	HANDS ON
Food & Drink offer	★	★ ★ ★
Value added services	★	★ ★ ★
Décor	★	★ ★ ★ ★
Capex	★	★ ★ ★

Value Retail Village offers:

- Luxury chauffeur-driven service
- Valet parking
- Shopping Express® (luxury coach)
- Direct trains (Chiltern Railways) from London or Oxford

- Roaming Photographer
- Selfie points
- Art Installations

- Privilege membership
- VIP lounge
- VIP Card (extra discounts)
- Hands-free Shopping Service (collect bags at the end)
- Dog strollers

- Personal Shopping Team
- Instant tax refunds and currency exchange
- Frequent flyer rewards

Restaurants (Café Wolseley, EL&N Café, Doughnut Time, Ladurée, Flax & Kale, etc.)

Source: Company website and Bernstein analysis

EXHIBIT 92: Value Retail offers a tailored brand selection in each location: Among the 167 brands at Shanghai Village, 55 brands (33%) are also in Bicester Village (UK), and 24 brands (14%) are Chinese brands

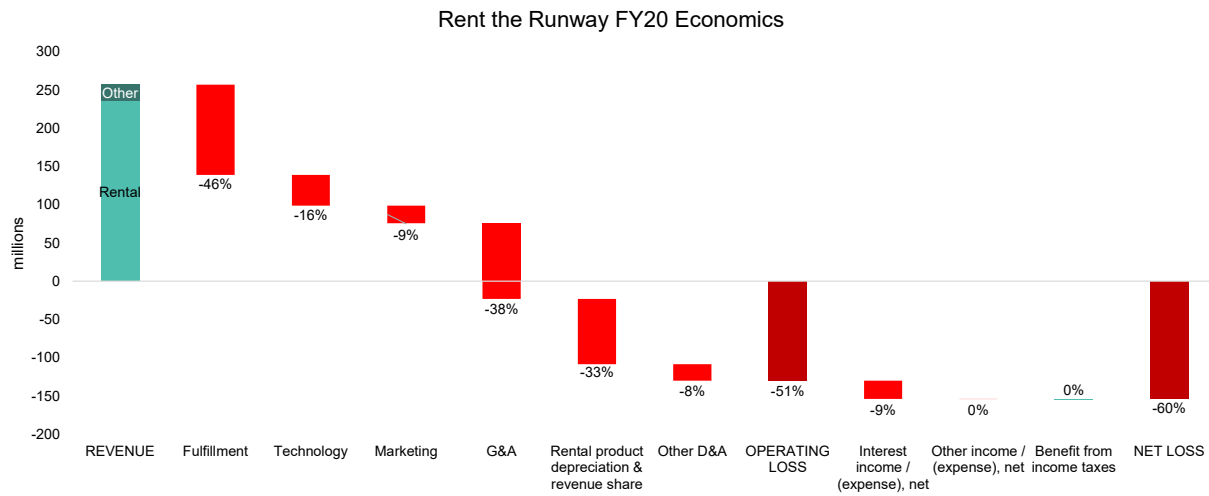
Bicester Village, Oxford, UK			Shanghai village, China		
Acne Studios	Gina	Polo Ralph Lauren Children	Adidas	Furla	Onitsuka Tiger
Agent Provocateur	Girard Perregaux	Pomellato	Agnès b.	Golden Goose	Palladium
Alexander McQueen	Giuseppe Zanotti	Prada	Agatha	Gucci	Polo Ralph Lauren
AllSaints	Givenchy	Qeelin	Aigle	Guess	Paul Frank
Anne Fontaine	Golden Goose Deluxe Brand	Radley	Aigner	Givenchy	Ports
Annoushka	Gucci	Rado	Aimer	G-Star Raw	Puma
Aquazura	Gucci Timepieces	Rapha	Alexandre de Paris	HUGO BOSS	Patagonia
Armani	Hackett	Reis	Alice and Olivia	Hogan	Patrizia Pepe
ASICS	Hamilton	Rituals	Aquascutum	HONMA	Paw in Paw
ba&sh	Holland Cooper	Roger Vivier	ArcTeryx	Hechter	Philipp Plein
Balenciaga	Hour Passion	Rupert Sanderson	Armani	Hilditch & Key	Pinko
Bally	Hourglass Cosmetics	Saint Laurent	Ashworth	i-lollipop	Razle
Balmain	HUGO	Salvatore Ferragamo	ASICS	Indigo Living	Replay
Bamford	Hunter	Samsonite	AUM	Initial	RayBan
Barbour	Jack Wills	Sandro	Autason	Jack Wolfskin	Repetto
Belstaff	Jimmy Choo	Savoy Tailors Guild	ba&sh	JNBY	River Woods
Bonpoint	Juicy Couture	Sergio Rossi	Balmain	J. Lindeberg	Salvatore Ferragamo
BOSS	KARL LAGERFELD	Smythson	Beanpole	Juicy Couture	Samsonite
Bottega Veneta	kate spade new york	Stella McCartney	Bonpoint	KARL LAGERFELD	Shanghai Tang
Boucheron	Kenzo	Stuart Weitzman	Brooks Brothers	kate spade new york	Skechers
Breitling	L'Occitane en Provence	Superdry	Brunello Cucinelli	Kenzo	Staccato
Brioni	L.K. Bennett	Swarovski	Burberry	Kingkow	Salomon
British Fashion Council	Lacoste	Swatch	Callaway	Kipling	Stella Luna
Brooks Brothers	Lalique	Swasty Betty	Club Monaco	Le Sportsac	Stk Studio
Brunello Cucinelli	Le Creuset	TAG Heuer	CNC	Listle Space	Sandro
Burberry	Levi's®	Ted Baker	Converse	Li Ning	Saiko
Calvin Klein Jeans	Linda Farrow	Temperley London	CROQUIS	Liu Jo	Shiatzy Chen
Calvin Klein Underwear	Links of London	The Cosmetics Company Store	Calvin Klein	Lacoste	Sridal
Calvin Klein Watch & Jewelry	Loewe	The Koooples	Claudia Pierlot	Le Creuset	Swarovski
Cambridge Satchel Company	Longchamp	The North Face	Chloe Chen	Lululemon	Stuart Weitzman
Cath Kidston	Longines	The White Company	Clariks	Lee	Tory Burch
Celine	Loro Piana	The Wolseley Shop	Coach	LansCrafters	Tenise Weenie
Certina	Lululemon	Thom Browne	Coccinelle	Levi's®	The Cosmetics Company
CH Carolina Herrera	Maje	Timberland	Cole Haan	Loewe	The North Face
Charles Tyrwhitt	Manolo Blahnik	Time & Gems	Columbia	Lotusse	Theory
Chloé	Mami	Tissot	DESCENTE	L'Occitane en Provence	Thom Browne
Church's	Max Mara	Tod's	DIAMOND DAZZLE	Mo&Co	Timberland
Clarins	MCM	Tommy Hilfiger	Diesel	Mr&Mrs Italy	Tommy Hilfiger
Clarks	Michael Kors	Tony Burch	dunhill	Mugen Optical	Triumph
Claudia Pierlot	Mido	True Religion	Diane von Furstenberg	Merisfrog	Trussardi
Clive Christian Perfume	Missoni	Tumi	DIAMOND DAZZLE	Moussy SLY	Tumi
Coach	CLOSED	UGG	Escada	Mandarina Duck	Under Armour
Coccinelle	Molton Brown	Ulysse Nardin	Eland	Maje	UGG
David Clulow Sunglasses	Moncler	Under Armour	Ecco	MCM	Versace
Diane von Furstenberg	Monica Vinader	Valentino	Elsa Lee	Maud Frizon Paris	Vivienne Westwood
Diesel	Montblanc	Versace	Erdos	Mammamia	VAI
Dior	Mulberry	Vilebrequin	EVISU	Michael Kors	VANS
DKNY	N.Peal	Villeroy & Boch	Fandacia	Mulberry	Wolfford
DoDo Jewellery	New Balance	Vivienne Westwood	Feiyue	Moschino	WMF
Dolce & Gabbana	Orlebar Brown	Wolford	Fila	Nautica	Wacoal
dunhill	Oscar de la Renta	Yves Salomon	Fusion	Neil Barrett	Yoho!Buy
Emma Bridgewater	Pandora	Zadig&Voltaire	Folli Follie	New Balance	Yves Salomon
Ermengildo Zegna	Paul Smith	Zwilling J.A. Henckels		Nike	ZhuChongYun
Escada	Penhaligon's	49Winters		Orchirly	Zwilling J.A. Henckels
Fendi	Philipp Plein			O'Viva Burton	ZuZug
Furla	Polo Ralph Lauren			O blu	

Brands in common: Oxford & Shanghai
Chinese brands

Source: Company websites and Bernstein analysis

- (c) **Development of rental.** While the economics of rental players are yet to be proven ([Rent the Runway Pre-IPO: Welcome to the Infinite Wardrobe](#)), offering consumers the opportunity to rent rather than buy can increase the number of uses per unit produced — specifically in the case of low uses per unit categories such as couture and ready-to-wear (RTW). This will also likely expand the number of consumers using these categories, resulting in volume increase (see Exhibit 93 to Exhibit 97).

EXHIBIT 93: **The economics of rental players are yet to be proven**



Note: Rent the Runway YE January 31

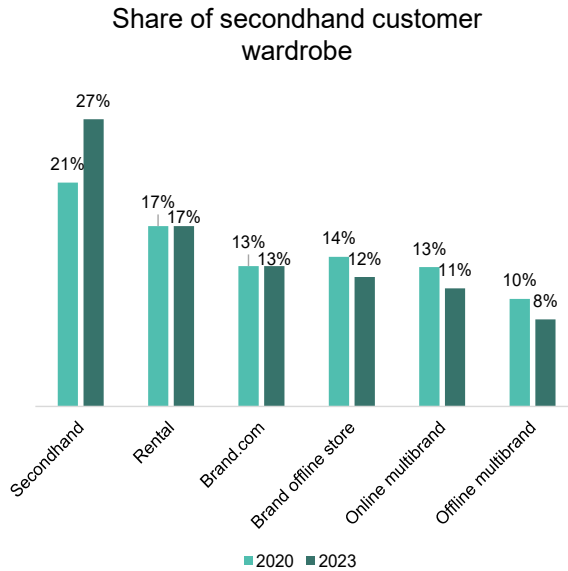
Source: Company reports and Bernstein analysis

EXHIBIT 94: **Offering consumers the opportunity to rent rather than buy can increase the number of uses per unit produced**



Source: Computer Generated Solutions (CGS) 2019 and Bernstein analysis

EXHIBIT 95: **Rental is the second most preferred option of consuming luxury for customers who already shop secondhand**



Source: BCG x Vestiaire Collective 2020 and Bernstein analysis

EXHIBIT 96: **Kering has already invested in luxury handbag subscription website Cocoon**

COCOON SPECIAL | 1st month free on Premium & Deluxe monthly memberships with code BAGIT2021 | Ts&Cs apply

MEMBERSHIPS THE COLLECTION BACK IN STOCK WHAT'S NEW

HARVEY NICHOLS EDIT DESIGNERS CATEGORY TRENDING NOW SELL YOUR BAG

We're Flexible

New Flexi Membership has arrived. Access the luxury bags you want, when you want, for one week at a time.

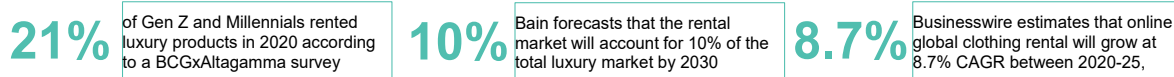
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Kering invests in luxury subscription service Cocoon June 2021

- Cocoon was launched in 2019
- Cocoon is UK-based and offers new, pre-owned and limited-edition vintage handbags including Gucci, Bottega Veneta and Prada from £49 a month in the UK
- The start up saw **triple-digit growth** over 2020, but the business is not yet profitable
- The total investment raised to date is over £2.5million
- Kering CDO Grégory Boutté: "This investment in Cocoon will enable us to monitor new consumption habits and digital practices. We see the subscription model as a very interesting trend in fashion, and by extending the product life cycle, it resonates particularly well with Kering's circularity ambition."
- Kering also took a 5% stake in top luxury resale site Vestiaire Collective in March 2021

Source: Vogue Business, company website, and Bernstein analysis

EXHIBIT 97: **Luxury resale market key statistics**



Source: BCG, Bain & Company, Business Wire, and Bernstein analysis

- (d) **Upcycling** is a clever alternative to destroying end-of-season inventory. The process ticks the box on more responsible use of resources as well as attractive economics. Upcycling refers to the process of reusing existing clothes and accessories and refashioning them into new, unique garments. Deadstock, or fabric leftovers from the fashion industry, can also be used to produce new garments and accessories. Since writing on the topic in January 2020 ([Luxury's New World: The Future of End-of-Season](#)), most of our coverage brands have embraced the trend with capsule collections or by integrating it directly into their runway collections (see Exhibit 98 and Exhibit 99). Upcycling could potentially transform 85% of the leftover inventory that usually ends up in landfills, and can save more than 13,000 pounds of CO₂ emissions a year.

EXHIBIT 98: Upcycling is a trend that has been embraced by the luxury industry particularly since 2019; LVMH enables the practice with the fabric resale platform Nona Source

LVMH
 In April 2021, the LVMH group launched *Nona Source*, an online resale platform offering emerging creatives and brands access to the group's fabrics and leathers at an average of 70% off the original wholesale price, encouraging creative reuse of materials that may otherwise remain unused in archives. *Nona Source* is a startup incubated by LVMH's DARE intrapreneurial program to accelerate innovative solutions. Developed with a sustainable vision, *Nona Source* is all-digital and favors local distribution. Because stocks are located in France, the platform will for the time being deliver within Europe (including the United Kingdom). Available materials range from lace to leathers in different compositions, weights, colors and patterns. Only exclusive patterns or branded fabrics are not available. Product characteristics are presented in minute detail thanks to high-quality visuals, videos to translate the touch and feel experience, plus displays on wooden mannequin's for fall and drape visualization.

MIU MIU
Upcycled by Miu Miu is a special collection of vintage dresses reworked by Miu Miu. A limited selection of 80 one-off and numbered designs, the collection is built around precious, anonymous finds, dating from the Thirties to the Eighties, sourced from vintage clothing stores and markets worldwide. Once restored, pieces are re-fashioned with signature Miu Miu embroideries and embellishments by hand. *Upcycled by Miu Miu* dresses are available in 9 selected Miu Miu boutiques.
Miu Miu x LEVI'S
 Miu Miu and Levi's have teamed up on an upcycled collection which dropped on May 24, 2021. The designs transform classic Levi's denim silhouettes with Miu Miu's signature embellishments - embroidery, crystals, and patches. Each piece is unique.

LOEWE
The Surplus Project crafts items exclusively with excess leather from previous collections. The complexity of the patterns used to craft Loewe bags naturally leads to excess leather pieces when new collections are made. In a video on its website, Loewe presents *The Surplus Project* with Ana Maria Muñoz, a leather artisan with the Spanish Maison for the past twenty years. Details of the bags are hand-stitched with the same ultra-precise care as a new one. The emblem of the project is a piece of surplus leather intricately folded in the shape of a crab, a charm attached to the handles or shoulder strap of the bag.

£195

CHLOE
 Gabriella
 Hearst's new-look Chloé Edith bags are made from 50 vintage Ediths that were upcycled and refreshed with surplus AW21 fabrics. The new Edith family includes bags in recycled cashmere or with recycled jacquard and it is offered as a mini version, a tote and a doctor's bag. The bags are one-of-a-kind.

HERMÈS
 The *Petit h* workshop was launched in 2010 with the sole purpose of giving new life to leftover, unwanted and forgotten materials. A team of 30 people design the items under the creative direction of Godefroy de Virieu, who took over from the label's founder Pascale Mussard in 2018. *Petit h* has a new dedicated space as of September 2021, adjacent to the luxury brand's flagship on Rue de Sèvres in Paris. The collection is also sold on Hermès' e-commerce site, and pop-ups organised in Hermès stores throughout the world.

£50 - £3,780

BALENCIAGA
 Balenciaga's spring/summer 2021 collection is comprised of 93.5% plain materials that are either certified sustainable or upcycled.

LOUIS VUITTON
 Virgil Abloh's spring/summer 2021 collection featured 30 looks of "Upcycling Ideology". Two looks were made from new material, 25 looks were made from recycled material, and 25 looks from the previous collection were reshown. The "Upcycled" looks were divided into four categories: pieces upcycled by recycling material from overstock, pieces upcycled from recycled ideas, pieces upcycled through reiteration from the previous pieces and pieces upcycled as part of the "Homework" initiative. Reconditioned pieces carried the "Upcycling Signal Logo", a new LV emblem exercised to imbue the "old" with new value.

A collection of Louis Vuitton men's trainers are also made from upcycled leather from prior LV Trainer collections as well as the house's Be Mindful accessories collection, a capsule crafted from upcycled, reclaimed materials. Stitched on the back of the shoes is "LV Upcycling", alongside the Louis Vuitton branding and emblematic Monogram flowers on the sole. Each pair offers a unique experience for Louis Vuitton fans everywhere as the shoe provides do-it-yourself customization options. The sneakers recently sold for \$1250 on Grailed.

Source: Company websites and Bernstein analysis

EXHIBIT 99: Top fashion universities, such as Central St Martins, have introduced upcycling into their curriculum and competitions as they teach the designers who will shape tomorrow's industry

Introduction to Slow Fashion (Online Short Course)

College: Central Saint Martins | Taught by: Shelley McCarter

[View basket >](#)

Description

Slow fashion is a reaction against the unethical business practice of the fast, cheap, mass-produced branch of the fashion industry. Slow fashion's ethos is based on the sustainable circular idea that rates an environmentally friendly production lifecycle, vintage, on demand, bespoke, high quality and timeless design, repair, **upcycling** and rental.

Enquire

If you haven't found the information you're looking for or want to ask us a question about this course, please fill out our enquiry form.

Fashion Design and Production of the Future Short Course

College: Central Saint Martins | Taught by: Matthew Needham

[View basket >](#)


Description

A course designed for individuals who are interested or who have already begun **research** and development into future design solutions that are environmentally conscious. This includes **upcycling**, recycling, zero waste, and bio science, and is taught through project work, independent research, lectures/seminars, and practical demonstrations.

Enquire

If you haven't found the information you're looking for or want to ask us a question about this course, please fill out our enquiry form.

Twentieth Century Fox and Swarovski

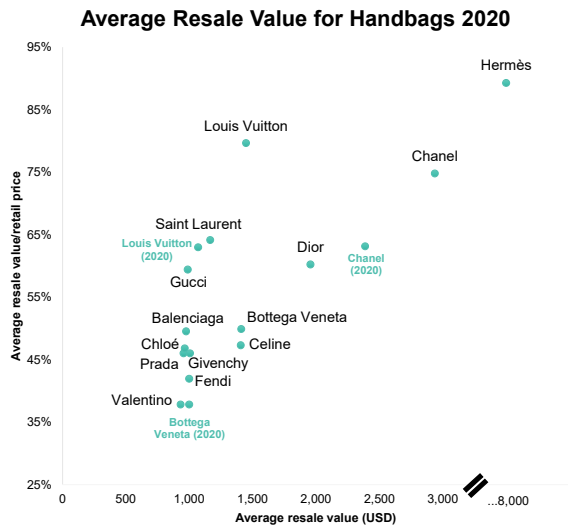


To coincide with Fox's biopic 'The Greatest Showman' about entertainment impresario PT Barnum, the studio approached Central Saint Martins to create a fashion collection inspired by the themes of the film, which include the power of imagination, individuality and inclusion. Eight groups of second year students from all pathways of the BA Fashion course created designs using a range of collected materials and donated Swarovski crystals which celebrate spectacle and fantasy but also incorporate sustainability and **upcycling** in surprising and pioneering ways.

Source: University websites and Bernstein analysis

Mega-brands have a material advantage when generating higher uses per unit produced, as well as reducing their unit impact. First, they have materially higher full-price sell-through, limiting end-of-season inventory to the extreme. Second, they hold value, taking an even bigger share of the secondhand market than of the unworn market (see Exhibit 100). Third, they have scale, which gives them the ability to develop and adopt more sustainable raw materials and manufacturing processes. All the more so, fourth, they have higher levels of upstream integration. In this light, we believe high "structural appeal" companies in our coverage — such as Hermès and LVMH (with leading brands such as Louis Vuitton and Dior) — stand tall ahead of peers in this realm of producing a more sustainable footprint (see Exhibit 101) ([Luxury Goods and the ESG Tower of Babel](#)).

EXHIBIT 100: More expensive brands seem to retain higher resale value, taking an even bigger share of the secondhand market than of the unworn market



Source: Rebag and Bernstein analysis

EXHIBIT 101: We believe high "structural appeal" companies in our coverage – such as Hermès and LVMH (with leading brands such as Louis Vuitton and Dior) – stand tall ahead of peers in this realm of producing a more sustainable footprint

	Hermès	LVMH	Tiffany	Kering	Farfetch	Moncler	Burberry	EssiLux	Prada	Richemont	Swatch
Reliability & Predictability	94	87	92	74	35	76	70	81	50	46	50
Forecasts Dispersion	94	100	70	92	69	80	78	62	41	75	0
Earnings Beats & Misses	100	95	98	73		87	47	93	62	0	80
Revenue Beats & Misses	100	93	99	85		65	100	93	20	50	61
Beta	83	60	100	45	0	71	55	73	76	58	60
Scale Advantage	56	62	24	45	16	10	14	19	12	23	6
Group Sales	11	100	6	28	0	1	4	31	4	25	13
Sales / Store	100	25	43	62	32	19	24	7	19	20	0
Mega-Brand Health	79	69	31	41	100	57	38	4	52	36	15
Digital Traffic	97	98	83	97	100	92	96	0	94	57	12
Growth Momentum	18	23	8	16	100	28	0	15	3	5	10
Entry-price Exposure	100	57	17	47	0	31	38	0	47	62	17
Off-price Exposure	100	100	14	3	0	75	20	0	66	22	22
Manufacturing of the Future	82	47	65	18	47	0	18	100	15	53	76
Distribution of the Future	81	81	100	71	100	70	74	14	77	35	0
Management Compass	85	52	54	55	0	73	67	53	32	41	35
Stability	86	100	91	64		77	79	91	51	68	76
Altitude	100	9	28	0	0	76	66	15	43	33	29
Direction	68	47	42	100		66	57	52	3	20	0
Average Score	79	67	61	50	50	48	47	45	40	39	31
Rank	1	2	3	4	5	6	7	8	9	10	11

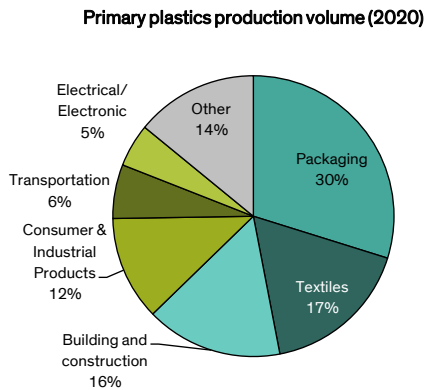
Note: EssiLux historical scores based on Luxottica; Tiffany is part of LVMH since 2021.

Source: Company reports and Bernstein analysis

EUROPEAN CHEMICALS

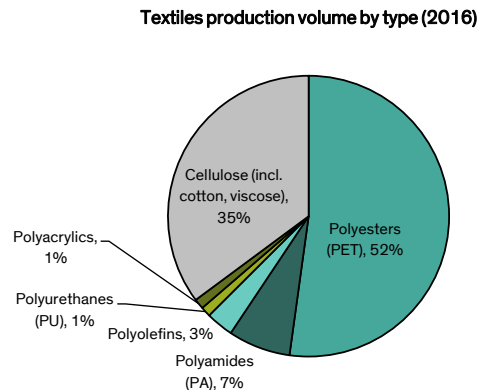
Textiles are the second-biggest end-market for plastic producers globally, with a 17% volume share (see Exhibit 102). They represent a sizable addressable market of 78 million tonnes or US\$60bn at current prices for specialist chemicals companies to provide sustainable substitutes and/or solutions. Given the trends discussed earlier, we see this as a high-growth opportunity for European chemicals companies addressing both the "take" and "waste" part of textiles cycles. At the same time, unlike many US and Asian chemical producers, European companies have little to no exposure to virgin plastic production. However, solutions must be compatible with the most commonly used types of plastic in the textiles industry, namely polyesters (PET), which account for 52% of textile volume (see Exhibit 103).

EXHIBIT 102: Textiles are 17% of plastic production



Source: Geyer et al and Bernstein analysis

EXHIBIT 103: Polyester (PET) accounts for the majority of textile plastics



Source: Research Institute of Sweden and Bernstein analysis

The key ways in which specialty chemical companies are reducing the environmental impact of fashion are:

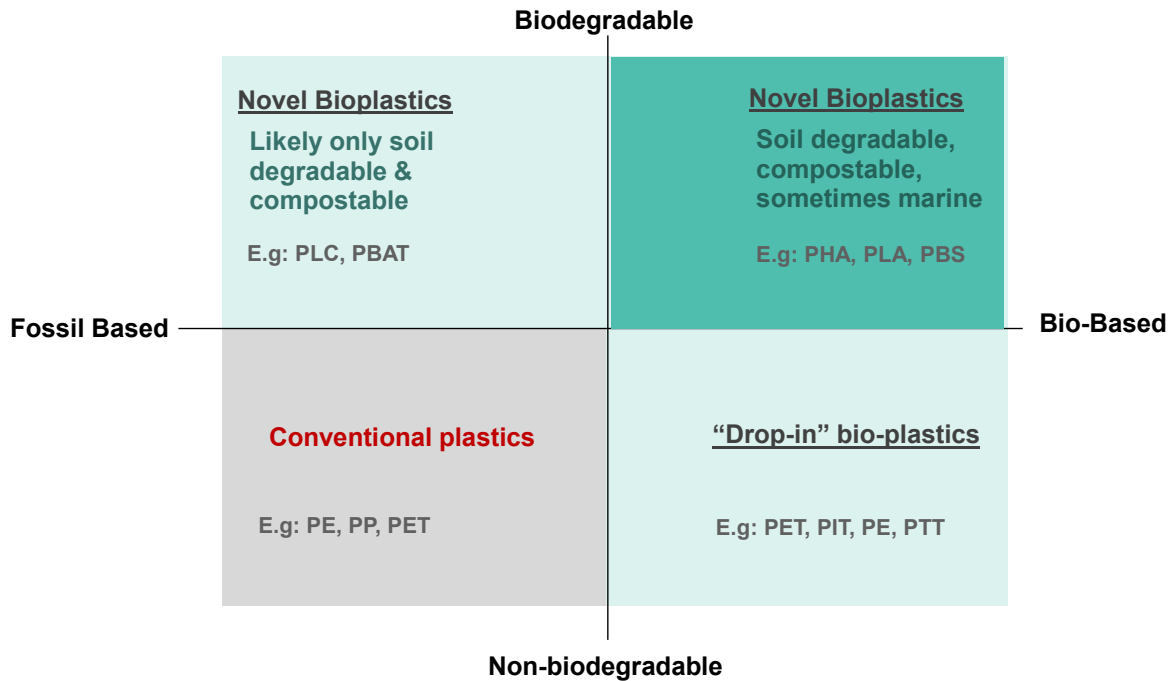
- **Biodegradable** plastics ("take" and "waste"),
- **Recycled** plastics ("take"), and
- Improved washing cycles and green **detergents** (use or "waste").

We see investable opportunities in all three areas, which we detail below.

Bioplastics

A bioplastic is either a plastic made from renewable sources (i.e., bio-based plastics or biopolymers), thus addressing the "take" part of the cycle, and/or one that is biodegradable, addressing the "waste" part of the cycle (see Exhibit 104). Bioplastics have varying properties and can biodegrade in different environments at different temperatures. For the textiles industry, biodegradability on land and water is crucial.

EXHIBIT 104: **Bioplastics market overview**



Source: Bioplastics Europe and Bernstein analysis

Bioplastics can be classed broadly by three methods of production:

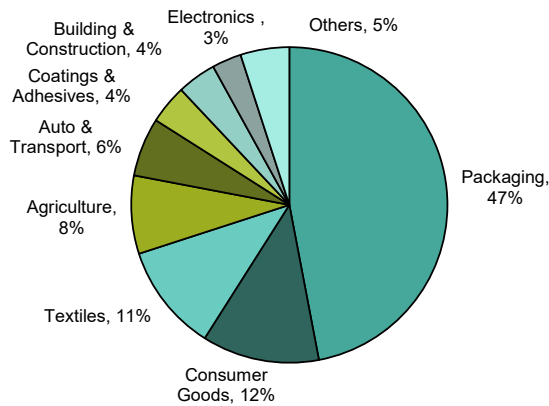
- Polymers extracted/removed directly from biomass, such as polysaccharides (e.g., starch, cellulose, and galactomannans) and proteins (e.g., casein and gluten).
- Polymers produced by chemical synthesis from renewable bio-derived monomers, such as polylactic acid (PLA), a thermoplastic polyester derived from lactic acid

monomers. The monomer itself is produced via fermentation of carbohydrate feedstocks.

- Polymers produced by microorganisms, like some polysaccharides (e.g., gellan gum and pullulan) and polyhydroxyalkanoates (PHA), which are fed with sugars and starches such as corn, glycerin, triglycerides, or methane.

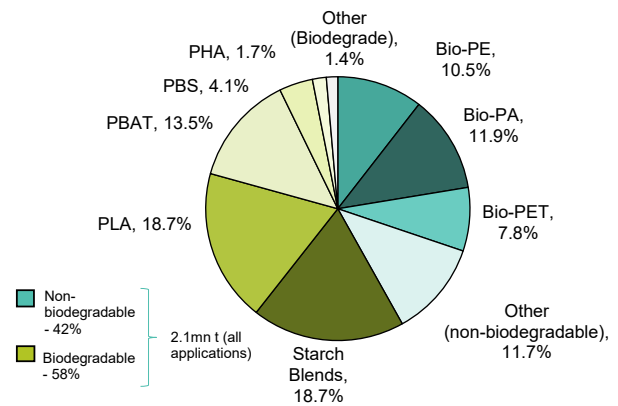
Starch-based blended bioplastics and PLA are the most commonly manufactured type of biodegradable plastics, and each represents 18.7% of capacity in 2020 (see Exhibit 106). PLA is the most commonly used bioplastic in the textiles industry (~30%) as its properties are similar to those of polyethylene and can be used in the production of polyesters (PET), which is 52% of plastic production for textiles. However, PLA is not certified as biodegradable in water, only in industrial composting.

EXHIBIT 105: 11% of bioplastics go into the textile industry



Source: European Bioplastics and Bernstein analysis

EXHIBIT 106: PLA is the most common bioplastic and is most commonly used in textiles



Source: European Bioplastics and Bernstein analysis

Bio-polyester (i.e., chemically the same as polyester but with bio-based feedstock) such as bio-PBS are also commonly used. PHA is also a bio-based polyester that is biodegradable in all types of environments, but due to its properties, only replaces PVC in clothing and decorations such as sequins. To replace nylon, or polyamides, which makes up 7% of textiles plastics, bio-PA is used, but this is not biodegradable and, therefore, only addresses emissions from the "take" part of the process.

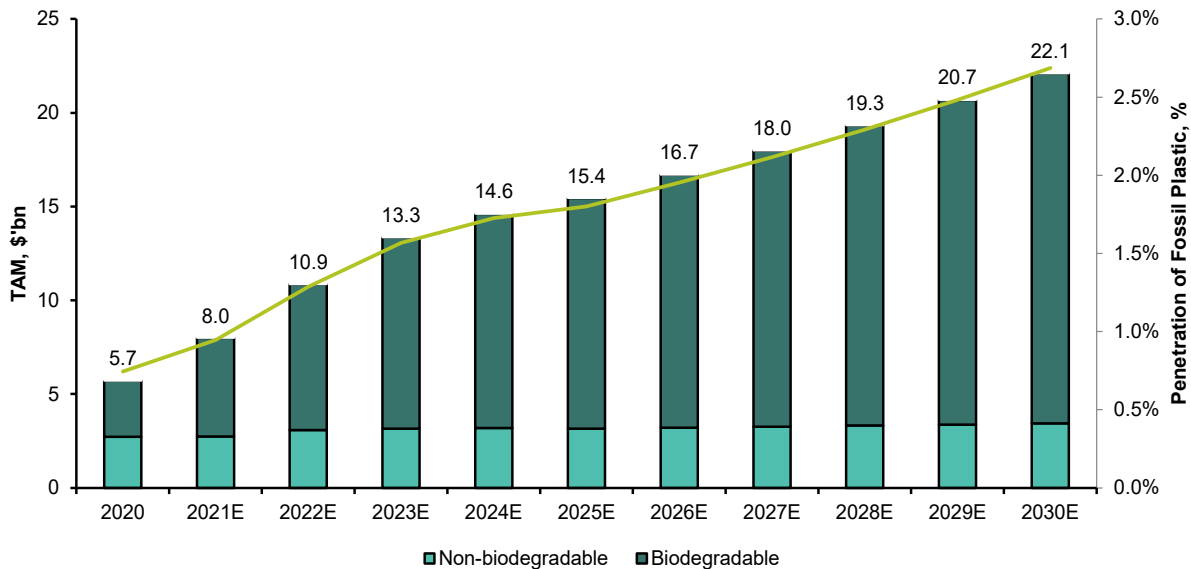
Bioplastics currently have a US\$5.7bn TAM, US\$3bn of which is biodegradable and US\$2.7bn non-biodegradable across all applications. We estimate this TAM based on 2.11 million tonnes of capacity, of which 42% is non-biodegradable and 58% is biodegradable. Of the total capacity, textile is the third-largest end-market, accounting for 11% of capacity (see Exhibit 105).

Bioplastic adoption historically faced the challenge of high prices compared to fossil-based plastics. PLA is currently the cheapest bioplastic due to the abundance of feedstock (~US\$1,850/tonne) and can explain the high level of adoption in textiles despite its lack of marine biodegradability. This compares to traditional plastic prices of between US\$1,231/tonne for PET on average for previous two-year averages. Bio-PBS is much

more costly at ~US\$4,500/tonne. However, we expect the price will decline by 18% by 2030 as capacity scales.

By 2030, we estimate bioplastics could reach a US\$22.1bn TAM, representing a 15% CAGR across all applications. Capacity announcements imply that by 2030, capacity could increase to 8.62 million tonnes, or 2.7% of our estimate for traditional plastic production across all end uses of 310 million tonnes by 2030 versus <1% today (see Exhibit 107). Biodegradable plastics across all applications will likely drive growth, increasing from a US\$3bn market today to US\$18.7bn by 2030, in our view, driven by a 19% CAGR in capacities. We expect price decreases to be only a minor headwind to the overall TAM value, declining from US\$3,177/tonne on a weighted average basis to US\$3,016/tonne (only -5%) as the penetration of higher-cost bioplastics (mainly PHA and PBS) increases.

EXHIBIT 107: We expect the bioplastics TAM across all applications to reach US\$22.1bn by 2030, growing at a 15% CAGR, driven by biodegradable bioplastics which will likely grow at a 19% CAGR



Note: Non-biodegradable capacity refers only to dedicated production and does not include estimates of mass-balance approach to bioplastics. This is across all applications.

Source: European Bioplastics for 2020 data, and Bernstein estimates and analysis

Within our coverage, BASF and Evonik produce bioplastics for use in the textiles industry. DSM's Materials business does as well but is up for sale. These are all relatively small contributors to group revenue and not widely disclosed. However, we see this as an exciting growth area for these companies and one that they plan to put more investment behind.

- **BASF** blends bio-based feedstocks into its production of Ultramid, a fossil-based polyamide material with a suede leather effect. It uses a mass balance approach where the proportion of bio-based feedstock is calculated and applied to the product. While the amount of fossil fuels is reduced in this process, it has been criticized as fossil feedstocks are still used in production.

- **Evonik** markets biopolymers under the brand Vestamid Terra for use in textiles. It is a second-generation bioplastic based on castor oil. This is a small business in terms of revenue, but is a growth opportunity for the company. It also sells the polyamide Trogamid; however, this is based on only 40% biomass material.
- **DSM** has recently launched bio-based Dyneema, its high-performance wear used in military wear and cycling clothing, which is based on wood pulp. It also uses a mass-balance approach, and the company estimates it produces five tonnes less of CO₂ than its conventional Dyneema material.

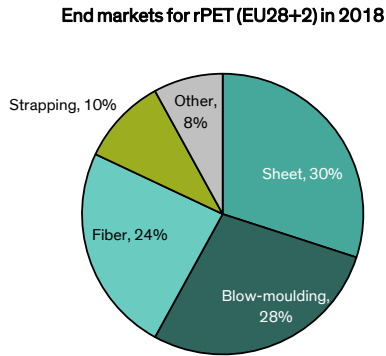
Outside our coverage, the largest bioplastics manufacturers and are either privately held (e.g., Natureworks and Novamont), have undisclosed operations as part of a JV (e.g., Corbion/Total), or are currently not profitable. However, Danimer Scientific, which will produce PLA and PHA, is estimated by Bloomberg consensus to reach EBITDA margin of 26% when capacity is fully operational in 2023. Other listed companies focused on sustainable textiles include Lenzing, which is a leader in fully biodegradable (fresh water and soil) wood-based synthetic polyesters. It also uses recycled cotton and paper pulp to improve the circularity of its products.

Recycled plastics

Polyester, which is made from PET, is the most common material used in textiles (see Exhibit 103). PET is also the plastic with the highest recycling rate at 39% globally. However, this recycling rate is only for rigid PET, whereas polyester is much less likely to be recycled (see Exhibit 109). PET-based textiles are often blended with other fibers (e.g., cotton-polyester is a common blend) or contaminated by dyes and other additives, which makes mechanical recycling difficult.

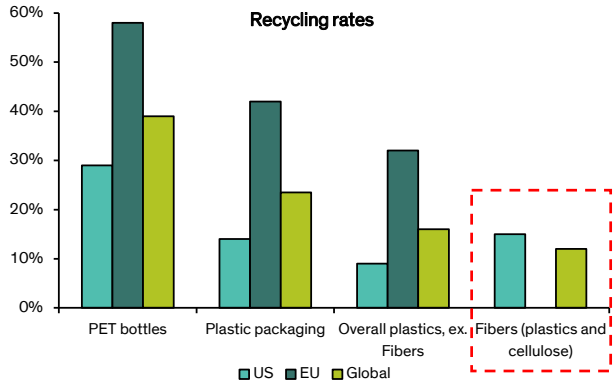
Downcycling from bottles to textiles and from textiles to insulation materials. Fiber is the third-biggest application of recycled PET (rPET) in the EU (see Exhibit 108). The main source for recycled polyester is downcycling of transparent, 100% PET packaging materials such as PET bottles. Textiles are also downcycled, for instance into insulation materials or mattress stuffing, as mechanical recycling returns fibers of shorter length and, therefore, of lower quality. Less than 1% of fibers end up recycled in a closed loop, whereas 12% are downcycled.

EXHIBIT 108: **rPET from rigid PET is often used to make textiles**



Source: Plastic recyclers Europe and Bernstein analysis

EXHIBIT 109: **Textiles have a much lower recycling rate than PET used in bottles; within textiles, polyester (PET-based fibers) is rarely recycled**



Source: EPA, Plastic Recyclers Europe, McKinsey, and Bernstein estimates (Global recycling rate for plastic packaging and PET bottles) and analysis

Plastics can be reincarnated in three key processes:

- **Mechanical recycling (plastic to plastic)** — This is the most commonly used method today. Collected plastic is sorted by type, cleaned, and then remelted into the same plastic type. Often, the quality of recycled plastic is worsened and material is downcycled. **Rigid PET is often downcycled from bottles to textiles.** This is true also for textiles, which are downcycled into insulation materials or mattress stuffing.
- **Monomer recycling (plastic to monomer)** — This method breaks down plastic polymers into their respective monomers, which are later polymerized once more. **Monomer recycling can be an attractive alternative to mechanical recycling for textiles** as it doesn't compromise the quality of recyclates and allows the process to be repeated multiple times.
- **Pyrolysis or gasification (plastic to feedstock)** — This method breaks down plastic into oil or syngas, which can later on be used to either create monomers and then new plastics or as fuel/energy. Textiles that end up as part of mixed plastic waste are often a contaminant for pyrolysis. **PET, even though it can be recycled with Pyrolysis, causes lower yields and has to be sorted out.**

For mechanical recycling, chemical companies sell [additives](#).⁸⁶ Stabilizers, compatibilizers, and chain extenders are used for PET (see Exhibit 110). Stabilizers (thermal or light protective) are mainly used to increase the quality of the recycled material and allow for more recycling cycles. They are commonly used in virgin plastics production to prevent oxidation during product use and can be applied during recycling of rigid PET. Compatibilizers allow two or more types of polymers to bond. Chain extenders are used to upgrade deteriorated recyclates. Cleaning additives for washing are key to obtaining good quality input for recycling. They remove some of the impurities that lower the quality of

⁸⁶ See report: [European Chemicals: Adding value in plastic recycling - A closer look at additives for mechanical recycling](#).

recycled plastics: product labels and adhesives, dirt, and food residue. This, paired with solutions for wastewater treatment, makes recycling more efficient. Additives often lead to upcycling of the recycled material, which could lower the availability of rPET-based fibers for textiles in favor of growing demand from the packaging industry. However, cleaning additives are needed to increase the availability of quality recycled polyester. There are also other opportunities for chemicals companies in products, such as whitening agents and coloring systems.

EXHIBIT 110: **Overview of additives used for mechanically recycled plastics – stabilizers, compatibilizers, and chain extenders are relevant for PET**

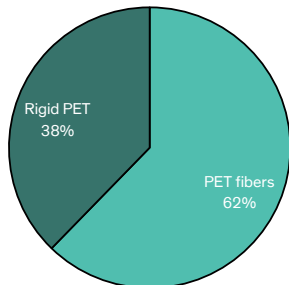
	Stabilisers	Compatibilizers	Chain extenders	Fillers	Plasticisers
PE	X	X	X	X	
PP	X	X	X		
PET	X	X	X		
PS		X		X	
PVC	X			X	X

Source: *Mechanical Recycling of Packaging Plastics: A Review* – Zoé O. G. Schyns, Michael P. Shaver, and Bernstein analysis

For monomer recycling, chemical companies can have a more direct role. Novozymes will be involved in monomer recycling of PET. At its latest CMD (September 2021), Novozymes showed that recycling 53 million tonnes of PET bottles and fibers (see Exhibit 111) can be done with monomer recycling. We see this as a long-term opportunity, which is only starting (see Exhibit 112). So far, Novozymes signed a joint redevelopment agreement in 2020 with Carbios for the industrial-scale production of its proprietary PET-degrading enzymes. Evonik is also exploring monomer recycling of heavily contaminated PET waste via methanolysis. The company tested the same alkoxides that it already offers for manufacturing biodiesel.

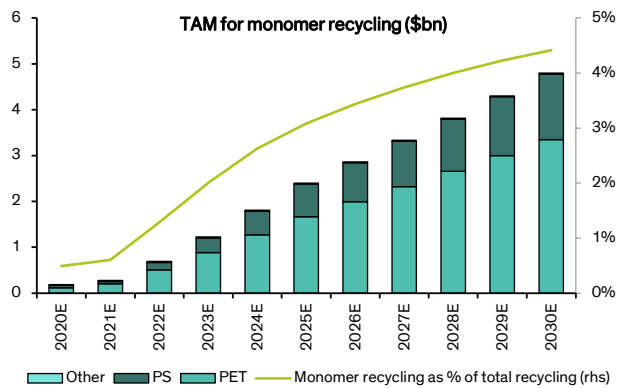
EXHIBIT 111: **Novozymes targets most opportunity in PET monomer recycling from textiles application...**

Landfilled and incinerated PET volume by type (2018)



Source: Novozymes and Bernstein analysis

EXHIBIT 112: **...this market is only starting to grow and will likely reach just a 4.4% share of plastic recycling by 2030**



Note: This applies across all end markets.

Source: Bernstein estimates (all data) and analysis

Resource efficiency in laundry

Laundering of both synthetic and natural textiles pulls on global water and energy supplies and can contribute to the amount of fossil-based chemicals in the sea. Both **Novozymes** and **IFF** have solutions to address this problem through enzymatic biological detergents. Enzymes can reduce the temperature at which you wash clothes from 60°C to 20-30°C, and thus the quantity of water and energy required to remove stains. Being biologically based and improving resource efficiency in laundering textiles, biological detergents address both "take" and "waste" parts of the manufacturing process.

Novozymes is the world's largest enzyme manufacturer and generates ~28% of its DKK14bn in sales in 2020 from biological detergents. It sees strong growth in emerging markets where penetration of biological detergents is one-sixth and is a 4x larger laundry detergent market than developed markets. In Western markets, sustainability will be a key element in reinvigorating growth. The company estimates biological detergents can prevent 5 million tonnes of chemicals washing down the drain every year. It targets 3-4% organic growth by 2025 in its Household Care division, which houses enzymes for biological detergents.

With the acquisition of DuPont's N&B division, IFF has also entered this category and sees the broader Home & Personal Care market for enzymes at US\$2.5bn as of 2020, growing 3% p.a. over the next five years. This accounts for 15% of its Health & Bioscience divisions sales, or ~US\$325mn sales (~3% of group sales in 2020).

Other solutions

Chemical companies also offer solutions to prevent microplastics from being released to the ocean. This would negate the need for biodegradable plastics in textiles and would likely only be used on recycled or virgin plastics in textiles. Whilst preventing microplastics from entering the ocean addresses the "waste" issue, this does not address emissions from the "take" part of the process.

These solutions are currently only a small part of specialty chemicals companies' portfolios. Within our coverage, **Evonik** offers Tegotex, a finishing product for textiles that stops microplastic pollution during washing. In the broader materials space, **PrimaLoft** (which produces a synthetic microfiber thermal insulation material) adjusted its synthetic fabric to be biodegradable, including microplastics; the company adds a food source for microorganisms that lets them feed off it and degrade the polyester at the same time.

INVESTMENT IMPLICATIONS

Global Luxury Goods

We rate Moncler, Prada, LVMH, and Kering Outperform; and Farfetch, Burberry, and Hermes Market-Perform.

European Industrial & Consumer Chemicals

We rate BASF, Evonik, IFF, and Novozymes Outperform; and DSM Underperform.

Specialty chemicals companies: (1) provide additives and cleaning ingredients to established mechanical recycling markets, (2) innovate in the nascent chemical recycling market, and (3) provide ready-to-use solutions to improve wash cycles and offer green detergents. Revenues from additives for mechanical recycling are currently small but growing for our coverage companies. BASF and Evonik are well positioned to lead in the fast-growing plastic recycling market, and Novozymes is the dominant market leader in enzymatic washing detergents, ahead of IFF.

EXHIBIT 113: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price
RMS.FP	M	EUR	1,640.00	1,363.00
MC.FP	O	EUR	697.20	843.00
BAS.GR	O	EUR	58.74	114.00
EVK.GR	O	EUR	26.80	41.00
IFF	O	USD	147.19	181.00
BRBY.LN	M	GBP	1,795.00	1,972.00
KER.FP	O	EUR	683.80	881.00
NZYM.B.DC	O	DKK	488.60	560.00
MONC.IM	O	EUR	64.60	75.00
FTCH	M	USD	36.71	42.00
1913.HK (Prada SpA)	O	HKD	49.50	65.00
DSM.NA	U	EUR	191.80	156.00
MSDLE15			1,856.96	
MXAPJ			624.39	
SPX			4,655.27	

Source: Bloomberg, and Bernstein estimates and analysis

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BERNSTEIN

MEAT ALTERNATIVES

Will the future of food be less meaty?

HIGHLIGHTS

- We cannot sustainably feed the population without shifting some protein demand to meat alternatives. **How big could the alternative meat market be?** We lay out three scenarios for alternative meat growth: (1) **Bear Case** (alternative meat fails to penetrate the mainstream consumer segment): **7.5%** market share in developed markets and **5%** in emerging markets by 2029; (2) **Base Case** (alternative meat reaches a similar market share in developed markets as alternative milk in the US): **15%** share in developed markets and **10%** in emerging markets; and (3) **Blue-Sky Scenario** (both plant-based and cultivated meat appeal to the mainstream consumer segment): **25%** share in developed markets and **15%** in emerging markets.
- **What are the environmental implications?** Compared to meat consumption levels in 2019, the current expected growth in meat consumption by 2029 could further increase GHG emissions by 617 million tons, require 253 million hectares more land (i.e., nearly half the Amazon rainforest), and use an additional 406 billion m³ of water (more than two Dead Seas!). On the other hand, a shift to meat alternatives in our base case scenario implies that by 2029 we need 31 million hectares less land, 25 billion m³ less water, and will emit 49 million tons less GHG compared to today's levels to meet our protein demand. The savings could be much greater in our blue-sky scenario. Even in our bear case scenario, we can more than halve the incremental GHG emissions and incremental land/water usage.
- **At the company level,** Beyond Meat and Impossible Foods have led the new generation of plant-based meat. Nestle and Unilever also have their sights on the space. Meanwhile, it may be harder for traditional meat producers to pivot away from animal-based meat. For ag input companies, veggie seeds will become important, as will incremental R&D on physical/digital products in areas such as fertilizer reduction. Elsewhere, animal feed and health companies have invested in sustainable animal consumption opportunities.

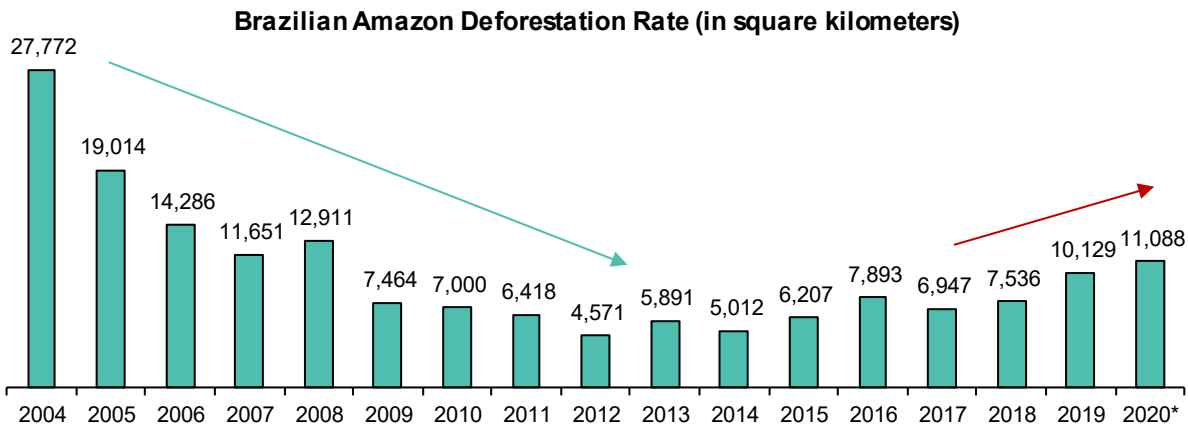
INTRODUCTION

This chapter was commissioned by the Gordon and Betty Moore Foundation and authored by Bernstein. The views expressed in this publication accurately reflect the Analyst(s) personal views and no part of his/her compensation was, is, or will be, directly or indirectly, related to the specific views in this publication.

The Amazon has lost ~17% of its forest over the past 50 years, mostly due to forest conversion to cattle ranching.⁸⁷ Although the pace of deforestation decreased in the early 2000s on the back of stricter government regulations in Brazil, it has picked up momentum in recent years again, with the level of deforestation reaching a 12-year high in 2020⁸⁸ (see Exhibit 114).

Meanwhile, global meat consumption is expected to increase by 13% from 256 million tons (in retail weight) in 2019 to 290 million tons in 2029 to feed the growing global population, especially in emerging markets (see Exhibit 115). How do we reconcile the increasing demand for meat and the livestock industry's outsized environmental footprint? Is plant-based or cultivated meat a credible alternative to feed the global population sustainably? If we fully embrace a less "meaty" future, what are the implications for the environment, the agricultural supply chain, and key players such as meat producers, fertilizer companies, and newer-generation plant-based/cultivated meat companies?

EXHIBIT 114: The Amazon has lost ~17% of its forest over the past 50 years; the pace of deforestation has picked up momentum in recent years again, reaching a 12-year high in 2020



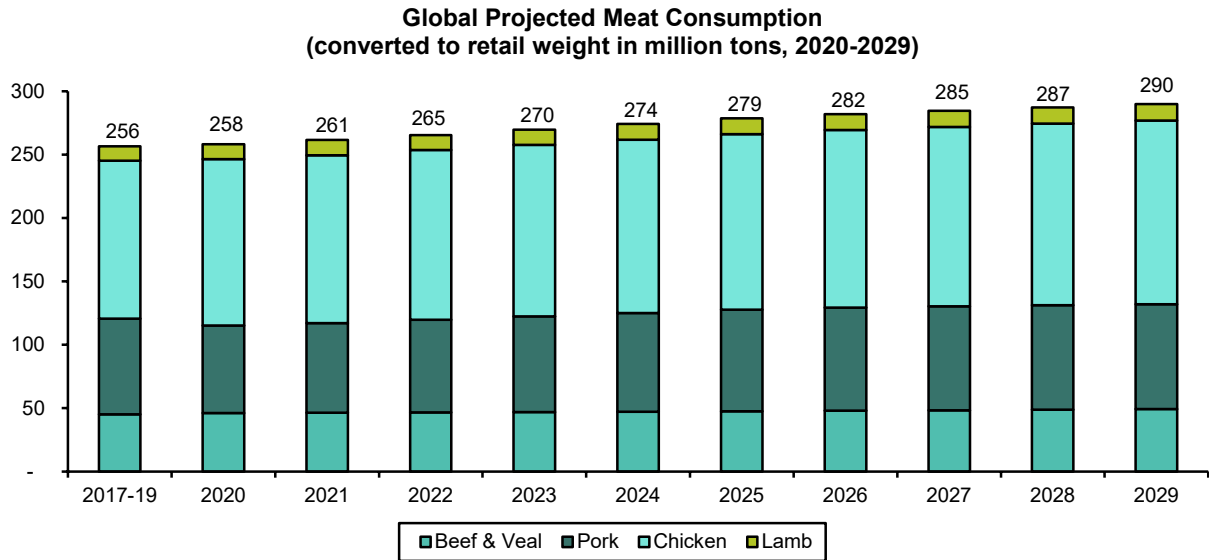
*2020 data was through November.

Source: PRODES (<http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes>) and Bernstein analysis

⁸⁷ <https://www.worldwildlife.org/threats/deforestation-and-forest-degradation#:~:text=In%20the%20Amazon%2C%20around%2017,land%20area%20on%20our%20planet.>

⁸⁸ <https://earthobservatory.nasa.gov/images/145988/tracking-amazon-deforestation-from-above>

EXHIBIT 115: Global meat consumption is expected to increase by 13% from 256 million tons in 2019 to 290 million tons in 2029 to feed the growing global population, especially in emerging markets



Note: Beef, pork, and lamb are converted to retail weight from carcass weight, using a conversion factor of 65% for beef and pork and 75% for lamb.

Source: OECD-FAO Agricultural Outlook 2020-2029 and Bernstein analysis

+ MEAT – A DELICIOUS ENVIRONMENTAL BURDEN

CARBON EMISSIONS

Agriculture, forestry, and other land use account for 24% of total global CO₂ equivalent emissions⁸⁹ (see Exhibit 116). Agriculture alone represents ~11% of global emissions according to the FAO. In particular, the agricultural sector is a big emitter of **methane** (~36% of total ag emissions in the US) driven by "enteric fermentation" of livestock — or in layman's terms burping (and other gases coming out of animals)⁹⁰ — and **nitrous oxide** (~52%) due to the application of nitrogen fertilizer, with only 12% of its GHG emissions actually coming from CO₂ (see Exhibit 117).⁹¹

This is concerning as methane and nitrous oxide are much more potent GHGs than CO₂ (i.e., they absorb much more energy for the same amount of emissions). The Global Warming Potential (GWP) measures how much energy the emissions of 1 ton of a gas will absorb over a given period of time relative to the emissions of 1 ton of CO₂. Methane is estimated to have a GWP of 28-36 times that of CO₂ over 100 years, which takes into account the fact that methane absorbs much more energy than CO₂, but only lasts for about a decade

⁸⁹ <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>; GHG emissions from this sector come mostly from agriculture (cultivation of crops and livestock) and deforestation. This estimate does not include the CO₂ that ecosystems remove from the atmosphere by sequestering carbon in biomass, dead organic matter, and soils, which offset approximately 20% of emissions from this sector.

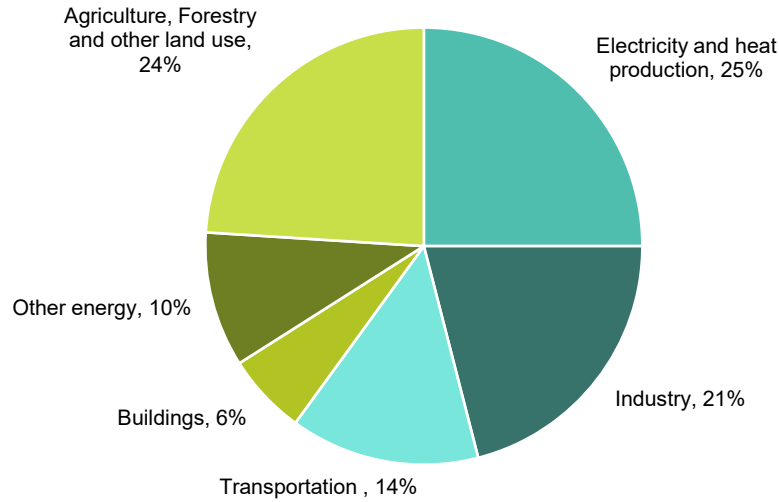
⁹⁰ See report: [The Long View: Global Ag Chems - Will Beyond Meat eat their lunch?](#)

⁹¹ <https://www.ers.usda.gov/topics/natural-resources-environment/climate-change>

in the atmosphere. Nitrous oxide, on the other hand, has a GWP of 265-298 times that of CO₂ for a 100-year timescale (see Exhibit 118).⁹²

EXHIBIT 116: Agriculture, forestry, and other land use account for 24% of total global CO₂ equivalent emissions; agriculture alone represents ~11% of global emissions

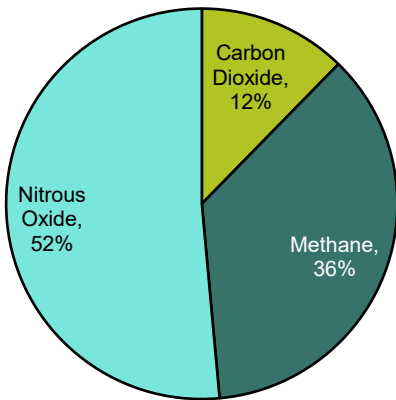
Global GHG Emissions by Sector



Source: EPA, Intergovernmental Panel on Climate Change (IPCC), and Bernstein analysis

EXHIBIT 117: US ag sector is a big emitter of methane and nitrous oxide...

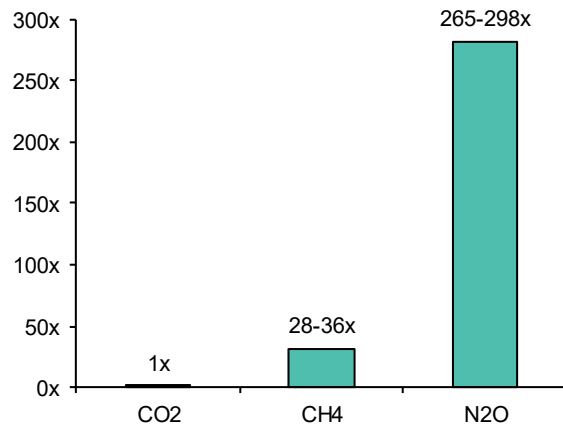
US Agricultural CO₂ Equivalent Emissions by Type



Source: USDA and Bernstein analysis

EXHIBIT 118: ...both are much more potent GHGs compared to CO₂

Global Warming Potential of Emissions



Source: EPA and Bernstein analysis

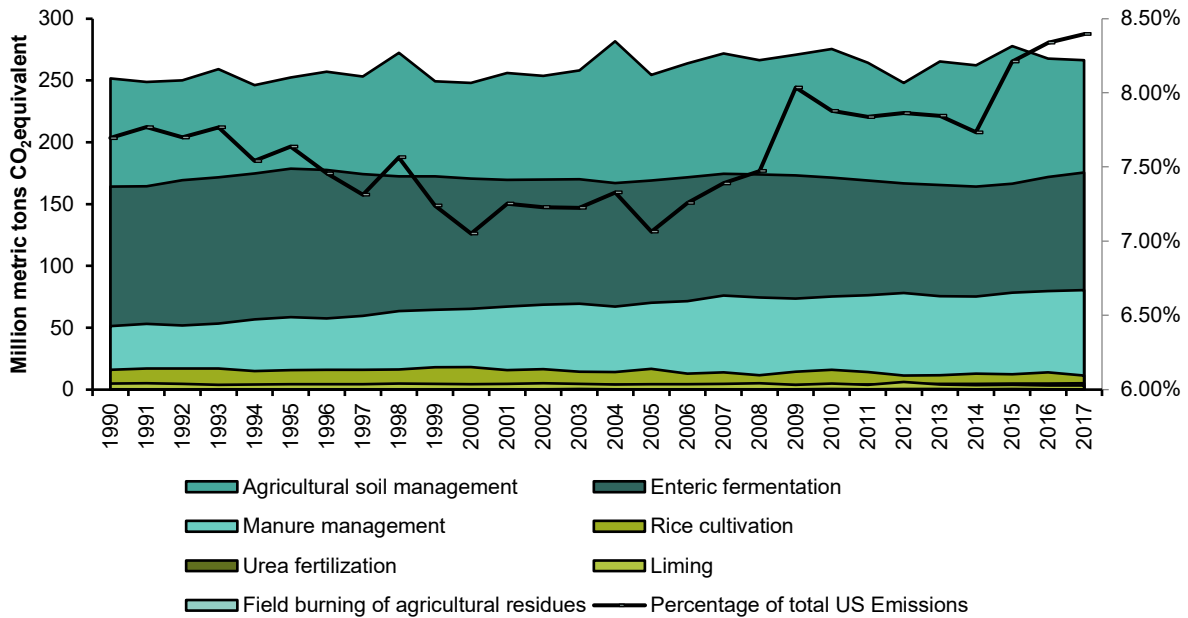
⁹² <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>

The livestock sector is the biggest contributor to agricultural emissions. Although only part of agricultural emissions is directly linked to cows burping (and other gases coming out of them), most nitrous oxide generated by the application of fertilizers can also be attributed to animal feed requirements (e.g., 60% of corn goes into feed; however, soy doesn't require nitrogen fertilizers).

In the US specifically, the agricultural sector accounted for 9% of total GHG emissions by economic sector in 2017 (see Exhibit 119), with the majority of this driven by fertilizer use and animals burping. The livestock sector represents ~40% of total agricultural GHG emissions, primarily due to enteric fermentation and manure management.

By meat type, buffalo meat, beef, and sheep meat are among the worst offenders from an emissions perspective. Producing 1kg each of buffalo, beef, and sheep protein emits an incremental 404kg, 295kg, and 201kg, respectively, of CO₂ equivalent GHGs (see Exhibit 120). Based on our back-of-the-envelope math, cattle that weigh 1,200lbs emit the same level of GHGs over a year as 3.5 cars driven for a year.⁹³

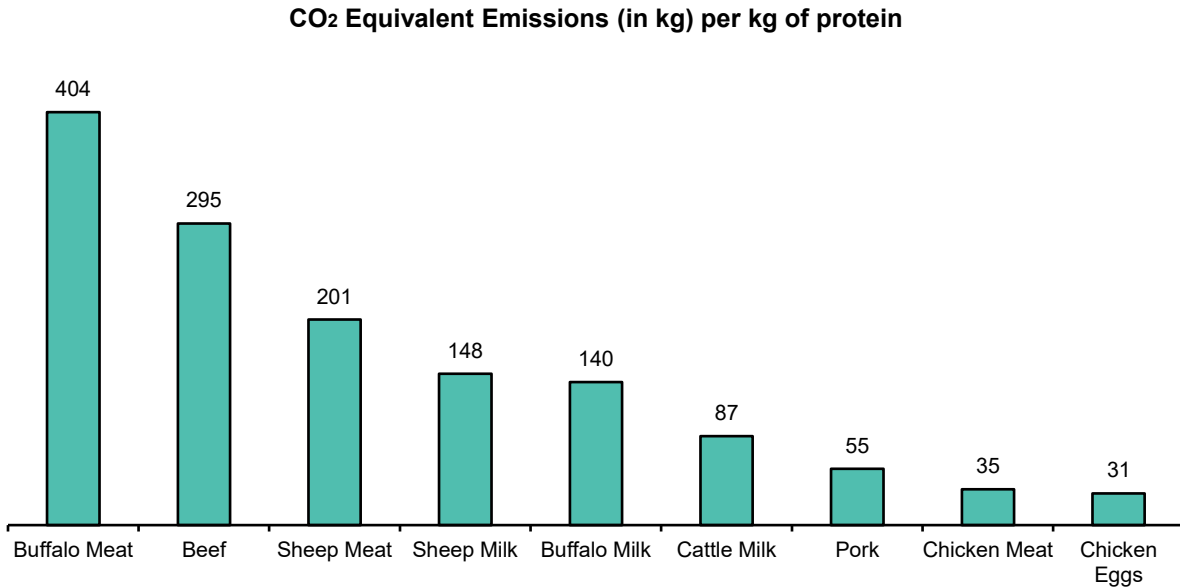
EXHIBIT 119: In the US, livestock averaged ~40% of total agricultural GHG emissions from 2012 to 2017 (primarily from enteric fermentation and manure management)



Source: US EPA and Bernstein analysis

⁹³ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>. This math assumes the 1,200lb cattle has a carcass weight of 750lbs and a retail weight of 488lbs, which contains 120lbs or 55kg of beef protein. To produce the incremental 55kg of beef protein emits 16,107kg of CO₂ equivalent GHGs into the environment.

EXHIBIT 120: Within the livestock sector, buffalo meat, beef, and sheep meat are among the worst offenders from an emissions perspective



Source: FAO and Bernstein analysis

LAND USE

Beyond being big polluters, animals take up a lot of space. The FAO estimates 25% of global land is used for livestock grazing and another ~4% (or 33% of cropland) is used for livestock feed production (see Exhibit 121).⁹⁴ Partly due to land conversion for agricultural uses, the world has lost a net area of 178 million hectares of forest since 1990 (see Exhibit 122), primarily led by losses in Africa and South America.⁹⁵ A study cited by the FAO shows 71% of deforestation in Argentina, Colombia, Bolivia, Brazil, Paraguay, Peru, and Venezuela was due to increased demand for pasture between 1990 and 2005, 14% due to cash crops, and only 2% due to infrastructure and urban sprawl.⁹⁶

According to the World Resources Institute, **beef** is among the most resource-intensive protein, requiring 140 hectares of land (mostly pasture land) to produce 1 ton of protein (see Exhibit 123).⁹⁷ In comparison, less than 10 hectares are required to produce 1 ton of grain protein from maize, rice, or wheat. Beef is also more resource intensive than most other animal-based proteins. For example, when accounting for all feeds, including both crops and forages, only 1% of gross cattle feed calories and 4% of ingested protein are estimated to be converted to human-edible calories. In contrast, poultry converts 11% of feed calories and 20% of feed protein. As such, beef uses more land and generates more GHG emissions per unit of protein produced than most other protein sources.

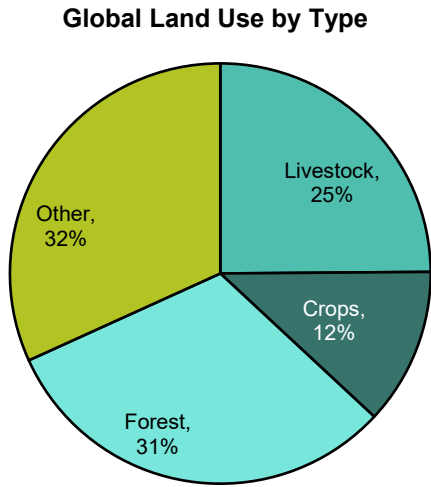
⁹⁴ <http://www.fao.org/3/ar591e/ar591e.pdf>

⁹⁵ <http://www.fao.org/3/ca9825en/ca9825en.pdf>

⁹⁶ <http://www.fao.org/americanas/noticias/ver/en/c/425600/>

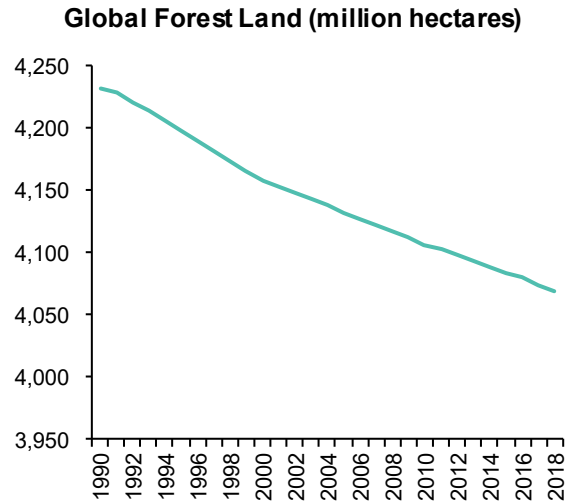
⁹⁷ https://files.wri.org/s3fs-public/Shifting_Diets_for_a_Sustainable_Food_Future_1.pdf

EXHIBIT 121: 25% of global land is used for livestock grazing and another ~4% (or 33% of cropland) is used for livestock feed production



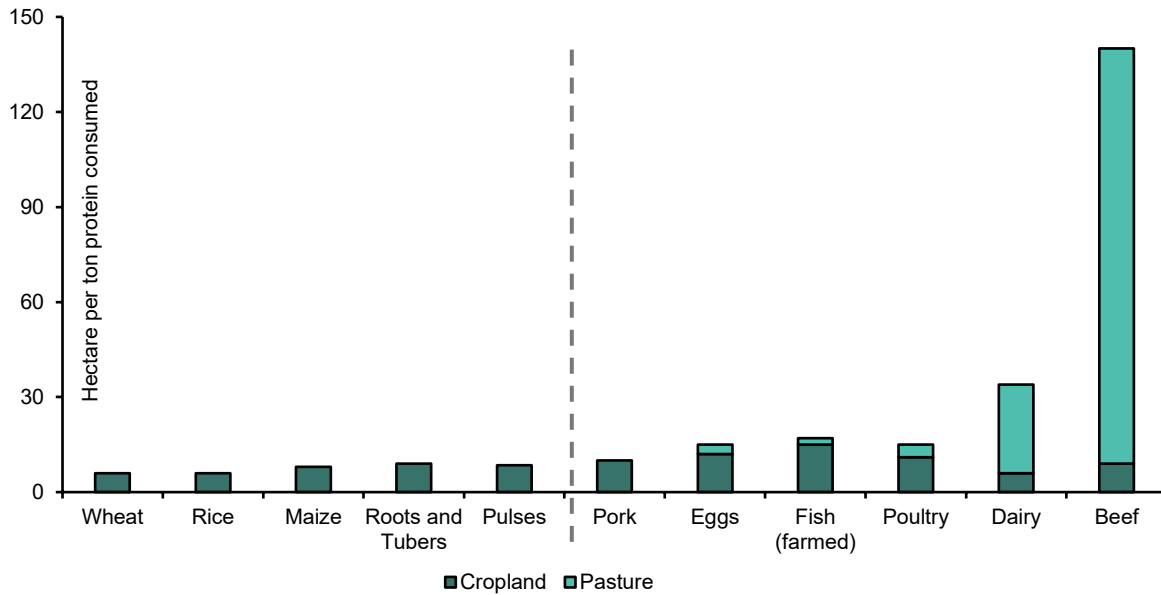
Source: FAOSTAT and Bernstein analysis

EXHIBIT 122: Partly due to land conversion for agricultural uses, the world has lost a net area of 178 million hectares of forest since 1990



Source: FAOSTAT and Bernstein analysis

EXHIBIT 123: Beef is among the most resource-intensive proteins, requiring 140 hectares of land to produce 1 ton of protein



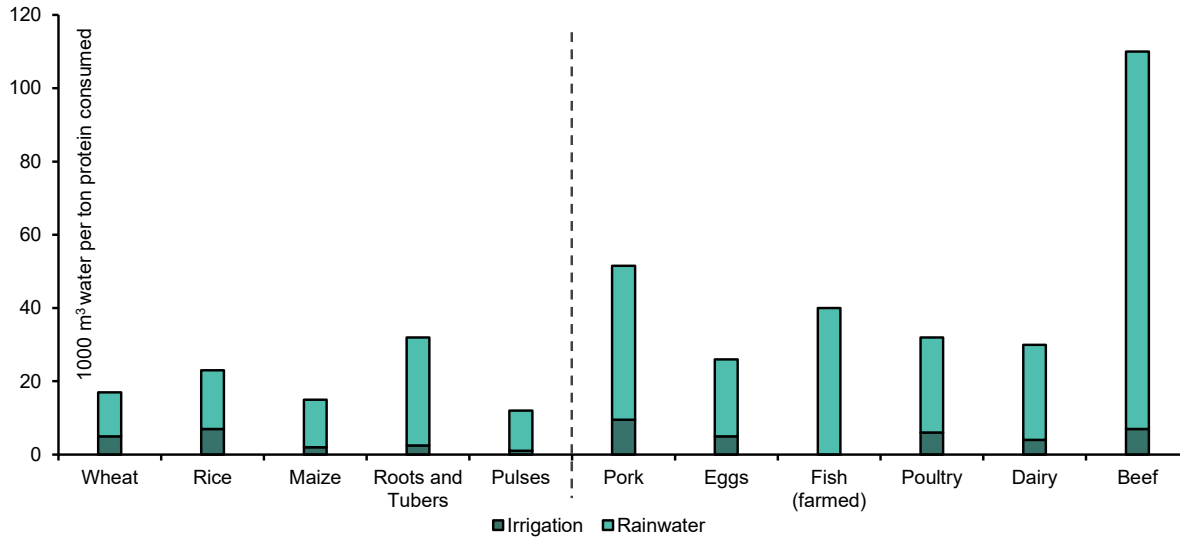
Source: World Resources Institute and Bernstein analysis

WATER USAGE

The livestock sector, and cattle ranching in particular, also places a significant strain on water resources (see Exhibit 124). The production of meat requires a large amount of water, primarily to produce animal feed. As beef has the lowest feed conversion efficiencies versus pork and poultry, it requires a disproportionate amount of water for feed production.

The water usage can be particularly problematic in water-stressed areas in the Middle East, North Africa, India, and even parts of the US (e.g., California).⁹⁸

EXHIBIT 124: The livestock sector, and cattle ranching in particular, also places a significant strain on water resources



Source: World Resources Institute and Bernstein analysis

PLANT-BASED ALTERNATIVES

According to the Good Food Institute, plant-based meat production could yield median savings of 88.5% GHG emissions, 93% of land use, and 95.5% of water use compared to animal-based meat production⁹⁹ (see Exhibit 125). Plant-based meat also offers a good alternative to consumers who are concerned about animal welfare issues. Advocates have been asking for more humane treatment of animals. For example, despite labels like cage-free, hens still live most of their lives confined within very large flocks. There are also questions about antibiotic-free claims by meat producers as they imply animals won't get treated when they fall ill.¹⁰⁰

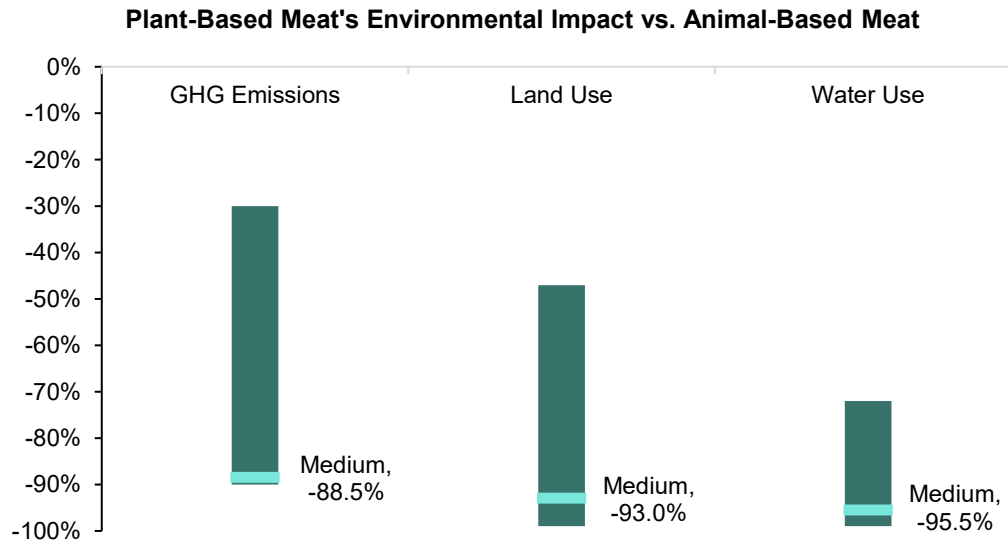
Aside from the many perks of plant-based meat, producers such as Beyond Meat and Impossible Foods still have more work to do to improve their health credentials, especially given their higher sodium levels than animal-based meat (although presumably this is because raw meat patties are generally seasoned while being cooked rather than being pre-seasoned, whereas Beyond Meat's pea protein production process produces an inherent level of sodium that cannot easily be extracted), despite containing no cholesterol (see Exhibit 126). For now, these products seem to appeal more to flexitarians in developed markets who are concerned about environmental and/or animal welfare issues in animal meat production. However, Beyond Meat is in the process of rolling out the 3.0 version of its plant-based burger patties, which will contain 3.5% less saturated fat than animal meat, and another version will be launched later in 2021 with 55% less saturated fat.

⁹⁸ <https://www.wri.org/insights/17-countries-home-one-quarter-worlds-population-face-extremely-high-water-stress>

⁹⁹ <https://gfi.org/blog/sustainable-meat-fact-sheet/>

¹⁰⁰ See report: [Beyond Boilerplate: Intensive Livestock Farming and the Global Antibiotic Crisis \(Transcript\)](#).

EXHIBIT 125: **Plant-based meat is more resource efficient**



Source: The Good Food Institute and Bernstein analysis

EXHIBIT 126: **Beyond Meat and Impossible Foods replicate the nutritional qualities of an 80% lean/20% fat beef burger; Tyson's Raised and Rooted lean beef and plant protein is similar, but with lower calorie content and saturated fats**

	80/20 Raw Beef Patty	Beyond Meat	Impossible	Tyson Raised & Rooted	Nestle Awesome Burger	Kroger Simple Truth Patty
Serving size	4 oz	4 oz	4 oz	112 g (3.95 oz)	4 oz	113 g (3.99 oz)
Calories	287	250	240	150	260	230
Protein (g)	19	20	19	19	26	20
Fat (g)	23	18	14	7	15	14
Saturated Fat (g)	9	6	8	2.5	7	9
Fiber (g)	0	2	3	1	6	0
Sodium (mg)	75	390	370	260	400	390
Cholesterol (mg)	80	0	0	35	0	0
Soy	N	N	Y	N	N	N
Gluten	N	N	N	N	N	N
GMO	N	N	Y	N	N	N

Note: Kroger is covered by Bernstein's US Broadlines & Hardlines Retail analyst Brandon Fletcher. Impossible Foods is not covered.

Source: Company websites and Bernstein analysis

HOW ABOUT CULTIVATED MEAT?

Although plant-based meat producers are actively improving their products' taste, burger patties made of soy or yellow peas will likely never taste exactly like real beef. This problem can be solved by new technologies that cultivate meat from animal cells. The process of cultivating meat is similar to that of plant cultivation (i.e., you start with a small sample of cells from an animal and place the sample in a nutrient-rich environment that allows it to grow). The end product is not imitation or synthetic meat — it's actual animal meat grown outside of the animal.¹⁰¹ This cultivation process is much more efficient than raising animals. Cultivated beef is estimated to reduce land use by 95%+ and carbon emissions by

¹⁰¹ <https://gfi.org/wp-content/uploads/2021/01/INN-CM-SOTIR-2020-0512.pdf>

74-87%.¹⁰² Cultivation also holds the promise of producing specific meat taste profiles that are tailored to consumer demand. That said, the main challenge with cultivated meat is around cost, which remains way out of reach for the mass market. Some studies have demonstrated ways to bring down costs without the development of any new "moonshot" technologies, although it may still take years for cultivated meat to become commercially viable. Having said that, Singapore approved the sale of Eat Just's (based in San Francisco, not covered) cultivated chicken nuggets in December 2020. Although the products are not yet on shelves, Singapore is taking the lead on granting regulatory approvals for such products, noting they use no antibiotics and were found to have lower microbiological content than regular chicken. This could be a big factor in curbing outbreaks of zoonotic diseases as well as reducing the incidence of antimicrobial resistance (AMR) in humans, which is currently believed to cause 700,000 deaths annually; but this may increase by up to 10 million people by 2050 according to the FAIRR¹⁰³ organization, with US\$100tn in economic losses attributed to these outbreaks.

SIZING THE ALTERNATIVE MEAT MARKET

How big could the alternative meat market be? Let's take a look at what consumers say.

In the US, beyond the traditional vegetarian and vegan population, the new generation of plant-based meats such as Beyond Meat and Impossible Foods¹⁰⁴ are increasingly appealing to meat eaters who self-classify as "flexitarians," which could expand the total addressable market of plant-based meat significantly beyond the ~5% vegetarian/vegan population.

- Our US Food team surveyed 1,037 consumers in 2019, 34% of whom said they were trying to eat less meat or other animal products, led by the Millennial generation.¹⁰⁵ Meanwhile, 59% of respondents wanted to incorporate more protein into their diets (see Exhibit 127). As one Millennial who participated in the team's focus group explained, *"I am exploring different ways to get protein into my diet so that I can eat less meat in each of my meals. I'm aiming for one meal a day with meat, substituting more plant-based proteins to help ease the transition."*
- In another survey conducted by our US Food team during the Covid-19 pandemic, 34% of the 1,038 surveyed said they had eaten more plant-based meat during the pandemic — ~11% liked the taste, ~9% were concerned about the environmental impact of the animal meat industry, ~7% were concerned about health risks associated with processed red meat, and another ~6% were concerned about animal welfare issues. Conversely, among people who didn't eat more plant-based meat, the main reasons why were the taste, the price, and plant-based meat not being healthier than animal-based meat (see Exhibit 128). There is clearly more work to be done for

¹⁰² https://gfi.org/wp-content/uploads/2021/01/sustainability_cultivated_meat.pdf

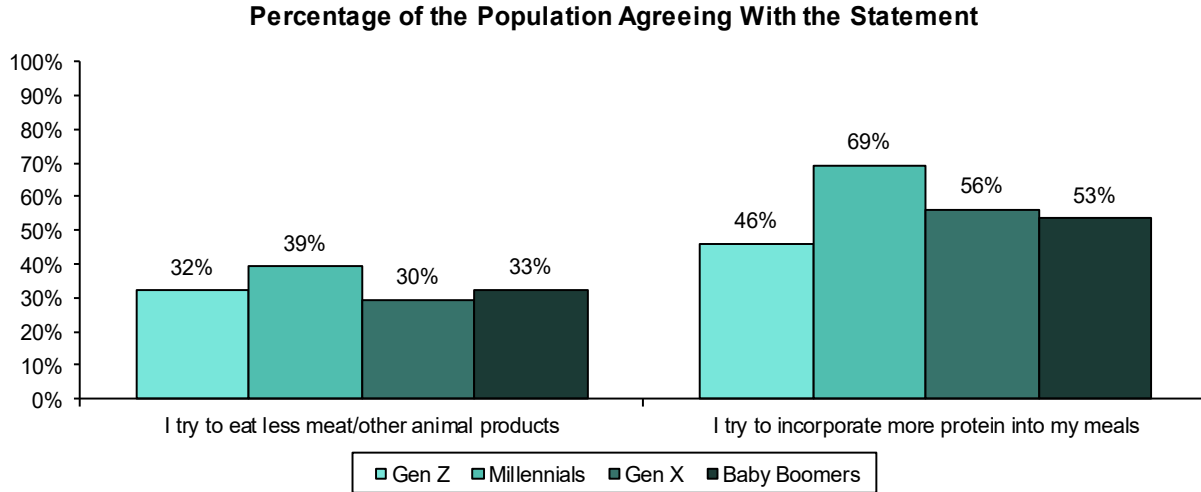
¹⁰³ FAIRR is an initiative launched by the Jeremy Coller Foundation to raise awareness of ESG risks and opportunities in intensive livestock farming.

¹⁰⁴ Not covered.

¹⁰⁵ See *Blackbook: US Food: Famine or Feast Post Covid-19?*

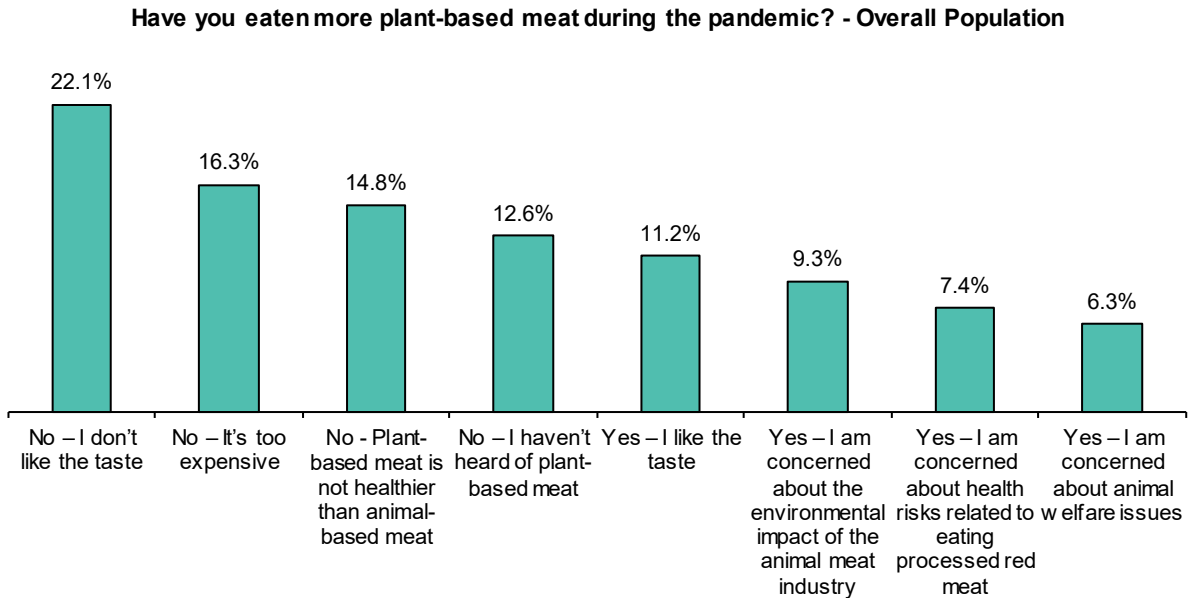
plant-based meat producers to improve their products' taste while lowering the cost of production before they can penetrate the mainstream consumer segment.

EXHIBIT 127: Our US Food team surveyed 1,037 consumers in 2019, 34% of whom said they were trying to eat less meat or other animal products, led by the Millennial generation



Source: Bernstein US Food Survey (2019), N=1,037

EXHIBIT 128: In another survey conducted by our US Food team during the Covid-19 pandemic, 34% of respondents said they had eaten more plant-based meat; among people who didn't eat more plant-based meat, the main reasons were taste, price, and plant-based meat not being healthier than animal-based meat

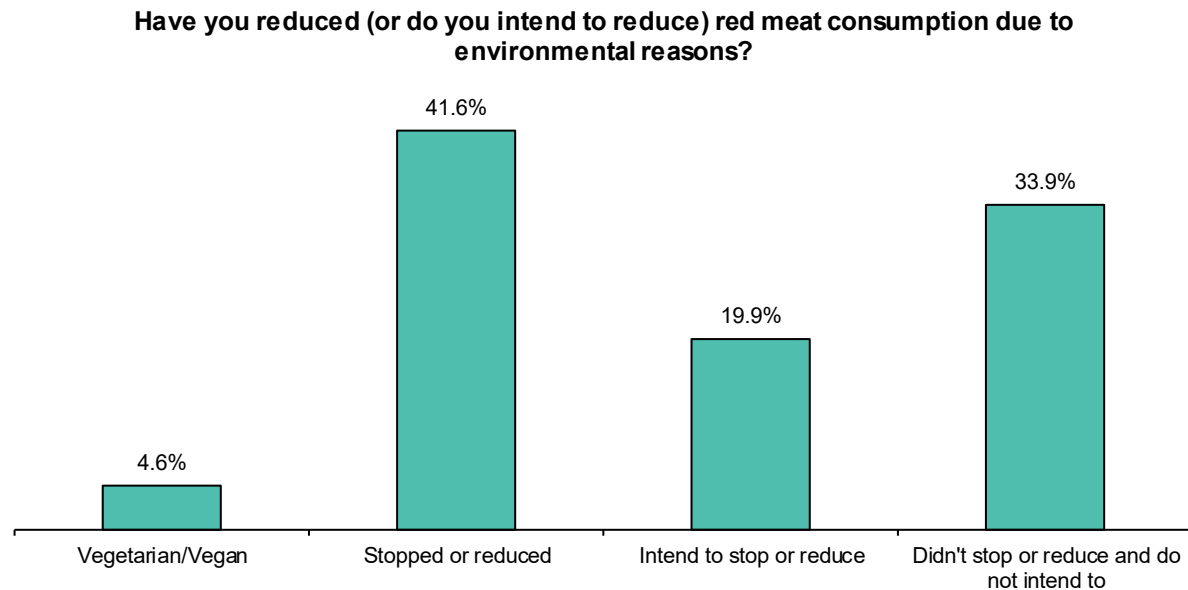


Source: Bernstein US Food Covid-19 Consumer Survey (2020), N=1,038

In Europe, we see a similar trend of flexitarians starting to embrace plant-based meat, largely for environmental reasons, although the level of acceptance for cultivated meat remains low.

- The European Consumer Organization conducted a survey in November 2019, with over 1,000 respondents per country across 11 EU countries.¹⁰⁶ Among the over 11,000 surveyed, 4.6% were vegetarian or vegan (in line with the percentage in the US). Beyond the vegetarian/vegan population, 41.6% of survey respondents had stopped (6.2%) or reduced (35.4%) their red meat consumption for environmental reasons, 19.9% intended to stop (3.5%) or reduce (16.4%), while 33.9% did not stop/reduce nor did they intend to do so in the future (see Exhibit 129).
- Compared to the ~34% of US survey respondents who intend to or did eat more plant-based meat, 36.5% of European respondents are willing to replace animal-based meat with plant-based meat alternatives, provided they are not based on GMO ingredients (see Exhibit 130). In comparison, only 13.4% of respondents are willing to replace meat with cultivated meat, suggesting the level of acceptance remains low for these less tested ideas as of now (see Exhibit 131).

EXHIBIT 129: European Consumer Organization surveyed over 1,000 respondents per country across 11 EU countries in 2019, of whom 41.6% had stopped or reduced their red meat consumption for environmental reasons, with a further 19.9% intending to stop or reduce it



Note: N=over 1,000 per country across 11 EU countries (Austria, Belgium, Germany, Greece, Italy, Lithuania, Netherlands, Portugal, Slovakia, Slovenia, and Spain)

Source: European Consumer Organization (BEUC, Nov 2019) and Bernstein analysis

¹⁰⁶ https://www.beuc.eu/publications/beuc-x-2020-042_consumers_and_the_transition_to_sustainable_food.pdf

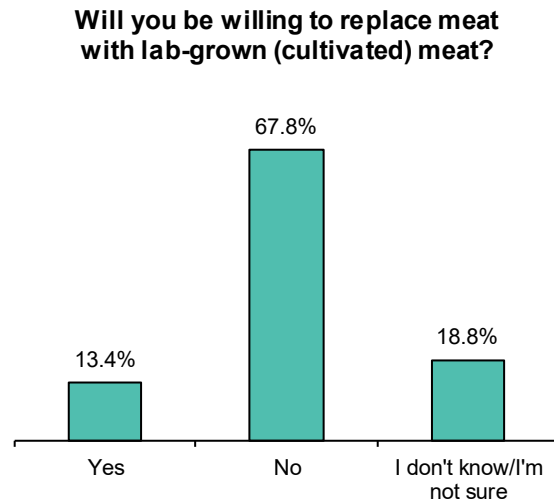
EXHIBIT 130: 36.5% of European respondents are willing to replace animal-based meat with non-GMO plant-based alternatives



Note: N=over 1,000 per country across 11 EU countries (Austria, Belgium, Germany, Greece, Italy, Lithuania, Netherlands, Portugal, Slovakia, Slovenia, and Spain)

Source: European Consumer Organization (BEUC, Nov 2019) and Bernstein analysis

EXHIBIT 131: In comparison, only 13.4% of respondents are willing to replace meat with cultivated meat



Note: N=over 1,000 per country across 11 EU countries (Austria, Belgium, Germany, Greece, Italy, Lithuania, Netherlands, Portugal, Slovakia, Slovenia, and Spain)

Source: European Consumer Organization (BEUC, Nov 2019) and Bernstein analysis

As consumers in developed markets start to gravitate toward plant-based meat or other meat alternatives, how do consumers in emerging markets fit into the picture?

In Brazil, consumers appear to be starting to warm up to plant-based meat, although mostly for health reasons, and very few consumers are aware of the environmental impact of the livestock supply chain. Price also remains a major hurdle for more people to try out plant-based meat products.

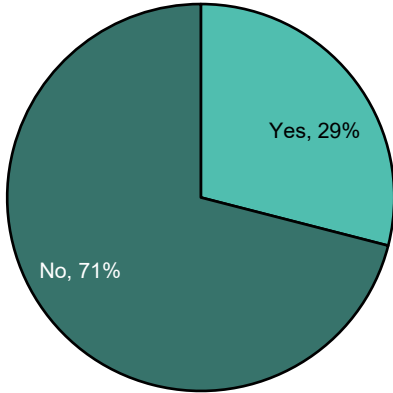
- The Good Food Institute, a non-profit that promotes alternative meat products and supports startups, conducted a survey in Brazil in 2018 of over 9,000 consumers, of which 6% were vegan or vegetarian.¹⁰⁷ 29% of respondents were willing to reduce their consumption of animal products, below the over 60% level in Europe (see Exhibit 132). Interestingly, ~70% of respondents who wanted to reduce their consumption of animal products were doing it for health reasons or due to health restrictions and 17% had concerns about animal welfare issues, while only 3% cited environmental reasons (see Exhibit 133). This suggests health issues are the most top of mind for Brazilian consumers when it comes to plant-based meat, while more consumer education is needed to raise awareness of the environmental impact of the livestock supply chain. The relative price premium at which plant-based meat is sold is a major hurdle for people to consume more plant-based alternatives, which we believe will remain a key

¹⁰⁷ <https://gfi.org/images/uploads/2018/10/GFI-Brazil-Plant-Based-Market-Consumer-Research-2018.pdf>

challenge for plant-based meat products in emerging markets in the foreseeable future (see Exhibit 134).

EXHIBIT 132: In Brazil, 29% of respondents were willing to reduce their consumption of animal products

Do you reduce or wish to reduce the consumption of animal products (meat, fish, milk, eggs, etc.)?

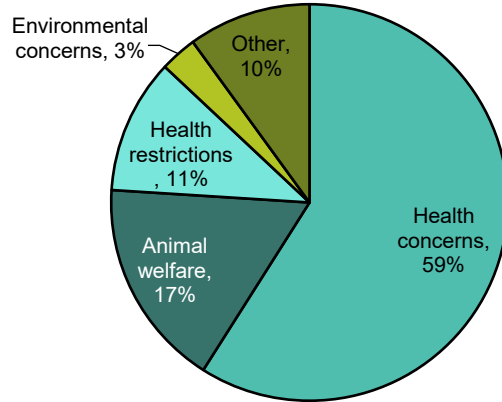


Note: N>9,000

Source: The Good Food Institute and Snapcart (2018), and Bernstein analysis

EXHIBIT 133: ~70% of respondents who wanted to reduce their meat consumption were doing it for health reasons and only 3% cited environmental reasons

Why do you want to reduce the consumption of animal products?

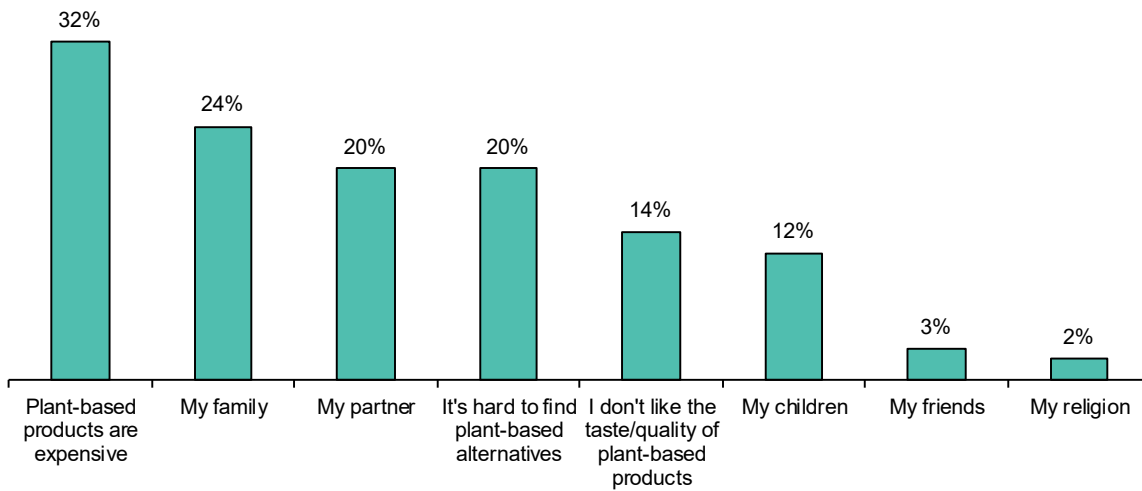


Note: N>9,000

Source: The Good Food Institute and Snapcart (2018), and Bernstein analysis

EXHIBIT 134: The relative price premium of plant-based meat is also a major hurdle for people to consume more plant-based alternatives

Are there any reasons or persons that are stopping you from reducing more or cutting the consumption of animal products?



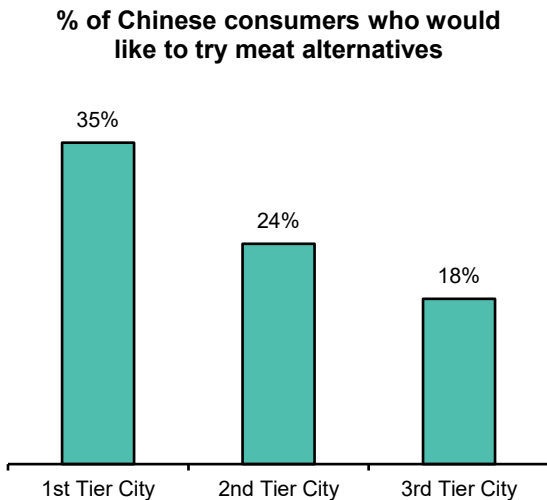
Note: N>9,000

Source: The Good Food Institute and Snapcart (2018), Bernstein analysis

In **China**, higher-income consumers in urban areas are more likely to try alternative meat products, mostly for health reasons. Price also appears to be a hurdle, especially for lower-income Chinese consumers in second- and third-tier cities.

- In a survey of close to 1,000 consumers in China, 35% of respondents from first-tier cities (e.g., Beijing, Shanghai, and Shenzhen) would like to try meat alternatives.¹⁰⁸ This percentage drops to 24% in second-tier cities and 18% in third-tier cities, where consumers' purchasing power decreases accordingly (see Exhibit 135). 61% of respondents cited health reasons as the driving factor behind why they would like to try alternative meat products. This sentiment is mostly shared by consumers in first-tier cities for whom obesity is becoming a more prevalent problem. Conversely, 74% of respondents cited the heavily processed nature of meat alternatives, and 64% cited a lack of food safety standards as key concerns they had about meat alternatives, followed by 59% citing concerns about product taste (see Exhibit 136). Similar to the sentiment we see with Brazilian consumers, health issues are the most top of mind for Chinese consumers when choosing between animal-based meat and alternative meat products. The price premium of meat alternatives also appears to be a hurdle, especially for Chinese consumers in second- and third-tier cities.

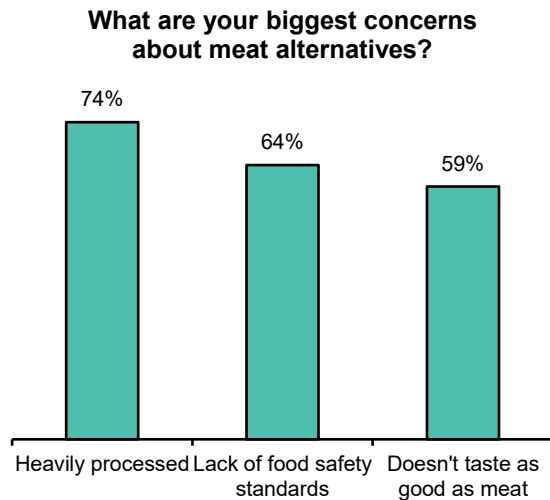
EXHIBIT 135: In China, 35% of survey respondents from tier 1 cities would like to try meat alternatives, 24% in tier 2 cities, and 18% in tier 3 cities



Note: N=929

Source: Ipsos (2020) and Bernstein analysis

EXHIBIT 136: Heavily processed nature of meat alternatives, lack of food safety standards, and product taste are key concerns for Chinese consumers



Note: N=929

Source: Ipsos (2020) and Bernstein analysis

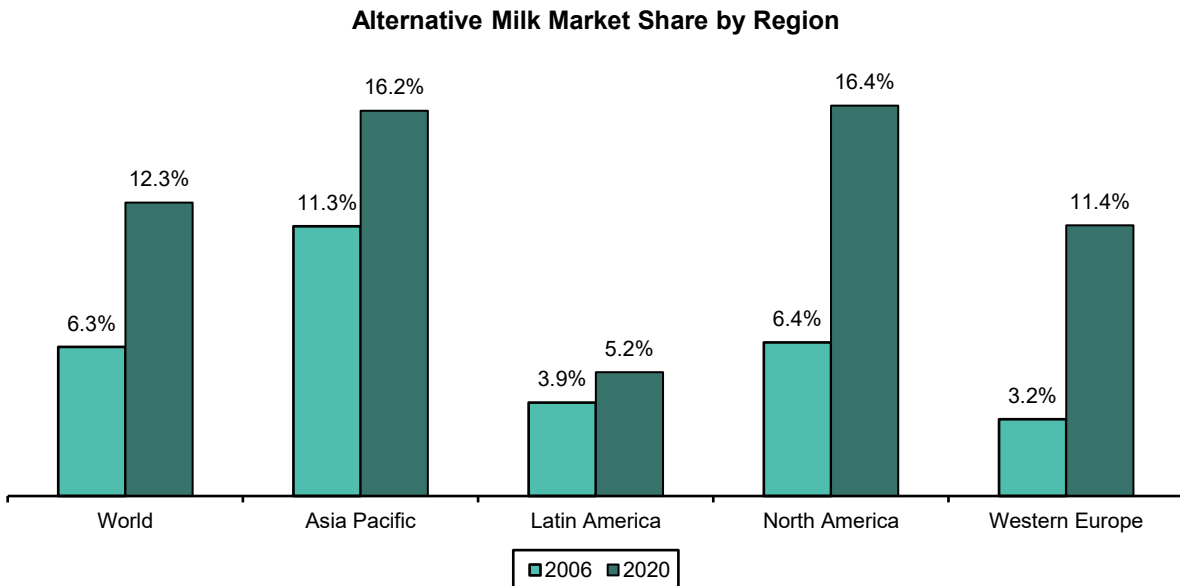
While these survey results help frame the conversation, they all used somewhat different methodologies, such that the results are not directly comparable across regions. Consumer intentions in surveys also may not translate directly into actual purchasing behaviors.

¹⁰⁸ <https://www.ipsos.com/zh-cn/yipusuoipsos-2020renzaorouzhongguoqushidongcha>; <https://www.infzm.com/contents/189280>

Given these considerations, we also compare the alternative meat market to alternative milk, which has grown its market share to represent ~12% of global milk consumption (see Exhibit 137). That said, these two markets are not entirely comparable as many consumers gravitate toward alternative milk for health reasons (e.g., lactose intolerance), whereas the health and wellness credentials of alternative meat products are still debatable.

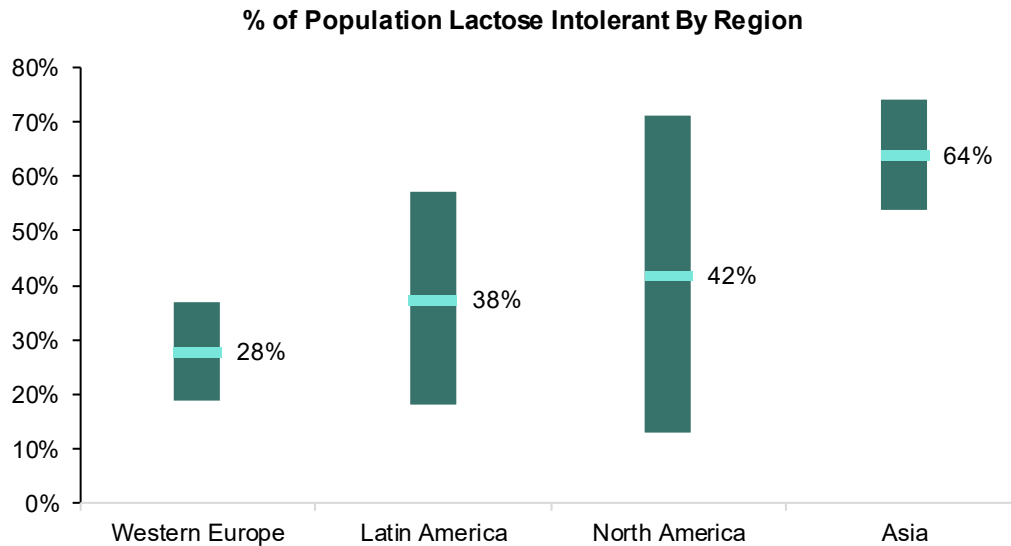
- By region, Asian consumers are more likely to be lactose intolerant (64% on average, see Exhibit 138), which helps explain alternative milk's relatively high market share of 16.4% in Asia. Now, not all Asian consumers who are lactose intolerant are aware of the issue or can afford alternative milk. Growing up in China, this analyst's family used to have a cup of cow milk every morning; as it turned out, their entire family is lactose intolerant, but they didn't know about it until much later. This explains why alternative milk's market share isn't nearly as high as the proportion of the population who are lactose intolerant. So far, consumers of alternative milk products are largely limited to middle class and upper-middle class people living in urban areas.
- In comparison, only 42% of the North American population are lactose intolerant, but alternative milk has reached a similar market share as in Asia (16.2%), reflecting the higher purchasing power of North American consumers.
- Similarly, although the prevalence of lactose intolerance is higher in Latin America (38% on average) than in Europe (28%), alternative milk has only taken a 5% market share in Latin America as the price premium of alternative milk limits its appeal to the mass market.

EXHIBIT 137: **We compare the alternative meat market to alternative milk, which has grown its market share to represent ~12% of global milk consumption**



Source: Euromonitor and Bernstein analysis

EXHIBIT 138: Lactose intolerance is a big driving factor for alternative milk products; high prevalence of lactose intolerance in Asia helps explain the relatively high market share of alternative milk in that market, despite Asian consumers' lower purchasing power



Source: Storhaug et al. and Bernstein analysis

What does this tell us about alternative meat's future growth potential?

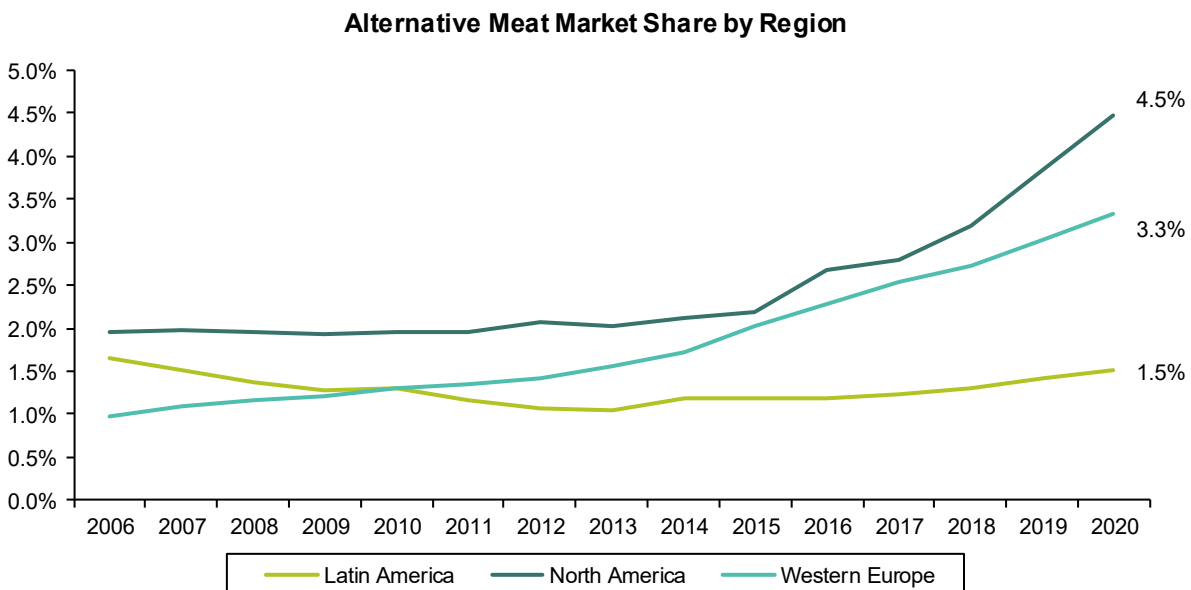
According to Euromonitor estimates, alternative meat has grown to represent 4.5% of the meat market in North America, 3.3% in Europe, and 1.5% in Latin America (see Exhibit 139).

In our **bear case scenario**, we expect alternative meat's market share to grow to **5%** in emerging markets by 2029, similar to alternative milk's market share in Latin America today, where lactose intolerance is not a major health consideration and affordability remains a hurdle for mass market adoption. We expect alternative meat to grow to a **7.5%** market share in developed markets over the next decade, below alternative milk's market share in Europe today. This scenario reflects assumptions that plant-based meat producers do not manage to reach price parity with animal-based meat, and fail to significantly improve the taste and texture of their products. This is also assuming that cultivated meat doesn't take off in any meaningful fashion over the next decade. As such, alternative meat fails to penetrate the mainstream consumer segment in our bear case scenario.

In our **base case scenario**, we expect alternative meat to grow its market share to **15%** in developed markets by 2029, similar to alternative milk's market share in North America today. In emerging markets, we expect alternative meat's market share to grow to **10%**, below developed markets' 15%, reflecting the lower purchasing power of emerging market consumers. That said, in our base case scenario, we expect plant-based producers to make meaningful progress in lowering their costs of production, thereby offering plant-based meat products at a similar price to animal-based meat products.

In our **blue-sky scenario** (pun intended), we expect cultivated meat to also appeal to the mainstream consumer segment as producers improve their techniques and reach scale to bring costs down significantly. In this case, we expect alternative meat (plant-based and cultivated meat) to grow its market share to **25%** in developed markets, assuming the ~35% of European and US consumers who are looking to increase their plant-based meat consumption (based on survey results) actually make alternative meat a main part of their diets. And we expect alternative meat to grow to represent a **15%** market share in emerging markets, assuming meat alternatives are able to offer products that are healthy, tasty, and affordable at least for a portion of emerging market consumers.

EXHIBIT 139: According to Euromonitor estimates, alternative meat has grown to represent 4.5% of the meat market in North America, 3.3% in Europe, and 1.5% in Latin America



Note: We do not include Euromonitor's estimate for alternative meat's market share in Asia as Euromonitor does not do a good job of capturing the large proportion of meat sold in wet markets in Asia.

Source: Euromonitor and Bernstein analysis

+ IMPLICATIONS FOR THE ENVIRONMENT

Could the growth of meat alternatives help alleviate the livestock supply chain's environmental impact?

The OECD and FAO currently expect beef and pork consumption to grow at a 0.9% CAGR and poultry consumption to grow at a 1.5% CAGR from 2019 to 2029, with most of the growth led by emerging markets (see Exhibit 140). This implies an incremental 4,062 kilotons of beef, 7,156 kilotonnes of pork, and 20,455 kilotonnes of poultry by 2029 to feed the growing population. Beef is the most resource intensive of all. Each kg of incremental beef protein emits 295kg CO₂ equivalent emissions (see Exhibit 120), and each ton of incremental beef protein requires 140 hectares of land and 110,000m³ of

water (see Exhibit 123 and Exhibit 124). Pork and poultry are less resource intensive, but still quite costly especially compared to grains and vegetables.

At this rate, assuming each 3oz of beef, pork, and poultry contain 21, 22, and 26 grams of protein, respectively,¹⁰⁹ **the expected increase in meat consumption will increase GHG emissions by 617 million tons, require 253 million hectares of more pasture and crop land, and use an additional 406 billion m³ of water.** This analysis assumes there will be no efficiency gains or technological improvement that could reduce livestock production's GHG emissions, land, or water use over the next decade. As such, the environmental impact of the incremental meat consumption might have been overstated. That said, efforts to reduce livestock's environmental footprint could lead to unintended consequences. For example, reducing land use could lead to lower pasture quality and more methane emissions.¹¹⁰ Shortening the livestock production cycle could also weigh on meat's nutritional value.¹¹¹ In reality, we will need a combination of agricultural efficiency gains and a portion of our diet shifted to meat alternatives to alleviate the environmental burden.

In the absence of any efficiency gains, how big is the environmental impact of our incremental meat consumption over the next decade (see Exhibit 141)?

- 617 million tons of GHG emissions represent a 7.6% increase from the total livestock sector emissions of ~8.1 billion tons. This is also equivalent to adding over 134 million cars on the road for one year.¹¹²
- How about 253 million hectares of land? Well, the Amazon rainforest is 550 million hectares — this incremental land use could take up nearly half the Amazon rainforest, which represents a 7.8% increase from the total pastureland of ~3.2 billion hectares.
- 406 billion m³ of water represents a 14.5% increase from the total agricultural sector freshwater use of ~2.8 trillion m³. Basically, we will need freshwater in the volume of more than two Dead Seas to raise more livestock to feed the global population over the next decade.

¹⁰⁹ <https://www.allinahealth.org/health-conditions-and-treatments/eat-healthy/nutrition-basics/protein/meat-poultry-and-fish>

¹¹⁰ <https://www.agric.wa.gov.au/climate-change/reducing-livestock-greenhouse-gas-emissions>

¹¹¹ <https://michaelpollan.com/articles-archive/power-steer/>

¹¹² <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

EXHIBIT 140: OECD and FAO currently expect beef and pork consumption to grow at a 0.9% CAGR and poultry consumption to grow at a 1.5% CAGR from 2019 to 2029, with most growth led by emerging markets

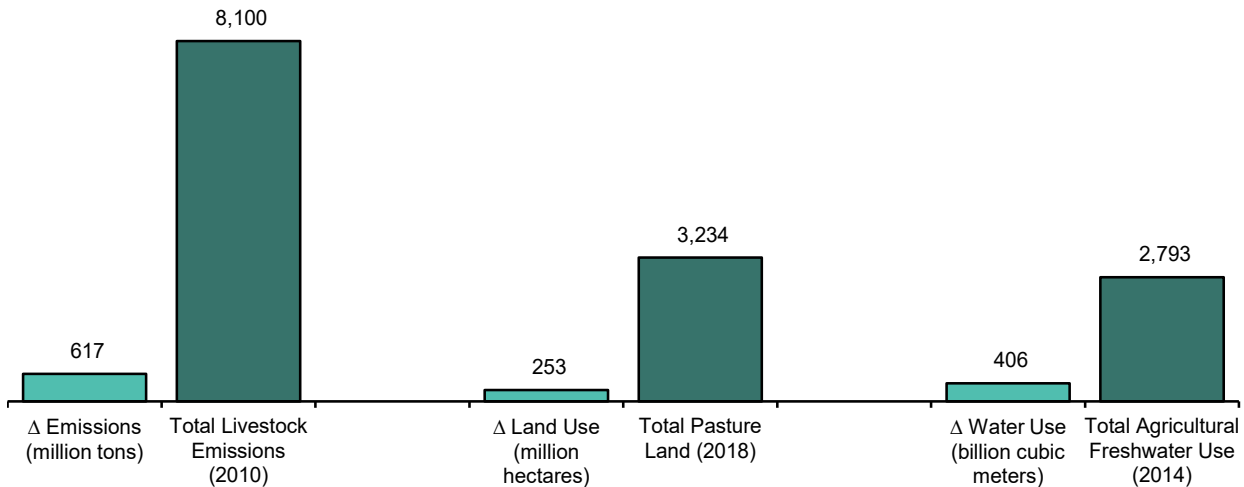
in kt retail weight	Beef			Pork			Poultry		
	2017-19	2029	CAGR	2017-19	2029	CAGR	2017-19	2029	CAGR
World	45,161	49,223	0.9%	75,575	82,731	0.9%	124,419	144,874	1.5%
North America	8,552	8,990	0.5%	6,884	7,425	0.8%	19,845	21,838	1.0%
U.S.	7,929	8,387	0.6%	6,373	6,908	0.8%	18,392	20,110	0.9%
Latin America	9,796	10,250	0.5%	5,888	6,964	1.7%	24,066	27,245	1.2%
Brazil	4,916	5,060	0.3%	2,194	2,495	1.3%	9,624	10,232	0.6%
Europe	7,078	6,830	-0.4%	17,337	17,402	0.0%	21,024	22,789	0.8%
EU	4,414	4,168	-0.6%	12,637	12,510	-0.1%	11,767	12,693	0.8%
UK	724	720	-0.1%	923	918	-0.1%	2,176	2,440	1.2%
Africa	4,679	5,696	2.0%	1,140	1,553	3.1%	7,806	10,163	2.7%
Asia	14,522	16,918	1.5%	43,740	48,746	1.1%	50,153	61,037	2.0%
China	4,961	5,428	0.9%	33,809	37,880	1.1%	20,612	23,591	1.4%
India	638	770	1.9%	195	178	-0.9%	3,659	5,395	4.0%
Oceania	534	539	0.1%	585	641	0.9%	1,525	1,801	1.7%
Developed	19,019	19,677	0.3%	26,770	27,386	0.2%	48,427	53,290	1.0%
Developing	26,142	29,546	1.2%	48,805	55,345	1.3%	75,992	91,584	1.9%

Note: Beef and pork volumes are converted from carcass weight equivalent to retail weight, assuming retail weight is 65% of carcass weight equivalent. Poultry volume represents ready-to-cook weight (in kt).

Source: OECD-FAO Agricultural Outlook 2020-2029 and Bernstein analysis

EXHIBIT 141: Expected increase in meat consumption, absent any efficiency gains, could increase GHG emissions by 617 million tons (7.6% of livestock emissions), require 253 million hectares more land (7.8% of total pasture land), and use an additional 406 billion m³ of water (14.5% of ag water use, or more than two Dead Seas!)

Environmental Impact of Incremental Meat Consumption (2019-2029) vs. Agriculture/Livestock's Current Environment Footprint



Source: FAO, World Resource Institute, Our World in Data, and Bernstein estimates (Δ emissions, Δ land use, Δ water use) and analysis

This is a very costly way to feed future generations. **If we shift a portion of the incremental meat consumption to plant-based or cultivated meat, the environmental toll could be reduced materially.**

In our base case scenario, we assume meat alternatives reach a 15% market share in developed markets and a 10% market share in emerging markets by 2029 (see Exhibit 142). Compared to the environmental footprint of the livestock sector today, we will need 31 million hectares less land and 25 billion m³ less water and will emit 49 million tons less GHGs to still be able to meet the growing population's protein demand (see Exhibit 143). The savings could be much more significant in our blue-sky scenario, where meat alternatives reach a 25% market share in developed markets and 15% market share in emerging markets by 2029. Even in our bear case scenario, we can more than halve the incremental GHG emissions and incremental land/water usage by growing meat alternatives to 7.5% in developed markets and 5% in emerging markets over the next decade.

This analysis leverages the Good Food Institute's estimates that plant-based meat requires 93% less land and 95.5% less water, while emitting 88.5% less GHGs (see Exhibit 125). We also assume meat alternatives have a similar amount of protein content compared to animal-based meat, which is largely what we see with current plant-based meat products (see Exhibit 126).

EXHIBIT 142: Demand for meat alternatives: bear, base, and blue-sky scenarios

Alternative Meat Market Share Assumptions

	Bear	Base	Blue Sky
Developed	7.5%	15.0%	25.0%
Emerging	5.0%	10.0%	15.0%

Bear Case

<i>in kt retail weight</i>	<i>Alternative Beef</i>			<i>Alternative Pork</i>			<i>Alternative Poultry</i>		
	2017-19	2029	Δ	2017-19	2029	Δ	2017-19	2029	Δ
North America	401	674	273	323	557	234	931	1,638	707
Latin America	150	513	363	90	348	258	367	1,362	995
Europe	243	512	269	596	1,305	710	722	1,709	987
Africa	123	285	161	30	78	48	206	508	302
Asia	221	846	625	666	2,437	1,771	764	3,052	2,288
Oceania	33	40	7	36	48	12	95	135	40
World	1,172	2,870	1,698	1,741	4,773	3,032	3,086	8,404	5,319

Base Case

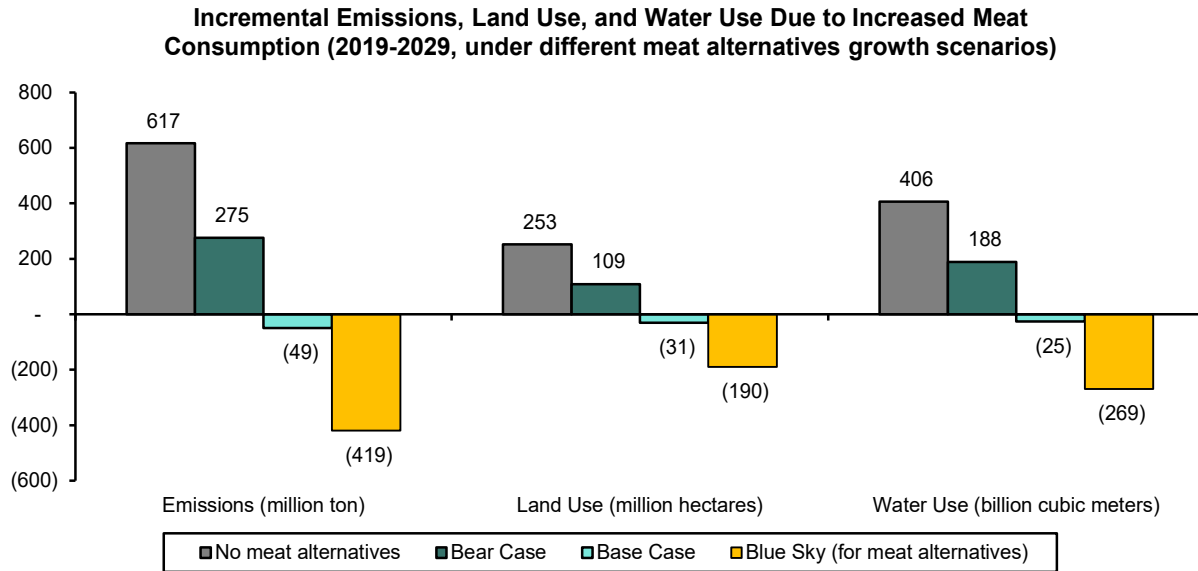
<i>in kt retail weight</i>	<i>Alternative Beef</i>			<i>Alternative Pork</i>			<i>Alternative Poultry</i>		
	2017-19	2029	Δ	2017-19	2029	Δ	2017-19	2029	Δ
North America	401	1,348	947	323	1,114	791	931	3,276	2,345
Latin America	150	1,025	875	90	696	607	367	2,725	2,357
Europe	243	1,025	781	596	2,610	2,015	722	3,418	2,696
Africa	123	570	446	30	155	125	206	1,016	810
Asia	221	1,692	1,471	666	4,875	4,209	764	6,104	5,340
Oceania	33	81	48	36	96	60	95	270	175
World	1,172	5,740	4,568	1,741	9,546	7,805	3,086	16,809	13,723

Blue Sky

<i>in kt retail weight</i>	<i>Alternative Beef</i>			<i>Alternative Pork</i>			<i>Alternative Poultry</i>		
	2017-19	2029	Δ	2017-19	2029	Δ	2017-19	2029	Δ
North America	401	2,247	1,846	323	1,856	1,533	931	5,460	4,528
Latin America	150	1,538	1,388	90	1,045	955	367	4,087	3,720
Europe	243	1,708	1,464	596	4,350	3,755	722	5,697	4,975
Africa	123	854	731	30	233	203	206	1,524	1,319
Asia	221	2,538	2,317	666	7,312	6,646	764	9,156	8,392
Oceania	33	135	102	36	160	124	95	450	355
World	1,172	9,019	7,848	1,741	14,956	13,215	3,086	26,374	23,288

Source: FAO, Euromonitor, and Bernstein estimates and analysis

EXHIBIT 143: If we shift a portion of incremental meat consumption to plant-based or cultivated meat, we can reduce the environmental toll materially while still being able to meet the growing population's protein demand



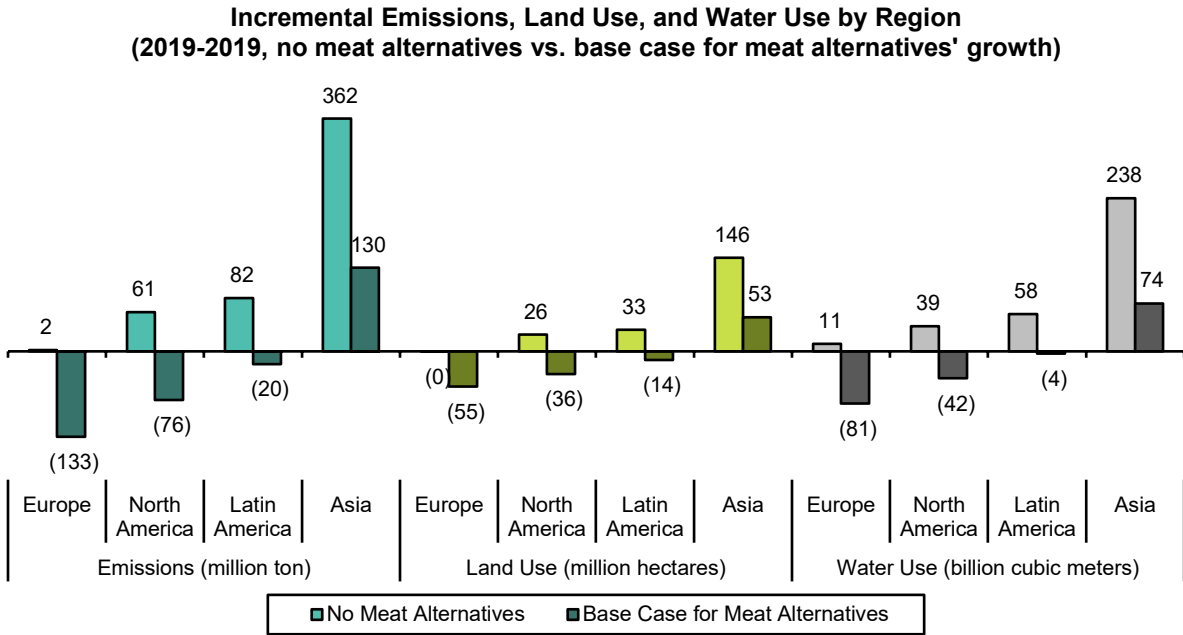
Source: FAO, World Resource Institute, Good Food Institute (GFI), Euromonitor, and Bernstein estimates and analysis

By region, **Europe's** beef consumption is already expected to decline moderately by 2029, such that the incremental meat consumptions' environmental impact is nominal to begin with. Shifting a portion of this demand to meat alternatives could yield net savings of 133 million tons of GHG emissions, 55 million hectares of land, and 81 billion m³ of water (see Exhibit 144).

In **North America and Latin America**, increased meat alternatives consumption (using assumptions from our base case scenario) could tilt the environmental impact of increased protein demand from a net burden to a net benefit. In **Latin America**, the shift to meat alternatives could prevent 33 million hectares of forest land (or 6% of the Amazon rainforest) from being converted for livestock farming and reduce the need for an additional 14 million hectares of land currently used for livestock production.

In **Asia**, although the shift to meat alternatives in our base case scenario is not enough to offset the incremental environmental impact of meeting the local population's growing protein demand, it could still cut the environmental impact by more than half.

EXHIBIT 144: **Environmental impact of meeting the global population's increased protein demand by region, assuming no meat alternatives versus using our base case assumptions for meat alternatives**



Source: FAO, World Resource Institute, GFI, Euromonitor, and Bernstein estimates and analysis

+ HOW ARE COMPANIES RESPONDING?

Most animal protein producers are vulnerable to climate change and deforestation risks over the long run. Some have started diversifying away from animal-based meat into alternative meat products, but are these efforts serious enough to move the needle?

According to the FAIRR Protein Producer Index, 38 out of 60 companies evaluated are at a high risk across 10 factors, including GHG emissions, deforestation & biodiversity, water use & scarcity, waste & pollution, antibiotics, animal welfare, working conditions, food safety, governance, and sustainable proteins¹¹³ (see Exhibit 146). Only three out of the 60 companies are ranked as low risk, including **Mowi** (Norwegian seafood company), **Maple Leaf Foods** (Canadian sustainable protein company), and **Bakkafrost** (European salmon company).

As with all ESG rankings, the FAIRR Protein Producer Index is more a reflection of companies' disclosure quality rather than their underlying practices. A number of Asian and Latin American companies rank at the bottom due to their limited disclosures. That said, we think disclosure is a critical first step as companies start to evaluate their environmental and social impact. Any improvement in ESG practices usually starts with better disclosures.

¹¹³ <https://www.fairr.org/index/company-ranking/>

Let's take a closer look at some of the key metrics that are the most relevant for the alternative meat industry:

- **GHG Emissions.** 75% of protein producers rank as high risk for GHG emissions. Notably, only four companies out of the 60 have set up science-based targets for Scope 1, 2, and 3 emissions (*Tyson, Mowi, Maple Leaf, and Grieg Seafood*). We believe it is critical for protein producers to set up science-based targets to align their emission reduction targets with the Paris Agreement, and to measure and reduce Scope 3 emissions in the supply chain, which make up the vast majority of these companies' total emissions.
- **Deforestation & Biodiversity.** 80% of land-based protein producers rank as high risk for deforestation & biodiversity. Interestingly, beef companies perform the best on deforestation risks according to FAIRR's assessment, which likely reflects the fact that deforestation is a major ESG risk for beef producers and they have paid more attention to managing the issue. Conversely, dairy companies rank the lowest in managing deforestation risks.
- **Water Use & Scarcity.** 92% of protein producers rank as high risk for water usage. This is the worst-performing risk factor, with companies receiving an average score of just 8%. No company ranks as low risk or best practice in this category, which highlights the need for greater awareness and management of water risks in the animal protein sector.
- **Sustainable Proteins.** 22 out of the 60 protein producers have started to diversify away from animal-based protein into alternative protein products, up from 15 in 2019. In particular, a number of beef companies (e.g., Grupo Nutresa, JBS, Marfrig, and NH Foods) launched dedicated alternative protein brands in 2020. That said, we wonder if some of these companies' investments in alternative proteins are too small to move the needle. Producing plant-based or cultivated meat also requires quite different skill sets compared to what's needed in the traditional livestock supply chain. As such, it could prove difficult for many traditional livestock companies to successfully disrupt themselves and shift their product mix toward alternative protein in a meaningful way.
- FAIRR also evaluates 25 leading food companies and retailers in terms of their readiness to embrace the growth of alternative protein across six metrics (materiality, strategy, product portfolio, consumer engagement, tracking and reporting, and investor engagement; see Exhibit 145).¹¹⁴ *Tesco and Unilever* are top ranked as pioneers. Both companies view meat alternatives as a key opportunity and have developed their own plant-based offerings. Unilever recently announced a new global sales target of €1bn from plant-based meat and dairy products over the next five to seven years as part of its "Future Foods" ambition.¹¹⁵ Meanwhile, Tesco has committed to a 300% increase in its sales of meat alternatives by 2025, making it the first UK retailer to set a sales target for meat alternatives.¹¹⁶ Conversely, *Costco*,

¹¹⁴ <https://www.fairr.org/sustainable-proteins/>

¹¹⁵ <https://www.unilever.com/news/press-releases/2020/unilever-sets-bold-new-future-foods-ambition.html>

¹¹⁶ <https://www.tescopl.com/news/2020/tesco-commits-to-300-sales-increase-in-meat-alternatives/>

Amazon, and Kraft Heinz are ranked poorly in terms of their preparedness to embrace the meat alternatives transition.

EXHIBIT 145: **FAIRR Sustainable Proteins Index: 25 food manufacturers and retailers**

FAIRR Sustainable Proteins Index			
Pioneer	Proactive	Active	Reactive
Tesco Unilever	Nestle M&S Kerry Group ICA Gruppen Sainsbury's Conagra Groupe Casino Carrefour General Mills	Loblaw Mondelez Kroger Hershey Ahold Delhaize Woolworths Morrisons Coles Groupo Nutresa Saputo Walmart	Kraft Heinz Amazon Costco

Source: FAIRR (<https://www.fairr.org/sustainable-proteins/>) and Bernstein analysis

EXHIBIT 146: FAIRR Protein Producer Index (2020): 60 animal protein producers

Ticker	Company	Overall Risk	GHG	Deforestation	Water Use &	Waste &	Antibiotics	Animal Welfare	Working	Food Safety	Governance	Sustainable
			Emissions	& Biodiversity	Scarcity	Pollution		Conditions		Proteins		
MOWI:NO	Mowi	Low Risk	Low Risk	Low Risk	Not Available	Not Available	Best Practice	Low Risk	Low Risk	Low Risk	Low Risk	Not Available
MFI:CN	Maple Leaf	Low Risk	Medium Risk	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	High Risk	Medium Risk	High Risk	Best Practice
BAKKA:NO	Bakkafrost	Low Risk	Medium Risk	Low Risk	Not Available	Not Available	Best Practice	Medium Risk	Low Risk	Medium Risk	Low Risk	Not Available
MRFG3:BZ	Marrig	Medium Risk	Medium Risk	Medium Risk	Medium Risk	High Risk	High Risk	Low Risk	High Risk	Low Risk	Medium Risk	Best Practice
GSF:NO	Grieg Seafood	Medium Risk	Low Risk	Low Risk	Not Available	Not Available	Low Risk	Low Risk	Medium Risk	Medium Risk	High Risk	Best Practice
TSN:US	Tyson	Medium Risk	Low Risk	Medium Risk	High Risk	High Risk	High Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk	Best Practice
FCG:NZ	Fontterra	Medium Risk	Low Risk	High Risk	Medium Risk	Medium Risk	High Risk	Medium Risk	Low Risk	Medium Risk	Medium Risk	Best Practice
LSG:NO	Leroy	Medium Risk	Medium Risk	Low Risk	Not Available	Not Available	Low Risk	High Risk	Medium Risk	Medium Risk	Medium Risk	Not Available
JBSS3:BM	VFJBS	Medium Risk	Medium Risk	Medium Risk	Medium Risk	High Risk	High Risk	Medium Risk	Medium Risk	Medium Risk	Medium Risk	Best Practice
BRF53:BZ	BRF	Medium Risk	High Risk	Medium Risk	High Risk	High Risk	Medium Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk	Best Practice
HRL:US	Hormel	Medium Risk	High Risk	Medium Risk	Medium Risk	High Risk	Medium Risk	Medium Risk	Medium Risk	Medium Risk	High Risk	Best Practice
CPF:TB	CPF	Medium Risk	High Risk	Medium Risk	High Risk	High Risk	Medium Risk	Medium Risk	Medium Risk	Medium Risk	Medium Risk	Best Practice
CWK:LN	Cranwick	Medium Risk	High Risk	Medium Risk	High Risk	High Risk	High Risk	Low Risk	Medium Risk	High Risk	Medium Risk	Best Practice
TU:TB	Thai Union	Medium Risk	Medium Risk	High Risk	Not Available	Not Available	High Risk	High Risk	Low Risk	Medium Risk	Medium Risk	Best Practice
MULTIFOO:CI	Multixport	Medium Risk	High Risk	Medium Risk	Not Available	Not Available	Medium Risk	Medium Risk	Low Risk	High Risk	Medium Risk	Not Available
288:HK	WH Group	Medium Risk	Medium Risk	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	Medium Risk	Medium Risk	Medium Risk	Best Practice
NUTRESA:CB	Grupo Nutresa	Medium Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Low Risk	High Risk	High Risk	Medium Risk	Best Practice
SALMOCAM:CI	Salmones Camanchaca	Medium Risk	High Risk	Medium Risk	Not Available	Not Available	Low Risk	High Risk	High Risk	High Risk	Medium Risk	Not Available
VNM:VN	Vinamilk	Medium Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	Medium Risk	High Risk	Best Practice
SALM:NO	SalMar	Medium Risk	Medium Risk	Medium Risk	Not Available	Not Available	Medium Risk	High Risk	Medium Risk	Medium Risk	High Risk	Not Available
LOUP:FP	LDC	Medium Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	High Risk	High Risk	Best Practice
2319:HK	Mengniu	Medium Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	Medium Risk	Best Practice
BELL:SW	Bell Food Group	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Best Practice
2282:JP	NH Foods	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	High Risk	Best Practice
TGR:AU	Tassal	High Risk	High Risk	Medium Risk	Not Available	Not Available	Medium Risk	High Risk	Medium Risk	High Risk	High Risk	Not Available
SCST:SS	Scandi Standard	High Risk	Medium Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	Best Practice
600887:CH	Yili	High Risk	Medium Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	Best Practice
GFPT:TB	GFPT	High Risk	High Risk	High Risk	High Risk	High Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk	High Risk	Not Available
AAC:AU	AACo	High Risk	High Risk	High Risk	High Risk	High Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk	High Risk	Not Available
RCL:SJ	RCL Foods	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Best Practice
MHPC:LI	MHP	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	Medium Risk	High Risk	High Risk	Not Available
BEEF3:BZ	Minerva	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	High Risk	Not Available
CALM:US	Cal-Maine Foods	High Risk	High Risk	Medium Risk	High Risk	High Risk	Medium Risk	High Risk	High Risk	Medium Risk	High Risk	Not Available
600429:CH	Sanyuan	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Best Practice
1332:JP	Nissui	High Risk	High Risk	High Risk	Not Available	Not Available	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	Not Available
QAF:SP	QAF	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Low Risk	High Risk	High Risk	High Risk	Not Available
ALMARAI:AB	Almarai	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	Not Available
1333:JP	Maruha Nichiro	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	Medium Risk	Not Available
ARL:SJ	Astral	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	Medium Risk	High Risk	Not Available
JAP:SP	Japfa	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
1210:TT	Great Wall	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Best Practice
876:CH	New Hope	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	Not Available
QLG:MK	QL Resources	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
BACHCOB:MM	Bachoco	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Low Risk	High Risk	Not Available
SEB:US	Seaboard	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
SAFM:US	Sanderson Farms	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
TFG:TB	Thaifoods	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
FB:PM	San Miguel	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
GCHE:RM	Cherkezovo	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	Not Available
ING:AU	Inghams	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
1117:HK	Modern Dairy	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
1610:HK	COFCO Meat	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
860:CH	Shunxin Agriculture	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
300498:CH	Wens	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
2281:JP	Prima Ham	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Medium Risk	High Risk	Not Available
BAFARB:MM	Grupo Bafar	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
2714:CH	Muyuan	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
WH:IN	Venky's	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
2299:CH	Sunner	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available
600965:CH	Fucheng	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	High Risk	Not Available

MEAT ALTERNATIVES

BERNSTEIN

Source: FAIRR and Bernstein analysis; <https://www.fairr.org/index/company-ranking/>

SECTOR PERSPECTIVES

US FOOD (ALEXIA HOWARD)

As Exhibit 139 shows, the alternative meat market has accelerated in the US in recent years with the arrival of Beyond Meat and Impossible Foods. Beyond Meat launched its frozen beet-juice bleeding "Beast Burger" into grocery outlets to great fanfare in early 2015, and although this product has since been discontinued, it heralded the start of a new era for plant-based meats. The intention was to target meat-eaters looking to dial down their animal meat consumption with a meat-emulating plant-based alternative. However, the real breakthrough came in 2016 when the company began to sell its Beyond Burger in the fresh meat section of a Whole Foods Market store in Boulder, Colorado. The vision was to place the product in the high-traffic refrigerated fresh meat area frequented by flexitarians, rather than the frozen vegetarian aisle.

Over the last decade, we have seen a great deal of disruption in the US plant-based meat space (see Exhibit 147 and Exhibit 148). In terms of deal-making, a number of brands have changed hands. The Quorn brand of mycoprotein-based meat alternatives originated in the UK in 1993 and has changed hands several times over the past 25 years, landing with Monde Nissin out of the Philippines in 2015. Similarly, Gardein was sold to Pinnacle Foods in 2014, which was subsequently bought by Conagra in 2018. Meanwhile, Tyson exited its relationship with Beyond Meat shortly before the IPO.

In terms of the fortunes of individual companies in this space, it seems it's really not easy to get these things right and make a dent in this marketplace, even if you have deep pockets:

- Kellogg (with the Morningstar and Gardenburger brands) has seen its market share fall from 47% in 2010 to 26% in 2019 according to Euromonitor, and is still seeing share losses despite the launch of Incogmeato by the Morningstar Farms subbrand in September 2019 (although overall share losses are moderating a little, which may be due to the stabilizing effect of Incogmeato).
- Kraft Heinz's Boca brand has also seen a steady decline from 13% in 2010 to 5% in 2019, despite relaunching an upgraded version of the Boca burger in early 2018.
- Nestle's efforts with the Sweet Earth brand that it acquired in September 2017 and Tyson's homegrown Raised and Rooted brands also seem to have failed to resonate strongly with consumers thus far, although perhaps Tyson is having more success with plant-based chicken products in the foodservice world.
- And while Conagra's Gardein brand and Maple Leaf's LiteLife and Field Roast Grain Meat have done fairly well, the share gains seemed to be starting to level off prior to the pandemic, most likely because their average velocities were well below the market leaders and so retailers may be less inclined to dedicate space in the high-traffic fresh meat section of the store. More recently in November 2021, Maple Leaf announced it has placed its plant-based division under review as sales have slumped in recent quarters.

Conversely, Beyond Meat and, more recently, Impossible Foods have been the clear winners thus far in the US retail market for alternative meats. Their on-menu presence in the foodservice market may be a big driver here, which has boosted awareness for both brands (plus the very valuable media coverage that Beyond Meat has enjoyed since its IPO in April 2019 can't have hurt!). In 2019 Beyond Meat had relationships with a string of companies including Denny's, Carl's Jr., and TGI Fridays, while Impossible Foods started with chains including White Castle and Red Robin. Beyond Meat continued to build its foodservice presence with Dunkin', although it withdrew from its relationship with Tim Horton's in Canada and now only sells its plant-based breakfast sandwiches to Dunkin' in Western US. Meanwhile, Impossible Foods signed up with Burger King to launch the Impossible Whopper in the summer of 2019. Interestingly, Starbucks seems to be building relationships with both companies in different countries, with the announcement of the launch of the Impossible breakfast sandwich in the US in June 2021, while also announcing the launch of products using Beyond Meat's product in China earlier in the year. Most recently, Beyond Meat announced in 2021 that it will become the global preferred supplier to McDonald's for the next several years for plant-based products under its McPlant platform, although the brand will not be mentioned directly on the menu as products are rolled out beginning in 2022.

There is no doubt the pandemic hit both Beyond Meat and Impossible Foods hard, both directly because of the sharp downturn in sales to foodservice channels and then the knock-on effect of greater competition for sales in retail channels. Prior to the pandemic, Beyond Meat reported having about half its sales in foodservice channels, with ~70% of these sales to smaller chains and independent restaurants. Structurally, these independents have been fairly devastated by the pandemic, with a commensurate hit to sales in these channels. And even though larger QSRs have performed well overall due to their drive-thru options, their sales of the new plant-based options have underperformed as consumers hunkered down to eat tried and trusted animal-based favorites.

The big question now for the US is whether encouraging repeat purchase rates will translate into a resurgence of these plant-based products as we emerge from the pandemic. Clearly, the data in retail channels looks poor on a year-over-year basis, but is more encouraging when looked at on a two-year basis (see Exhibit 149). The overall plant-based category is holding up and continuing to grow at a similar rate to the level it enjoyed prior to the pandemic, and even though the combination of Impossible Foods and Beyond Meat has slowed from a triple digit to around 40% as a two-year CAGR, it seems the overall momentum remains fairly strong in retail channels.

Moreover, Impossible Foods' decision to reduce wholesale prices in foodservice channels by 15% twice over the past year and by 20% in retail channels early in 2021 may also help bring prices for these products more in line with the prices of animal-based meats, particularly in a period where rising grain prices are likely to push prices up for these products.

Earlier in 2021, Beyond Meat launched the 3.0 version of its burger patties, which now have 35% less saturated fat than animal meats (with another version set for launch later this year with 55% less saturated fat). Clearly, the management team has embraced the idea that credible and more widespread health claims are likely to appeal to a broader set of

consumers than simply the absence of cholesterol in their previous versions of the product, and we will be watching to see how this affects consumer behavior over the coming quarters.

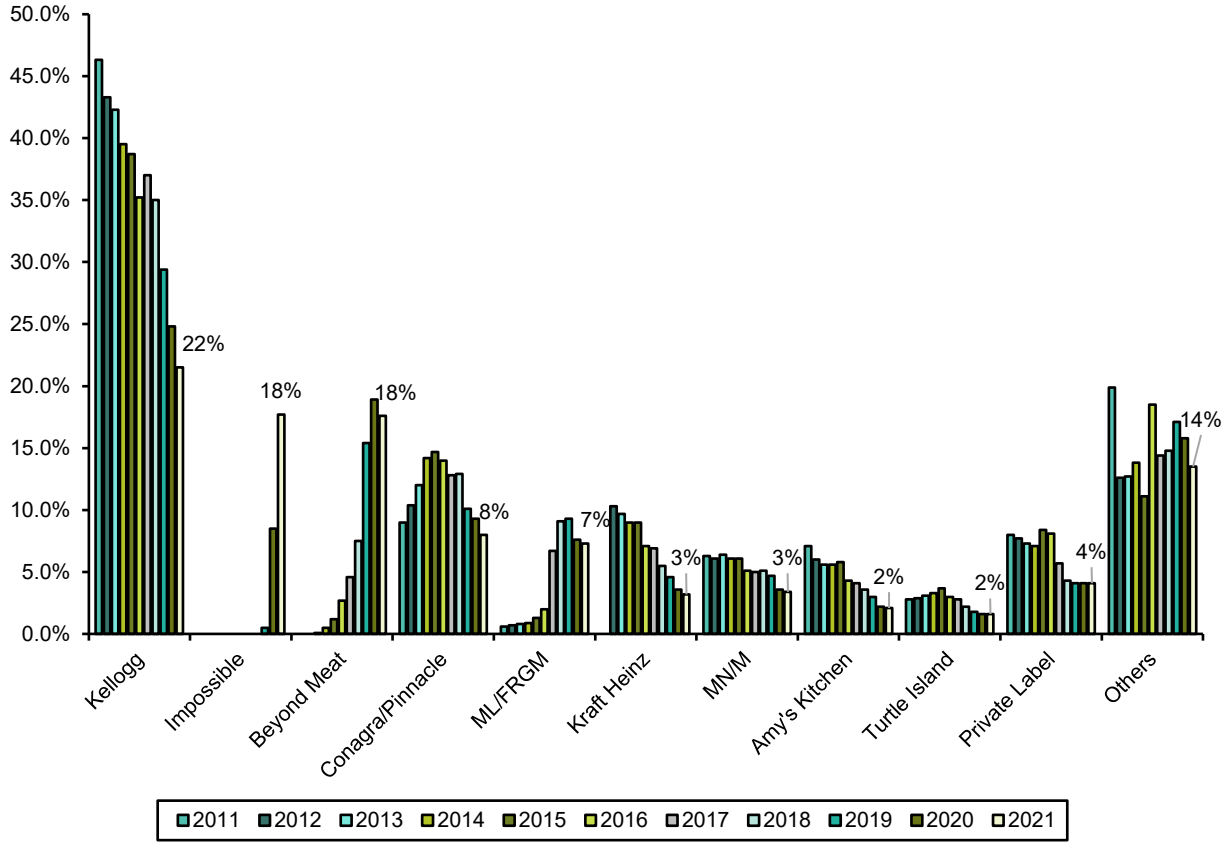
Overall, we believe the approach used here to create the bear, base, and blue-sky scenario assumptions makes sense by grounding the analysis around the penetration rates already seen in plant-based milk and dairy products. However, since the meat alternatives market is clearly at a more nascent stage of development than these dairy-based templates, it's hard to be sure whether the eventual penetration will be the same, especially given how the incidence of lactose intolerance seems to affect uptake in alternative dairy. Clearly, the key to the development of this market will depend on: (1) relative pricing to animal-based meats, (2) how improvements in taste and texture bring these products closer to the "real thing," (3) how effectively health advantages over animal meats are developed and marketed without sacrificing taste, and (4) how consumer concerns over health, climate change, and animal welfare develop to encourage adoption of these products.

Over time, we also suspect there will be a wide range of new technologies to tackle these issues, as demonstrated by the large number of new companies raising capital around the world in this field. Clearly, the cultivated meat market is still some ways from being fully commercialized due to cost constraints, but this could be a more acceptable alternative for some consumers, while other plant-based approaches plus other technologies such as biomass and precision fermentation could create a wide array of tools for replacing many different types of animal meats over time.

Of course, another key question here is what it may mean for traditional animal meat producers and the animal farming industry over time. We have already seen a lot of understandable resistance from states where the livestock industry is a key part of the economy, and we expect this to continue. Although companies such as Tyson are moving to create and market their own plant-based products and are also beginning to invest for the longer term in the cultivated meat space, it may be difficult for them to pivot quickly from their traditional product bases. Having said that, this is obviously a change that will take many years to play out to fruition, and demand for meat is still likely to be on the rise in emerging markets as income levels rise, which could provide further avenues for growth of both animal- and plant-based options over time.

EXHIBIT 147: **Over the last decade, we have seen a great deal of disruption in the US plant-based meat space according to Euromonitor data...**

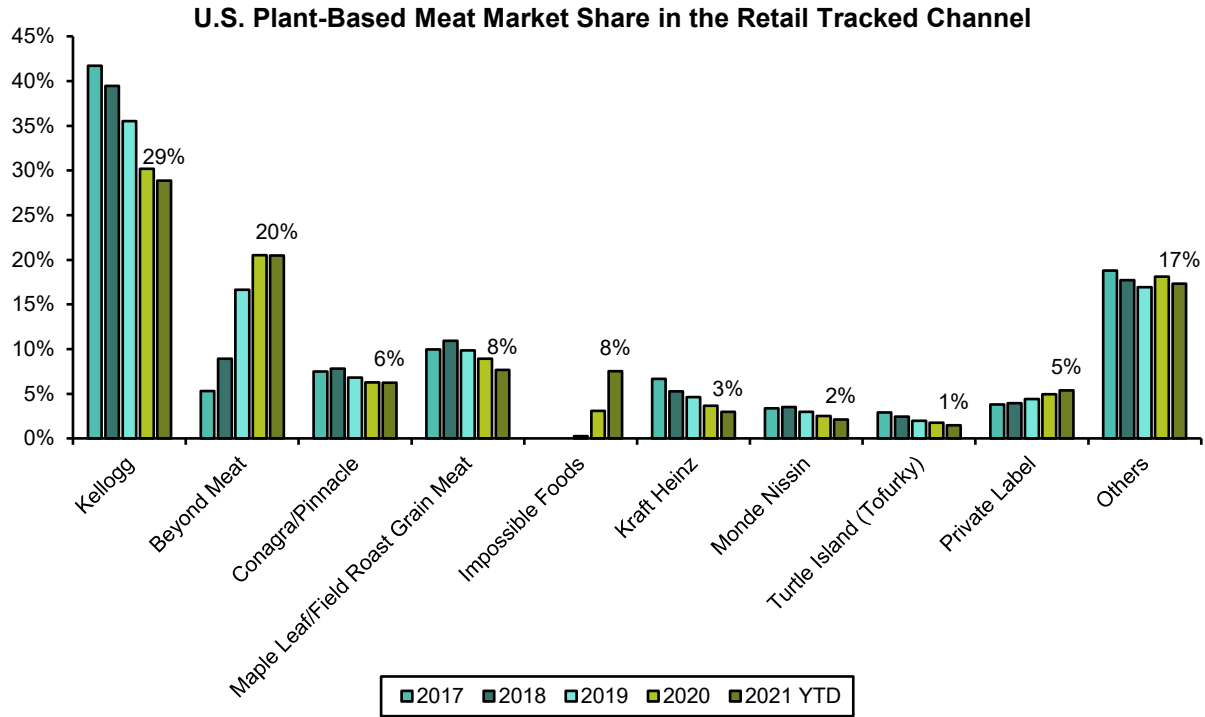
U.S. Plant-Based Meat Market Share in the Retail Channel



Note: Maple Leaf and Field Roast Grain Meat are abbreviated as ML/FRGM; Monde Nissin and Marlow Foods are abbreviated as MN/M.

Source: Euromonitor and Bernstein analysis

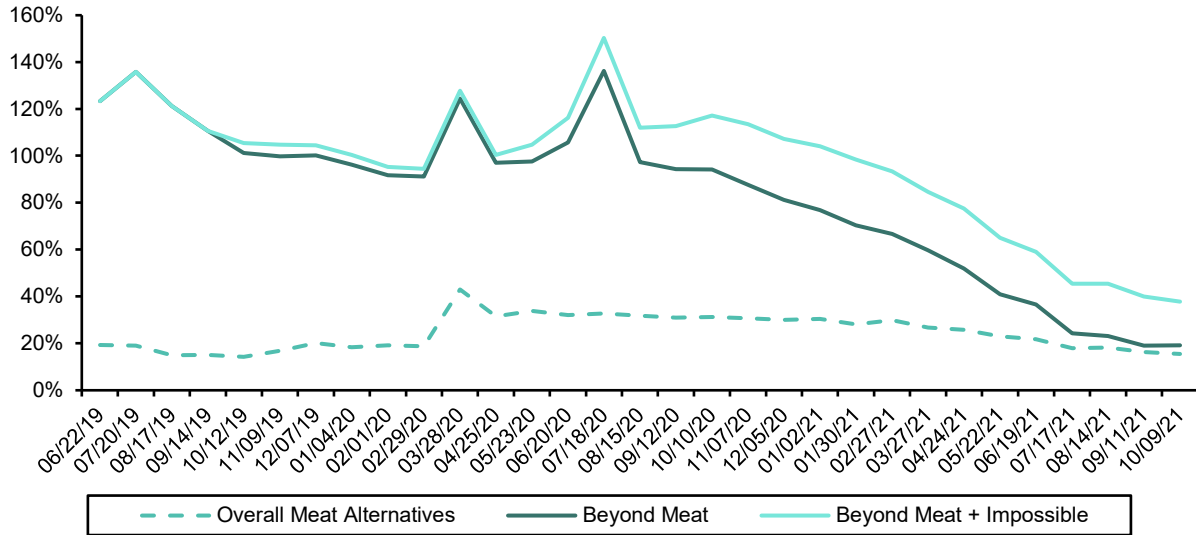
EXHIBIT 148: ...and as we look more closely at the more recent trends in measured channel data, we can see Impossible Foods is starting to make inroads, while private label is also seeing some success here



Source: Nielsen Scantrack Enhanced AOC+C and Bernstein analysis

EXHIBIT 149: The overall plant-based category is holding up and continuing to grow faster than it was prior to the pandemic, and though the combination of Impossible Foods and Beyond Meat has slowed from a triple digit to a high double-digit rate, the overall momentum seems to remain fairly strong in retail outlets

2-Year CAGR of growth of U.S. Meat Alternatives



Source: Nielsen Scantrack Enhanced AOC+C and Bernstein analysis

EUROPEAN FOOD & HPC (BRUNO MONTEYNE)

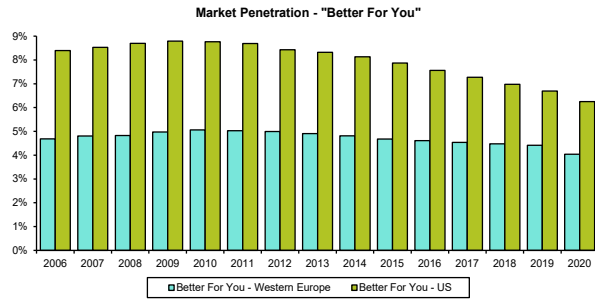
European consumers are likely to follow those in the US, with a short lag and lower penetration

It is tempting to think Europeans may lead in health- or environment-oriented trends: EU-based companies seem to be ahead in ESG planning, and the EU tends to put stricter regulations in place. Somewhat to our surprise, that is not mirrored in higher sales penetrations for health and wellness brands in Europe.

As shown in Exhibit 139, alternative meat has grown to represent 4.5% of the meat market in North America, compared to just 3.3% in Europe. Can we expect European consumers to catch up to their US counterparts, or even to overtake them? To answer this question, we look at alternative meat as part of a wider trend toward health and wellness, and look to comparable shifts in consumption patterns to inform our view of how this particular trend might play out.

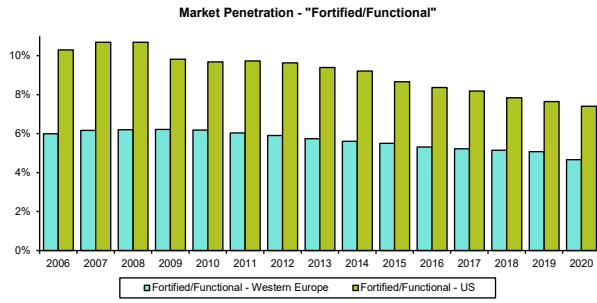
We compared the penetration (based on value share) of different categories of health and wellness products between the US and Western Europe, starting with two that have largely had their day: "Better For You" (reduced sugar, salt, fat, carbohydrates, etc.) and "Fortified/Functional" (e.g., bread or cereals with added vitamins/minerals). Exhibit 150 and Exhibit 151 show for both categories, the penetration in the US was and remains significantly higher, through the category's heyday and into its decline. It also puts the US somewhat ahead of Western Europe: "Better For You" starts its US decline around 2011 versus 2013 for Western Europe, and similarly "Fortified/Functional" starts to decline in the US in 2009 versus 2011 in Western Europe.

EXHIBIT 150: **Penetration is higher in the US...**



Source: Euromonitor and Bernstein analysis

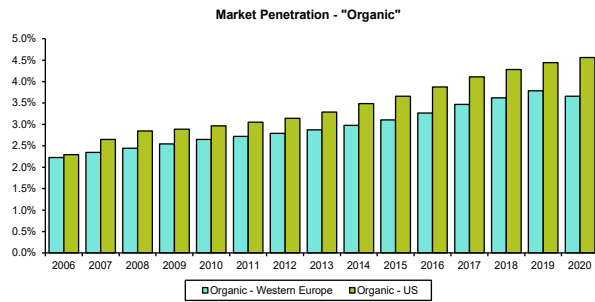
EXHIBIT 151: **...with Europe a couple of years behind**



Source: Euromonitor and Bernstein analysis

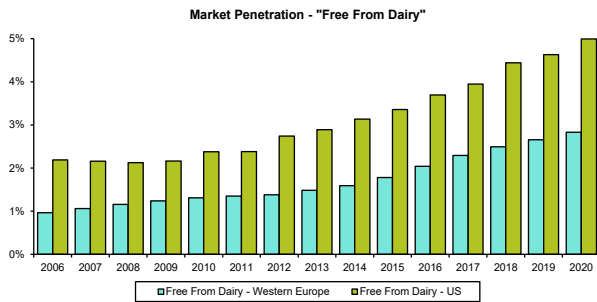
We extend the analysis to the successor trends of "Organic" (see Exhibit 152, includes packaged food where the organic aspect forms a significant part of the overall positioning/marketing of the product) and "Free From Dairy" (see Exhibit 153, plant-based dairy alternatives). We find US penetration remains higher even at this less advanced stage of the category lifecycle. We use Euromonitor data to track penetration, and note it includes only packaged food and not fresh produce. If fresh produce were included, we could potentially see those ratios switch over.

EXHIBIT 152: **Newer trends show a similar pattern**



Source: Euromonitor and Bernstein analysis

EXHIBIT 153: **The gap in penetration is particularly large in "Free From Dairy"**



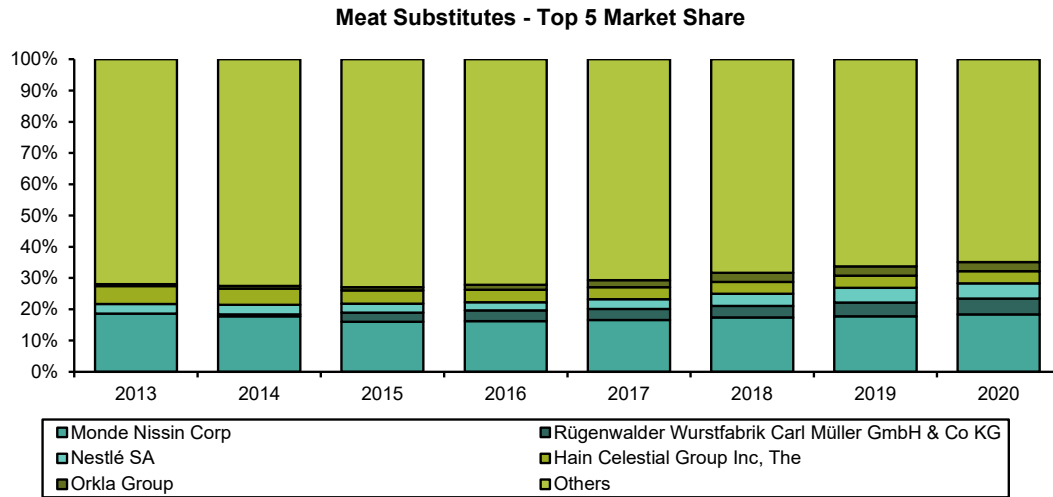
Source: Euromonitor and Bernstein analysis

On this basis — the propensity of US versus European consumers to embrace alternative foods that purportedly support health and wellbeing — we expect penetration of meat alternatives in the US to remain above Europe, and for Europe to follow the US with a slight lag.

European meat substitute market remains fragmented, with Quorn at the top

Exhibit 154 shows the market share of the top 5 meat substitute producers (by sales) in Europe, and shows the market is still very fragmented, with the top 5 accounting for just 35% of the market. The top producer Monde Nissin Corp has 18% of the market with its long-established Quorn brand. It has kept a roughly flat share in a growing market, with new entrants gradually gaining limited share at the expense of the bottom end of the market.

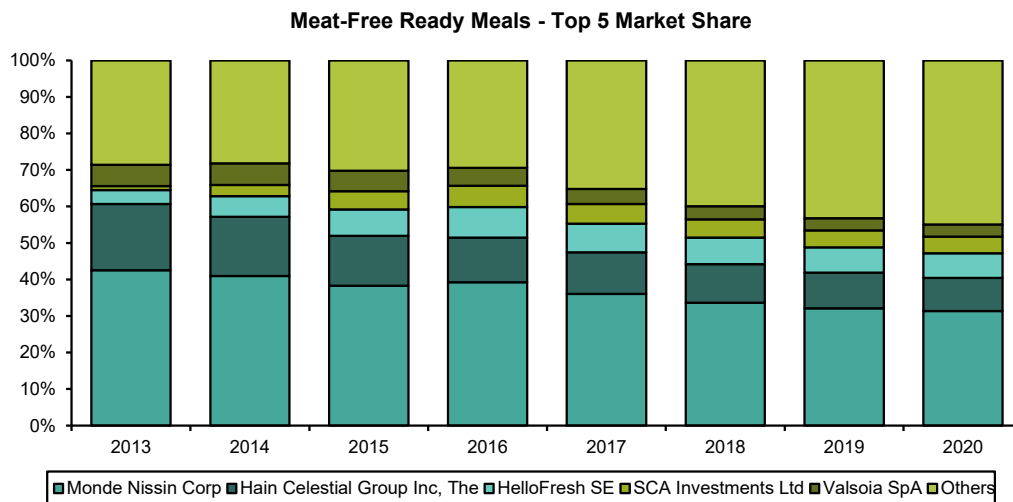
EXHIBIT 154: **Fragmented market led by Quorn owner Monde Nissin at 18%**



Source: Euromonitor and Bernstein analysis

In the meat-free ready meals market, the picture has certain similarities but also some important differences: Exhibit 155 shows concentration is far higher, with Monde Nissin at 31% of the market. The top 5 make up a larger portion of the market (55% in 2020, down from 72% in 2013), but overall the market appears to be fragmenting, with companies outside the top 5 gaining share at the expense of incumbents.

EXHIBIT 155: **Higher concentration in the meat-free ready meals segment, still led by Monde Nissin**



Source: Euromonitor and Bernstein analysis

Nestle and Unilever have their sights on the space

Plant-based meat and dairy alternatives remain a relatively small part of both companies' businesses for now, but they both have big ambitions in the space.

Unilever made just €200mn in sales of plant-based meat and dairy alternatives in 2020, equivalent to 0.5% of group sales:

- This is heavily skewed toward plant-based ice cream and mayonnaise,
- The majority of its meat replacement products are under The Vegetarian Butcher brand, and
- It aims to grow this €200mn fivefold to €1bn over 2025-27, focusing on organic growth over M&A.

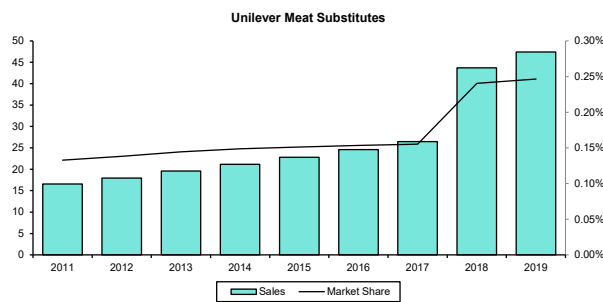
Nestle sold CHF820mn of plant-based meat and dairy alternatives in 2020, again less than 1% of sales. This breaks down into:

- CHF120mn of plant-based dairy alternatives, and
- CHF700mn of plant-based meat alternatives.

Unlike Unilever, Nestle hasn't given specific targets, but it "sees plant-based as a unique opportunity to reinvigorate our CHF12bn Food business" and has 10% of its R&D team working on plant-based developments.

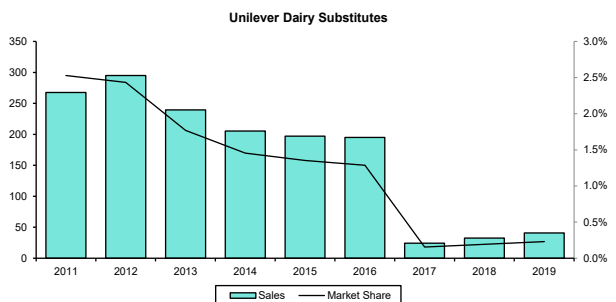
Unilever noted at its 2020 results that its plant-based brand The Vegetarian Butcher grew by over 70%, and it is expanding its plant-based offering within the existing Knorr brand to reach 50% plant based by 2050 and has already launched vego meatballs in tomato sauce in a number of European markets. Exhibit 156 shows how its sales and market share (based on retail sales per Euromonitor) have evolved, with the step up in 2018 reflecting the acquisition of The Vegetarian Butcher. The step down in Unilever's plant-based sales in 2017 (see Exhibit 157) reflects the sale of the spreads business — despite being plant-based, margarine's glory days are firmly in the past.

EXHIBIT 156: Meat alternatives sales jumped with The Vegetarian Butcher acquisition in 2017



Source: Euromonitor and Bernstein analysis

EXHIBIT 157: Dairy alternatives dropped as it sold the spreads business



Source: Euromonitor and Bernstein analysis

Don't expect a battle of the burger patties

Nestle segments its plant-based sales into pure "meat analogues" (vegetarian burger patties, sausages, etc.), plant-based dairy, and what it calls "downstream offerings" — this covers items such as frozen pizzas with plant-based toppings, or ready meals containing

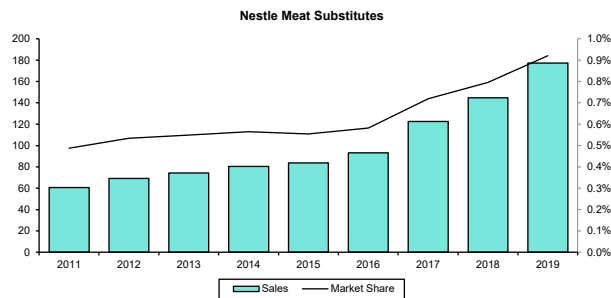
meat substitutes (like meatless lasagnas). Meat analogues is CHF200mn in sales and is growing "strong double digit," whereas downstream offerings are already CHF500mn and growing double digit.

Meat analogues have been around for a long time (albeit with increasing sophistication in recent years) and are less difficult to produce; this opens them up to the risk of commoditization, which explains why Nestle is focusing its efforts on downstream where the margins are higher and brands mean more.

Nestle is focusing its plant-based meat efforts on downstream brands in ready meals. It already has very strong brands that are well positioned to launch plant-based lines, including Stouffer's and Lean Cuisine ready meals and DiGiorno's frozen pizza. Exhibit 158 (again based on Euromonitor retail sales) shows Nestle's significant progress in sales and market share in the segment, and unlike Unilever and Danone, the growth is largely organic.

Investing in plant-based meat alternatives enables Unilever and Nestle to look for differentiation and higher growth in their existing food categories rather than developing the next burger patty.

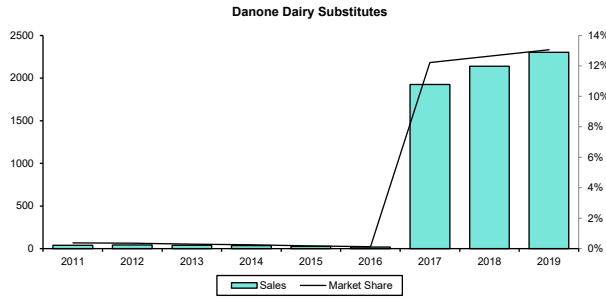
EXHIBIT 158: **Nestle's growth in the space is largely organic**



Source: Euromonitor and Bernstein analysis

On the dairy alternative side, Danone is an established and growing player, with the acquisition of WhiteWave in 2016 (see step up in Exhibit 159) giving the company a sizable position in plant-based milk and other dairy alternatives. The acquisition included Alpro, a purveyor of plant-based milk and yoghurt (mainly soy), long before the segment gained the popularity and awareness it currently enjoys. Plant-based dairy is obviously not the same as meat alternatives. However, given the strength of Danone in this product category, it would not surprise us if the new Danone CEO looks for new growth opportunities in nearby spaces like meat alternatives.

EXHIBIT 159: **Danone entered the market with the 2016 acquisition of WhiteWave**



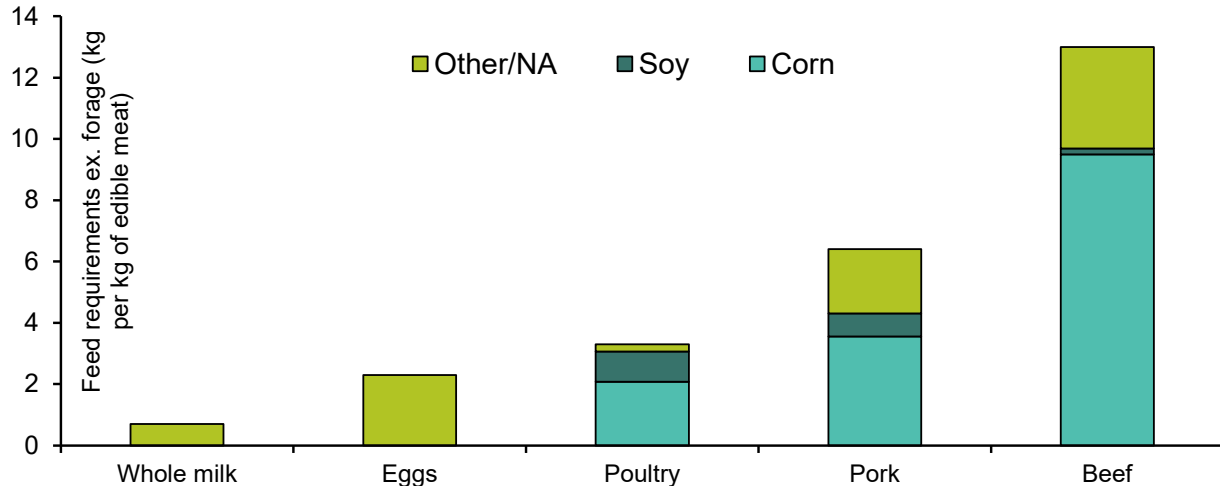
Source: Euromonitor and Bernstein analysis

EUROPEAN INDUSTRIAL & CONSUMER CHEMICALS (GUNTHER ZECHMANN)

Alternative meat is a moderate headwind for ag input companies and a tailwind for consumer chemical companies

Meat consumption, particularly beef, is crop intensive; therefore, softening meat demand poses a threat to ag input companies. Across all crops, beef requires 2x the amount of feed compared to the next most intensive meat – pork. For corn crops specifically, beef is extremely intense with, for example, each kg of US beef produced requiring ~10kg of corn versus 4kg for pork and 2kg for chicken (see Exhibit 160). For **Bayer** in particular, corn is an important crop, representing 26% of its Crop Science sales in 2020 versus 10% for soy.

EXHIBIT 160: **Beef ranks highest in terms of feed requirement; 1kg of beef requires at least 2.5x the amount of corn versus its nearest competitor, pork**



Source: Our World in Data and Bernstein analysis

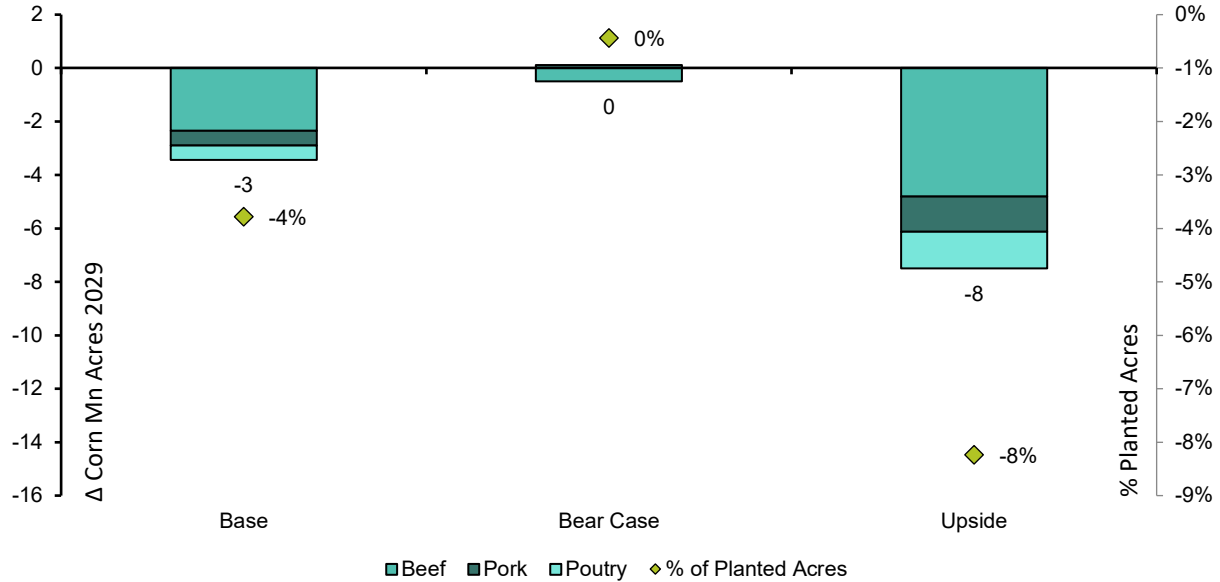
To estimate the impact on crop demand destruction from alternative meat in the US, we use the scenarios laid out in this report for 7.5% penetration in the bear case by 2029, 15.0% for the base case, and 25.0% for the bull case (from 5% today). These imply a 5-19% growth rate in beef, pork, and poultry alternative meats by 2029. We use the US as it is a key corn and soy market.

We find in the worst-case scenario (i.e., the bull case for alternative meat), corn demand could reduce by 8 million acres, representing an 8% reduction in US estimated planted acres for 2021-22 of 93.3 million acres by 2029. The largest lever to this is beef, making up 5 million of those acres. In our base case, demand is only reduced by 4% (see Exhibit 161). This would be in line with the lowest-ever planted acres in the US since 2008; the base case would be for 3 million acres (see Exhibit 163).

Soy could see half the impact of corn, with 4 million acres destruction in the worst case (i.e., 4% of 2021-22 estimate US acreage) and only 1.5 million acres in the base case. Poultry is the main culprit, making up 2.3 million of the 4 million in the worst-case scenario (see Exhibit 162). In both base and bull cases, planted areas would still be well above the lowest planted acres for soy since 2008 (see Exhibit 164).

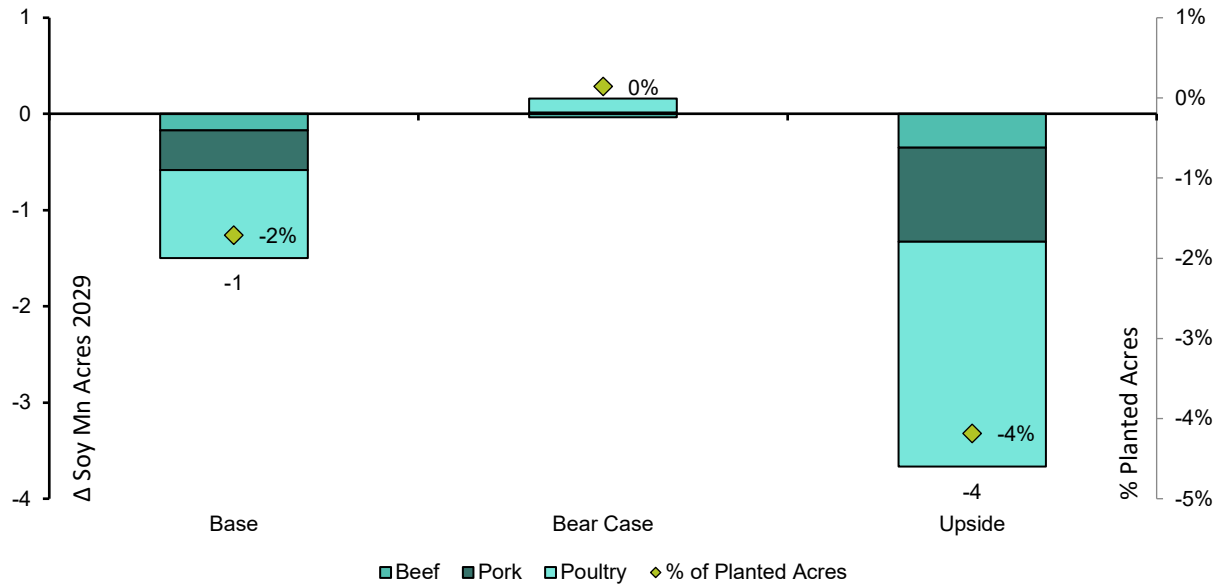
While corn may start to be of concern for ag input players, veggie seeds will likely be increasingly important, as will incremental R&D on physical/digital products in areas other than yield enhancement (e.g., reducing fertilizer application). Declining meat consumption should be modeled into R&D planning, given long lead times for trait/chemical development.

EXHIBIT 161: **Corn could lose 4-8% of planted acreage by 2029 in the US, mainly due to alternatives to beef**



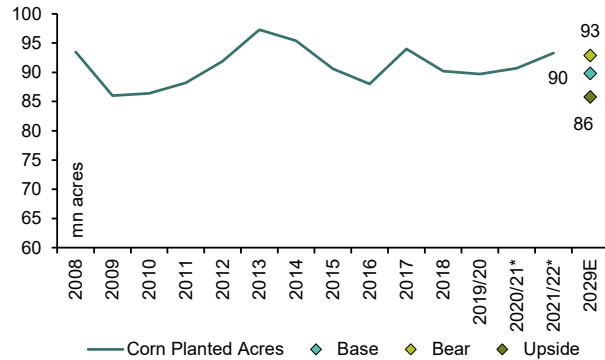
Source: Bernstein estimates and analysis

EXHIBIT 162: **For soy, poultry is the main cause and the demand destruction is halved versus corn**



Source: Bernstein estimates and analysis

EXHIBIT 163: **Base case would result in the lowest harvested acres since 2008, 3 million below for worst case**



Note: *USDA projections

Source: USDA, and Bernstein estimates and analysis

EXHIBIT 164: **Soy would still be above the lowest acres harvested since 2008**



Note: *USDA projections

Source: USDA, and Bernstein estimates and analysis

Animal feed and health companies have invested in sustainable animal consumption

DSM and Evonik have 38% and 12% of sales, respectively, to dedicated animal nutrition as of the last 12 months in 2021. For DSM, after divesting its Materials business, this will likely increase to 44%, of which ~45% is poultry, ~25% swine, and 20% ruminants with the remainder divided between fish and pets. With a portfolio focused on improving animal health, feed efficiency, performance, and environmental efficiency, consumer trends that influence reducing meat consumption are also supportive for demand in the mid-term.

The majority of Evonik's portfolio is Methionine, primarily used in poultry with some small exposure to swine and very little exposure to ruminants. For Methionine, replacing chicken with alternatives would slow demand in the long term, but this would appear ultimately noise against the more fundamental issue of balancing supply/demand in the market for what is a commodity product. Overall, therefore, we see greater risk to DSM's Animal Nutrition business in the long term were we to see the upside scenario of alternative meat adoption.

Two of DSM's "big ticket" projects are centered on sustainable consumption — Bovaer for ruminant livestock and Veramaris for sustainably produced Omega-3 for aquaculture (in partnership with Evonik). DSM's Bovaer project produces a feed supplement that claims to reduce methane emissions by ~30%, purporting to be the single cheapest way to reduce GHG emissions. It guides for 2H21 registration, and we expect sales to ramp from there, reaching ~€140mn by 2025 (2% of group sales excluding Materials).

Clearly, both effects (crop impact and animal feed/health) impact **BASF**, with both a sizable ag business and an animal nutrition business that competes with DSM. While lower commodity prices would put downward pressure on all ag inputs, with a greater exposure to veggies and to chemicals than to corn and soy, it is less directly exposed to a significant rise in alternative protein demand than peers Bayer and Corteva (not covered). While it has an exposure similar to that of DSM, Nutrition and Health is just 3% of group sales, so ultimately not a material concern for the group.

For flavors & fragrances, there are tasty incremental growth opportunities

With the growth in alternative meat also comes the opportunity for innovative flavors, texturizers, and other mouthfeel ingredients to help fake meat taste like real meat. Real meat's undoubtedly unique taste has historically been challenging to capture. A burger, for example, gains a lot of its taste from the quantity of fat that stays in the burger while cooking — vegetable oils are liquid at room temperature and burn off at a lower temperature. Burgers also have a unique texture, which comes from the neatly arranged fibers of animal protein. The patty also has a unique pink color and charred look when cooked.

IFF, Givaudan, and Symrise provide solutions for each of these challenges, and this is increasingly seen as a high-growth market for our companies in this sector. Companies don't disclose their sales in alternative meats, but demand has recently been driving sales in flavors (mainly savory), natural colorings, texturizers, and proteins — the latter two being now only relevant for IFF. Overall, IFF has >US\$1bn sales in protein solutions as of the last 12 months in 2021. We expect plant proteins (texturizers and proteins) to be the second-fastest-growing category within F&B over the next two years, and it is currently the fourth-largest market. Plant protein was also one of the key rationales for IFF acquiring DuPont's N&B division, which is a leader in this segment (see Exhibit 165 to see Exhibit 167).

EXHIBIT 165: Example of IFF and N&B solutions being used for plant-based burgers

- IFF Product Offering
- DuPont N&B Product Offering

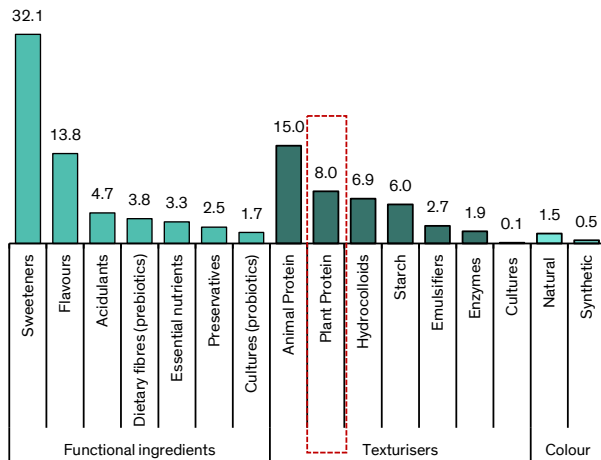
Better Plant-Based Burger



- Texturants (Mouth feel)
- Binders ("Glue" ingredients together)
- Plant-Based Protein (Nutritional component)
- Emulsifiers (Bun yield)
- System Blends (Dairy-free cheese)
- Flavor & Seasonings (Taste)
- Taste Modulation (Bitterness & salt reduction)
- Delivery Systems (Flavor performance)
- Natural Antioxidants (Food protection)
- Natural Color & Grill Mark (For appearance & clean label)

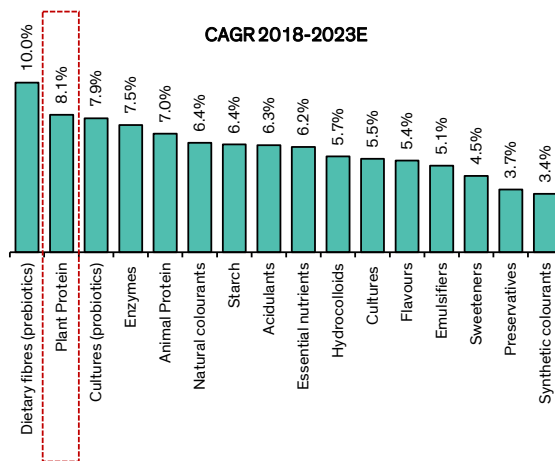
Source: Company presentation and Bernstein analysis

EXHIBIT 166: Subcategories in F&B 2018 market size US\$m



Source: Future Market Insights, Transparency Market Research, Grand View Research, Allied Market Research, Market Intellica, Global Market Insights, Markets and Markets, Hexa Research, and Bernstein analysis

EXHIBIT 167: Growth rate of F&B categories



Source: Future Market Insights, Transparency Market Research, Grand View Research, Allied Market Research, Market Intellica, Global Market Insights, Markets and Markets, Hexa Research, and Bernstein analysis

INVESTMENT IMPLICATIONS

US Food

We rate Kellogg Underperform; and Kraft-Heinz, Conagra Brands, and Beyond Meat Market-Perform.

European Industrial and Consumer Chemicals

We rate BASF, Evonik, Bayer, and IFF Outperform; Koninklijke DSM and Givaudan Underperform; and Symrise Market-Perform.

European Food

We rate Lindt & Sprüngli, Unilever, Danone, and Orkla Market-Perform; and Nestle Outperform.

For European Food & HPC: The meat and dairy alternatives space is a relatively small part of Unilever's and Nestle's portfolio to date, although their ambitions are much bigger (e.g., Unilever targets to grow its portfolio 5x in the next five to seven years). In the meat alternatives space, don't expect a battle over burger patties: we think our coverage companies will target downstream offerings like frozen pizzas with plant-based toppings where margins are higher and brands mean more, rather than trying to operate in the more commoditized meat analogues space. On the dairy alternatives side, Danone is well established with its WhiteWave acquisition, although it does have competitiveness issues in the US, especially in the oat space.

EXHIBIT 168: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price
BYND	M	USD	74.60	100.00
K	U	USD	63.87	54.00
KHC	M	USD	34.78	41.00
CAG	M	USD	31.51	38.00
LISP.SW	M	CHF	11,330.00	9,700.00
LISN.SW	M	CHF	112,300.00	102,500.00
NESN.SW	O	CHF	120.10	130.00
UNA.NA	M	EUR	46.61	40.50
ULVR.LN	M	GBp	3,921.00	3,500.00
BN.FP	M	EUR	54.33	54.00
ORK.NO	M	NOK	84.10	90.00
BAYN.GR	O	EUR	45.55	79.00
DSM.NA	U	EUR	191.80	156.00
EVK.GR	O	EUR	26.80	41.00
BAS.GR	O	EUR	58.74	114.00
IFF	O	USD	147.19	181.00
GIVN.SW	U	CHF	4,524.00	3,700.00
SY1.GR	M	EUR	126.15	106.00
MSDLE15			1,856.96	
SPX			4,655.27	

Source: Bloomberg, and Bernstein estimates and analysis

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BERNSTEIN

BIODIVERSITY

A risk that cannot be ignored, and a fertile ground for investment

HIGHLIGHTS

- **What is biodiversity?:** Biodiversity refers to the variety of life on Earth, which is critical to our wellbeing and economic growth. More than half the world's GDP is moderately or highly dependent on nature and its services. However, biodiversity loss and species extinction are occurring at an unprecedented rate. During the 4.5 billion+ years of Earth's history, there have been five mass extinctions, each wiping out 70-95% of species (see Exhibit 169). We've now entered the sixth wave, which has been accelerated by human activities.
- **Regulatory response:** The EU is taking a leadership position in setting up biodiversity-related regulations, from making biodiversity one of the six main environmental objectives under the EU Taxonomy to committing to restore degraded ecosystems by 2030 under the EU Biodiversity Strategy. The Taskforce on Nature-related Financial Disclosures (TNFD) will also provide recommendations for more effective nature-related disclosures for both investors and companies.
- **What it means for investors:** Investors should take biodiversity loss into account to reduce risk, especially for sectors that are highly dependent on ecosystem services (e.g., agriculture, chemicals & materials, forestry, and fishery) and sectors that are at risk from a regulatory and reputational standpoint due to their high impact on biodiversity (e.g., distribution, metals & mining, and oil & gas E&P). At the same time, a greater focus on biodiversity has created a fertile ground (pun intended) for investment opportunities, from regenerative agriculture to satellite imaging to enhance supply chain traceability, from plant-based meat to better environmental management systems for mining companies. We also include a shortlist of potential data sources and tools for investors at the end of this chapter to better assess biodiversity-related risks and opportunities.

BIODIVERSITY LOSS AS A SYSTEMIC RISK

Biodiversity is the variety of living components that make up natural capital. Biodiversity loss is a systemic risk: more than half the world's GDP (US\$44tn) is moderately or highly dependent on nature and its services, such as the provision of food, fiber, and fuel. Biodiversity loss reduces the quantity, quality, and resilience of ecosystem services and can present risks to investors across many sectors.¹¹⁷ To date, investors have primarily focused on biodiversity loss due to acute events, including those linked to illegal activity. Less

¹¹⁷ [Capital Coalition: Framing Guidance](#)

attention has been paid to how legal business activities are fundamentally reliant on biodiversity to produce goods and services, and their contribution to its decline.¹¹⁸

WHAT IS BIODIVERSITY?

The term biodiversity (from "biological diversity") refers to the variety of life on Earth at all levels from genes to ecosystems, and can encompass the evolutionary, ecological, and cultural processes that sustain life.¹¹⁹ During the 4.5 billion+ years of our planet's history, there have been five mass extinctions, each wiping out 70-95% of species, including dinosaurs (see Exhibit 169). These extinctions were caused by volcanic eruptions, depletion of oceanic oxygen, or collision with an asteroid.¹²⁰ Although life has proved to be the uttermost resilient, it took millions of years to regain the number of species following each extinction episode.

EXHIBIT 169: **During the 4.5 billion+ years of our planet's history, there have been five mass extinctions, each wiping out 70-95% of the species, including dinosaurs**



Source: Wikimedia Commons and Bernstein analysis

We've now entered the sixth mass extinction, which is led by human activities and could put future generations in danger. Around 1 million animal and plant species are now threatened with extinction, many within decades, more than ever before in human history.¹²¹

But are mass extinctions just part of the natural selection process or is the sixth mass extinction led by human activities? Compared to the Cretaceous-Palogene (K-Pg) mass extinction, which led to the extinction of dinosaurs around 65 million years ago,¹²² extinction rates today are much higher — more than 100x for amphibians and birds (see Exhibit 170).

¹¹⁸ UN PRI - Investor Action on Biodiversity: Discussion Paper.

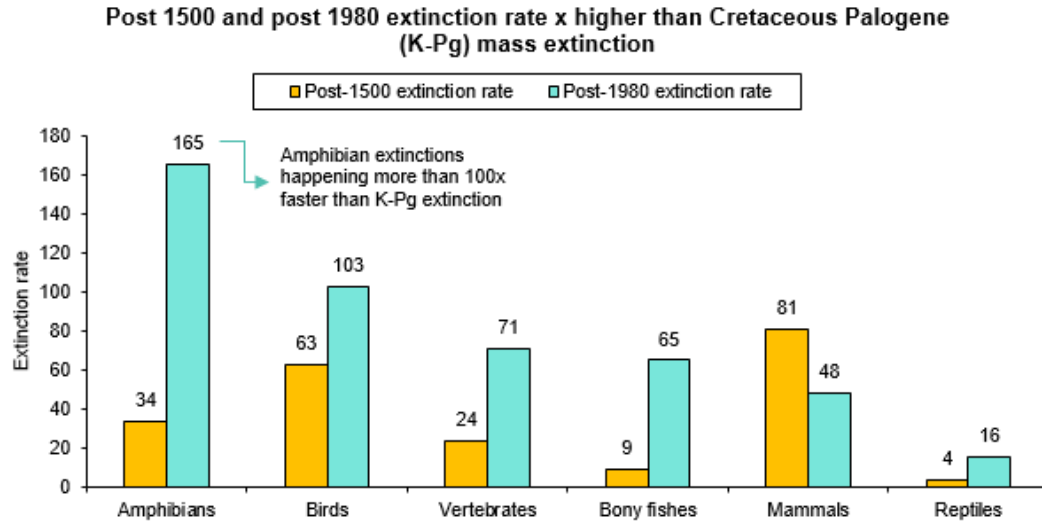
¹¹⁹ <https://www.amnh.org/research/center-for-biodiversity-conservation/what-is-biodiversity>

¹²⁰ <https://www.pnas.org/content/117/24/13596>

¹²¹ <https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/>

¹²² McCallum, M.L. Vertebrate biodiversity losses point to a sixth mass extinction. *Biodiversity and Conservation* 24, 2497–2519 (2015). <https://doi.org/10.1007/s10531-015-0940-6>

EXHIBIT 170: Extinction rates today are more than 100x higher for amphibians and birds compared to the Cretaceous-Palogene (K-Pg) mass extinction, which led to the extinction of dinosaurs ~65 million years ago



Source: McCallum 2015, Our World in Data, and Bernstein analysis

DRIVERS OF NATURE AND BIODIVERSITY LOSS

The key drivers of nature loss are climate change, invasive species, land use change, overexploitation of natural resources, and pollution.¹²³

Climate change: While climate change and biodiversity loss may seem like two very different subjects, they are actually two sides of the same coin. Ultimately, changing climate results in habitat loss and ecosystem destruction, and also poses risks in terms of the ability of businesses and society to provide goods and services. One example of the relationship between biodiversity and climate change is the loss of Arctic sea ice due to rising temperatures.

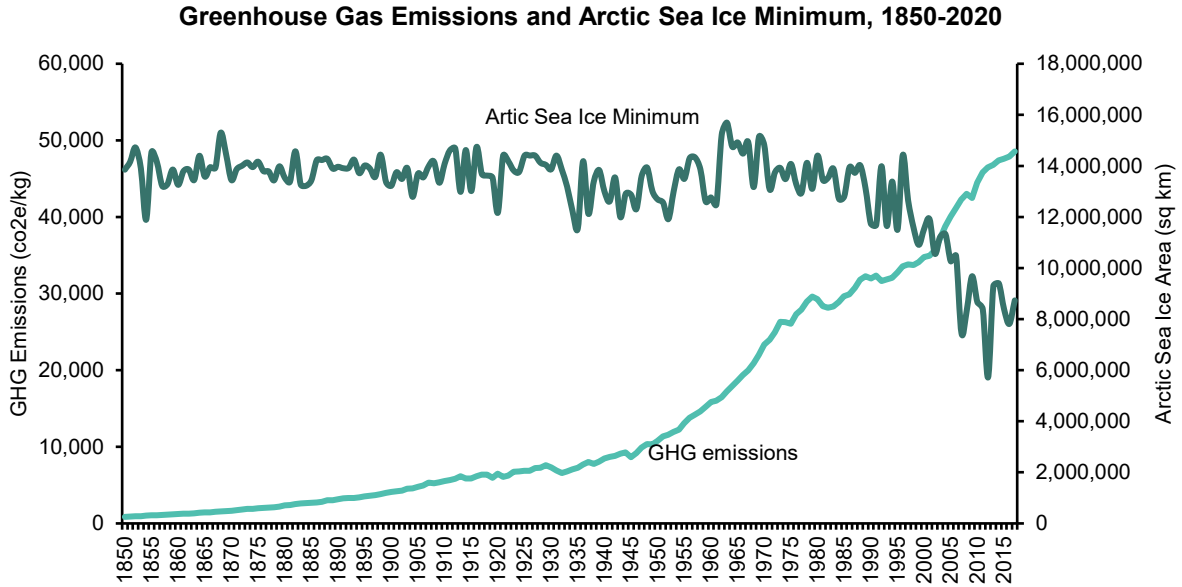
Arctic sea ice minimum extent has declined meaningfully since 1970, whereas GHG emissions saw a major uptick starting in the 1950s (see Exhibit 171). The heat trapped in the Earth's atmosphere because of human activity and GHG emissions have led to rising temperatures and subsequently less ice, impacting the biodiversity of polar regions due to habitat destruction (see Exhibit 172). In addition, Arctic sea ice is one of the ways the planet reflects the sun's heat rather than absorbing it, thus regulating global temperatures.¹²⁴ To put this in human terms, think about wearing a white t-shirt versus a black one on a hot summer day (the white is better equipped to reflect the sun's heat, while the black will absorb it). As the area of sea ice declines, especially during the summer months, more heat is absorbed into the planet rather than reflected, causing sea temperature levels to rise.

¹²³ Cambridge Institute for Sustainable Finance (CISL). (2016). Environmental risk analysis by financial institutions: a review of global practice. Cambridge: Cambridge Institute for Sustainable Finance (CISL). Retrieved from: <https://www.cisl.cam.ac.uk/resources/publication-pdfs/environmental-risk-analysis.pdf>.

¹²⁴ <https://nsidc.org/cryosphere/quickfacts/seaice.html>

This phenomenon ultimately disrupts ecosystems, habitats, and the global climate at large.¹²⁵

EXHIBIT 171: Arctic sea ice minimum extent (e.g., at the end of the summer months) has declined meaningfully starting in the 1970s, whereas global GHG emissions saw a noticeable uptick in the 1950s



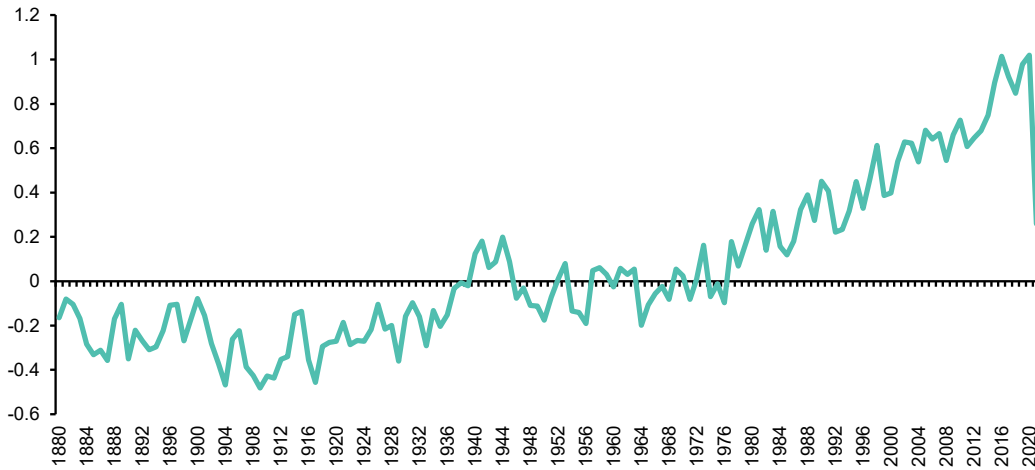
Source: The Arctic sea ice minimum marks the day each year when the sea ice extent is at its lowest. The sea ice minimum occurs at the end of the summer melting season. The summer melting season occurs after sea ice reaches its maximum in March and continues through September when it reaches its minimum. GHG emissions exclude emissions from land use and land use change.

Source: National Snow & Ice Data Center, PRIMAP-hist national historical emissions time series, and Bernstein analysis

¹²⁵ <https://oceanservice.noaa.gov/facts/sea-ice-climate.html>

EXHIBIT 172: Global observed temperatures have been warmer than baseline temperatures since the 1970s, with a significant drop in 2020, likely due to lower GHG emissions as a result of the Covid-19 pandemic

Global annual temperature mean anomalies, 1880-2021

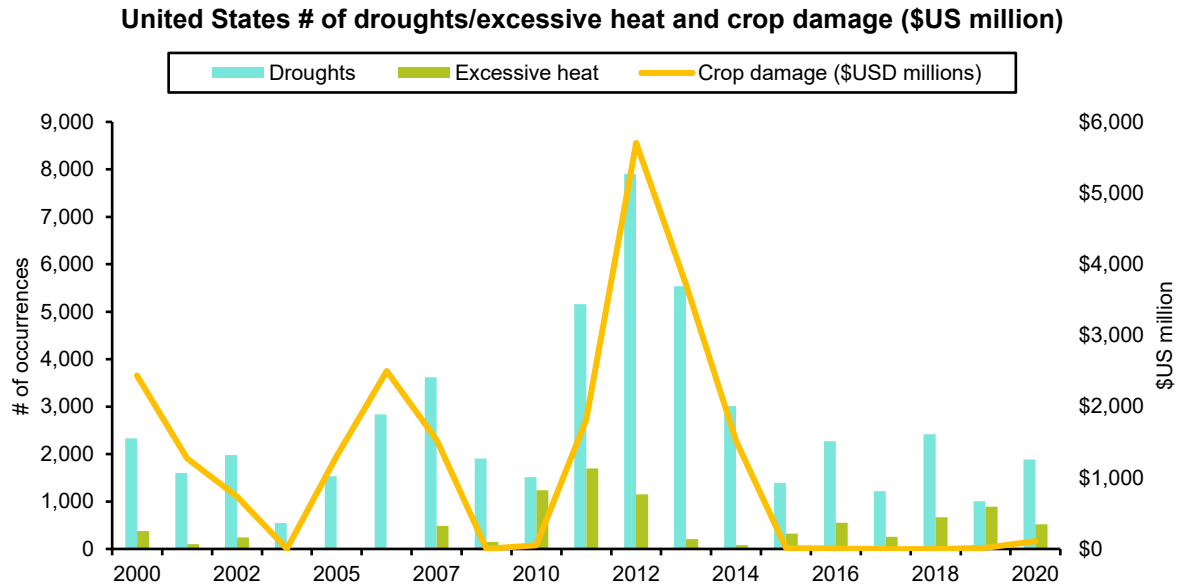


Note: Average temperature anomalies, which show whether temperatures are higher than baseline temperatures (which are an average of 30+ years of temperature data), have been continuously positive since 1970, also showing the relationship between rising rates of GHG emissions and global climate shifts. A positive anomaly means the observed temperature was warmer than the baseline, while a negative anomaly means the observed temperature was cooler than the baseline. Temperature anomalies were still positive, albeit much lower, in 2020, likely due to Covid-19 and the resulting drop in emissions as the world went into lockdown.

Source: National Aeronautics and Space Administration (NASA), Goddard Institute for Space Studies (GISS), and Bernstein analysis

As GHG emissions rise and climate shifts, changing climate patterns and extreme weather events, such as droughts and excessive heat, could impact natural capital in the form of food production, causing crop damage and driving up production costs (see Exhibit 173).

EXHIBIT 173: In the US, higher frequencies of droughts and excessive heat have correlated with meaningful crop damage



Source: National Centers for Environmental Information, National Oceanic and Atmospheric Administration (NOAA), and Bernstein analysis

Invasive species: Invasive species occur when plants or animals are moved to places where they damage existing ecosystems, leading to the extinction of native plants and animals, destroying biodiversity and permanently altering habitats.¹²⁶ While only a small percentage of transported organisms become invasive, they have a tremendous impact on the health of plants, animals, and even humans — threatening lives, and affecting food security and ecosystem health.¹²⁷ For example, invasive mosquitoes, which can spread by way of hitchhiking in used tires shipped from other regions, cause significant damage to public health by transmitting a range of diseases such as Zika, chikungunya, yellow fever, and dengue.¹²⁸

Land use change: Land use change is primarily the result of cutting down forests to make way for agriculture.

Overexploitation of natural resources: Overexploitation occurs when a resource is used up faster than it is replaced.

Pollution: Pollution of air, land, or water could also impact natural habitats and lead to biodiversity losses.

What does biodiversity loss mean for businesses and investors? Investors and companies need to better understand how business activities impact nature while also being highly

¹²⁶ <https://oceanservice.noaa.gov/facts/invasive.html#:~:text=Invasive%20species%20are%20capable%20of,coastal%20and%20Great%20Lakes%20ecosystems>

¹²⁷ [United Nations Decade on Biodiversity](https://www.un.org/en/development/desa/press/releases/un-decades-on-biodiversity-2020-2030)

¹²⁸ <https://www.sciencenews.org/article/invasive-species-cost-billions-damages-global-economy>

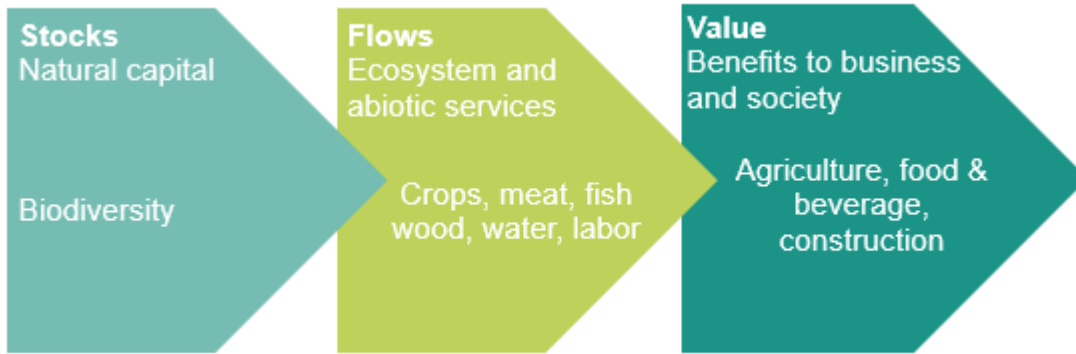
dependent on the ecosystem (see Exhibit 174). In particular, companies should measure three key areas: (1) *stocks*, or what natural resources a business is dependent on, (2) *flows*, i.e., changes in the availability of natural resources the business relies on (e.g., water, crops, meat, and fish), and (3) *value* of natural capital to the business and society (see Exhibit 175).

EXHIBIT 174: **Businesses and society are highly dependent on ecosystem services**

Ecosystem services	
Regulating	Air quality, climate, water runoff, erosion, natural hazards, pollution
Supporting	Nutrient cycling, water cycling, soil formation, photosynthesis
Provisioning	Food, fiber, biomass, freshwater, medicines
Cultural	Ethical values, existence values, recreation, ecotourism

Source: Earthwise Aware and Bernstein analysis

EXHIBIT 175: **Companies should measure three key areas related to biodiversity: stocks, flows, and value**



Source: Capitals Coalition and Bernstein analysis

Companies are dependent on biodiversity to produce goods and services, but we're losing our natural ecosystems and species at an alarming rate (see Exhibit 170), causing an inherent systemic risk to financial markets globally. In response to this, regulators, most notably in the EU, are starting to introduce frameworks and disclosure requirements around biodiversity. Although most regulations are still at an early stage of development, biodiversity has already become a top-of-mind issue for investors as people anticipate more regulatory pressure down the road.

+ REGULATORY FRAMEWORK

EU TAXONOMY

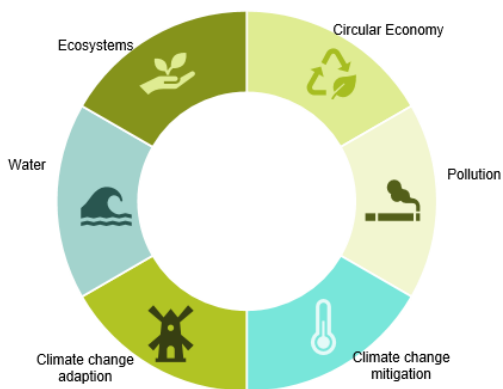
The EU Taxonomy includes biodiversity as one of the main environmental objectives to classify business activities. The Taxonomy is a major piece of regulation that establishes a framework to classify business activities or products based on their contribution to six major environmental objectives. Activities can only be classified as "green" if they make significant contributions to at least one of the objectives while doing no significant harm (DNSH) to the other objectives (see Exhibit 176).

In the context of biodiversity, business activities need to significantly enhance the protection and restoration of biodiversity and ecosystems in order to be counted as making a significant contribution, while the DNSH criteria ensures that business activities are not detrimental to the condition and resilience of ecosystems or the conservation status of habitats and species.¹²⁹

The Taxonomy will be implemented in two phases. In the first phase, the first two objectives – climate change mitigation and climate change adaptation – will come into effect on January 1, 2022. The other objectives will come into effect on January 1, 2023 and we will have more technical guidance around which business activities can be classified as making a significant contribution to the biodiversity objective in the following year or two (see Exhibit 177). Between now and then, investors can assess whether a business activity does significant harm to biodiversity while we wait for additional technical guidance.

Do no significant harm criteria: Since the first two taxonomy objectives come into effect on January 1, 2022, this means investors should assess the DNSH criteria for biodiversity in the context of these two objectives. An economic activity meets the conditions for causing significant harm to biodiversity if it is detrimental to the *overall condition and resilience of ecosystems* or if it is detrimental to the *conservation status of habitats and species*.¹³⁰ For example, if an economic activity claims to contribute to climate change mitigation (meaning an activity claims to reduce climate impacts) such as providing low-carbon transport, that activity should not cause significant harm to biodiversity in this context. If a company builds a new railroad as a way to shift transport from activities that have higher emission levels (e.g., trucks), but then clears a large area of protected rainforest to do so, this could cause harm to the overall climate mitigation objective because rainforests act as a carbon "sink."¹³¹ It could also cause harm to biodiversity if the area of the rainforest is home to endangered species.

EXHIBIT 176: The first two objectives in the EU Taxonomy – climate change mitigation and adaptation – will come into effect on January 1, 2022; the other four (including biodiversity) will come into effect on January 1, 2023



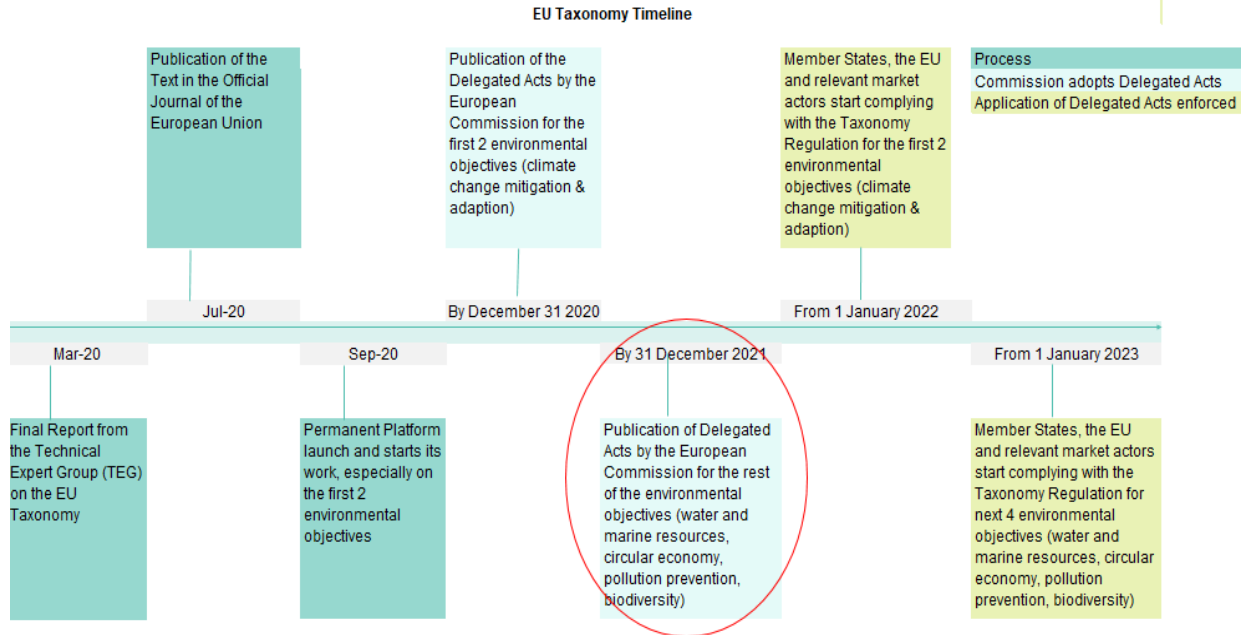
Source: European Commission and Bernstein analysis

¹²⁹ https://foes.de/publikationen/2021/2021-04_FOES_Taxonomy_BE.pdf

¹³⁰ EU Taxonomy Technical Annex.

¹³¹ <https://www.wri.org/insights/forests-absorb-twice-much-carbon-they-emit-each-year>

EXHIBIT 177: The biodiversity objective under the EU Taxonomy doesn't come into effect until 2023, but we expect additional technical guidance later this year, and investors can assess whether a business activity does any significant harm to biodiversity right now



Note: Delegated acts are used when acts have to be adapted to take account of technical and scientific progress.¹³² For instance, the EU's regulation on food labeling (Regulation (EU) No. 1169/2011) delegates to the Commission the power to adapt the definition of "engineered nanomaterials" to technical and scientific progress for a period of five years.

Source: European Commission and Bernstein analysis

EU BIODIVERSITY STRATEGY FOR 2030

The [EU's Biodiversity Strategy](#) is another key element of the European Green Deal and aims to restore degraded ecosystems by 2030, with a specific focus on building society's resilience to future threats, including the impacts of climate change, forest fires, food insecurity, and disease outbreaks.

The strategy includes three key commitments for nature protection by 2030.¹³³

- Legally protect a minimum of 30% of the EU's land area and 30% of the EU's sea area and integrate ecological corridors as part of a true Trans-European Nature Network.
- Strictly protect at least a third of the EU's protected areas, including all remaining EU primary and old-growth forests.
- Effectively manage all protected areas, defining clear conservation objectives and measures, and monitoring them appropriately.

¹³² Summaries of EU [https://eur-lex.europa.eu/summary/glossary/delegated_acts.html#:~:text=Delegated%20acts%20are%20non%2Dlegislative,to%20amend%20or%20supplement%20legislation.&text=either%20to%20amend%20or%20supplement,basic%20act%20\(i mplementing%20acts\).](https://eur-lex.europa.eu/summary/glossary/delegated_acts.html#:~:text=Delegated%20acts%20are%20non%2Dlegislative,to%20amend%20or%20supplement%20legislation.&text=either%20to%20amend%20or%20supplement,basic%20act%20(i mplementing%20acts).)

¹³³ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0380>

Strengthening the EU legal framework for nature restoration: Nature restoration is already partially required from Member States in existing legislation. However, one of the main roadblocks towards progress is a lack of biodiversity restoration plans as well as no requirement to comprehensively map, monitor or assess ecosystem services, health, or restoration efforts. To create stronger enforcement and support, the EU will put forward a proposal for legally binding EU nature restoration targets by the end of 2021.¹³⁴

EU nature restoration targets: The main objective of the initiative is to restore degraded ecosystems, in particular those with the most potential to capture and store carbon, prevent and reduce the impact of natural disasters, deliver further benefits such as soil health and pollination, and improve knowledge and monitoring of ecosystems and their services.¹³⁵ Some targets could build on relevant legislation that is already in place, such as the Birds¹³⁶ and Habitats¹³⁷ Directives, the Water Framework Directive,¹³⁸ and the Marine Strategy Framework Directive.¹³⁹

CLOSING DISCLOSURE GAPS:
TNFD

In addition to the regulatory framework, investors will need better disclosure practices from companies to assess biodiversity risks. An initiative to bring together a TNFD was announced in July 2020 on the back of various reports stressing the need to address biodiversity losses.

Building on the Task Force on Climate-related Financial Disclosures (TCFD), the TNFD informal working group now includes 74 organizations, including 49 financial institutions and corporates from five continents, as well as governments, regulatory bodies, think tanks, and consortia.¹⁴⁰ A global dissemination of the finalized TNFD framework is expected to take place in Q3/Q4 2023 (see Exhibit 178). Once launched, the TNFD will develop recommendations for more effective nature-related disclosures.¹⁴¹

¹³⁴ [EU Biodiversity Strategy for 2030](#)

¹³⁵ https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030/eu-nature-restoration-targets_en

¹³⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147>

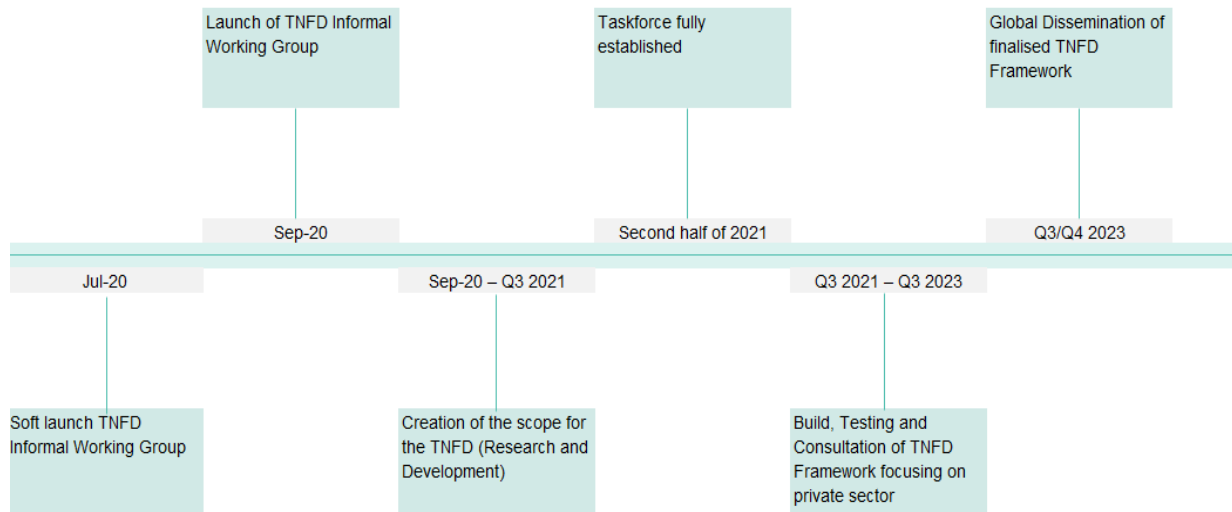
¹³⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043>

¹³⁸ <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32000L0060>

¹³⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32008L0056>

¹⁴⁰ <https://tnfd.info/how-it-works/>

¹⁴¹ <https://tnfd.info/news/frances-article-29-biodiversity-disclosure-requirements-sign-of-whats-to-come/>

EXHIBIT 178: **Global dissemination of the finalized TNFD framework is expected to take place in Q3/Q4 2023**

Source: TNFD and Bernstein analysis

While the TNFD has yet to release a finalized framework, its website contains a [Knowledge Base](#) with relevant reports and research. Notably, the [Handbook for Nature-related Financial Risks](#), developed by the University of Cambridge Institute for Sustainability Leadership, defines the key concepts for investors to identify and understand how nature loss is a risk to financial institutions.¹⁴² In essence, the framework helps us conceptualize physical risks or, in other words, how companies inherently rely on ecosystem services and how as nature declines, natural capital (crops, water, etc.) declines, reducing nature's ability to provide those ecosystem services intrinsic to an organization's ability to provide goods and services. In addition, the Handbook also identifies the relevant transition and litigation risks in the context of nature and biodiversity loss.

- **Physical risks:** Physical risks arise when these natural systems are compromised due to the impact of climate change (i.e., extreme weather events), geological events, or widespread changes in ecosystems, such as soil quality or marine ecology.¹⁴³ Companies' vulnerability to ecosystem services is ultimately a risk to investors, lenders, insurers, governments, and connected companies in supply chains, and is therefore a source of potential financial instability. In the market, physical risks could drive rating downgrades and share price losses, or impact balance sheets through direct operations or indirectly through supply chains.
- **Litigation risks:** Litigation risks are associated with emerging legal cases related to nature losses, which could arise if parties that suffer losses or damages from the effects of environmental change seek compensation from those they hold

¹⁴² Cambridge Institute for Sustainable Finance (CISL). (2016). Environmental risk analysis by financial institutions: a review of global practice. Cambridge: Cambridge Institute for Sustainable Finance (CISL). Retrieved from: <https://www.cisl.cam.ac.uk/resources/publication-pdfs/environmental-risk-analysis.pdf>.

¹⁴³ Cambridge Institute for Sustainable Finance (CISL). (2016). Environmental risk analysis by financial institutions: a review of global practice. Cambridge: Cambridge Institute for Sustainable Finance (CISL). Retrieved from: <https://www.cisl.cam.ac.uk/resources/publication-pdfs/environmental-risk-analysis.pdf>.

responsible.⁸ These losses or damages can include "potential pay-outs, fines, legal and administrative costs, insurance costs, financing costs, and reputational costs."¹⁴⁴ Fines for oil spills are a prominent example.

- **Transition risks:** As policies emerge to protect nature, so do transition risks. Despite their positive impact on nature, such policies can cause economic harm to some companies and, in turn, financial institutions connected to them. Regulatory or market efforts could include abrupt or disorderly introduction of public policies, technological changes, shifts in consumer or investor sentiment, and disruptive business model innovation.¹⁴⁵ Investees could face losses due to sanctions, stranded assets, damages, or inability to secure project finance.
- **Systemic risks:** Systemic risks are risks to the economy as a whole.¹⁴⁶ These risks go beyond nature-related risks for only one sector, such as agriculture, to consider risks that could have an impact on another element in the industry or value chain. An economic activity that causes nature loss could essentially cause a cascade of reactions and economic impacts to which investors and lenders are exposed.

Nature-positive economy: Physical, transition, and liability risks can drive a reorientation of portfolios and economic activity. As a result, financial flows could be redirected to boost the ecosystem services that provide benefits to people and drive a transition to a nature-positive economy. A *nature-positive economy* is an economy in which public and private sector actors, through choice and incentive, take action at scale to reduce and remove the drivers and pressures fueling the degradation of nature, actively improving the state of nature (natural capital) and the ecosystem services it provides.¹⁴⁷

WHAT DOES BIODIVERSITY LOSS MEAN AT THE SECTOR LEVEL?

Industries that are highly dependent on nature generate 15% of global GDP (US\$13tn), while those that are moderately dependent generate 37% (US\$31tn). The three largest sectors that are highly dependent on nature generate close to US\$8tn of gross value added (GVA) – these are construction (US\$4tn), agriculture (US\$2.5tn), and food and beverages (US\$1.4tn).¹⁴⁸ GVA represents the goods and services produced by a given industry, less the cost of inputs and raw materials attributable to that production. It is typically used to measure producer-, industry-, or sector-level contributions to GDP.

¹⁴⁴ Adapted from Carney (2015) and NGFS (2019), as expressed in: Solana, Javier. (2020, October). Climate change litigation as financial risk. Aims Press Green Finance. 2 (4): Retrieved from: <http://eprints.gla.ac.uk/225765/1/225765.pdf>.

¹⁴⁵ Adapted from Carney (2015) and NGFS (2019), as expressed in: Solana, Javier. (2020, October). Climate change litigation as financial risk. Aims Press Green Finance. 2 (4): Retrieved from: <http://eprints.gla.ac.uk/225765/1/225765.pdf>.

¹⁴⁶ Cambridge Institute for Sustainable Finance (CISL). (2016). Environmental risk analysis by financial institutions: a review of global practice. Cambridge: Cambridge Institute for Sustainable Finance (CISL). Retrieved from: <https://www.cisl.cam.ac.uk/resources/publication-pdfs/environmental-risk-analysis.pdf>.

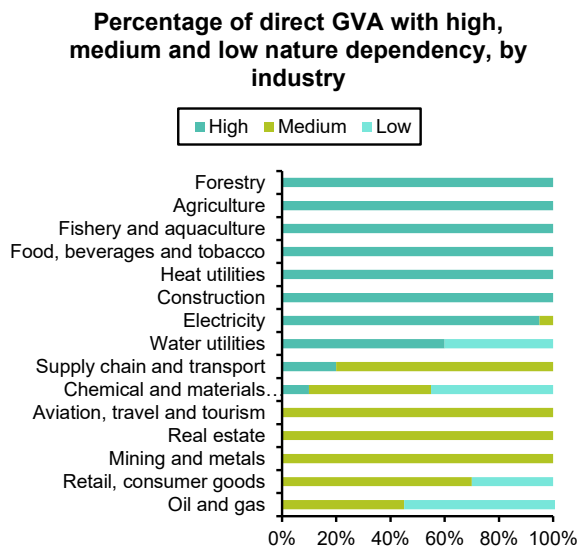
¹⁴⁷ Cambridge Institute for Sustainability Leadership (CISL). Business and Nature report. Cambridge: CISL.

¹⁴⁸ [WEF New Nature Economy Report](#)

In order to measure the extent to which the global economy depends on nature, existing research examines a sector's reliance on ecosystem services at the production process level. A "dependency rating" is given based on a sector's reliance on ecosystem services in production (e.g., raw material inputs), and also includes the sensitivity of the production process to changes in the availability of an ecosystem service, as well as potential financial implications as a result of changes to the availability of those ecosystem services needed for production processes.

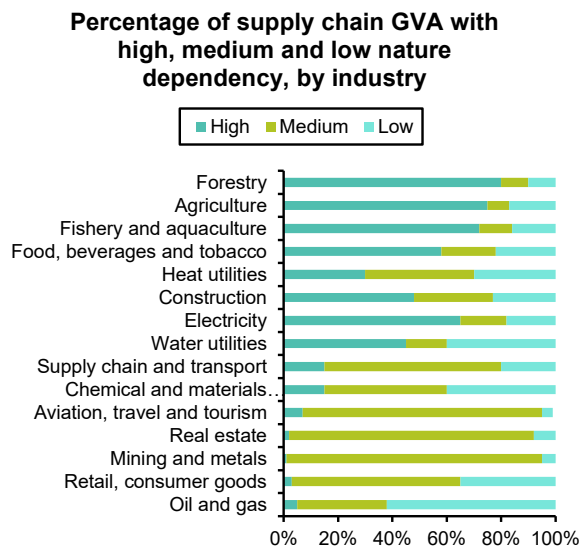
Sectors including forestry, agriculture, fishery, food/beverages, utilities, construction, and electricity are highly dependent on ecosystem services for direct outputs and from a supply chain perspective (see Exhibit 179 to Exhibit 180). Other sectors such as supply chain and transport, chemicals and materials, aviation, real estate, mining and metals, and retail/consumer goods are not as highly dependent on nature for direct outputs; however, more than 60% of GVA in their supply chains is highly or moderately dependent on nature, showing potential "hidden dependencies" (see Exhibit 180).

EXHIBIT 179: Forestry, agriculture, fishery, food/beverages, utilities, and construction, are highly dependent on ecosystem services for direct outputs...



Note: Industry GVA is calculated as the sum of GVA in all relevant sectors. The share of industry GVA in "high," "medium," or "low" dependency categories is then calculated based on the dependency scores of the sectors within that industry. Similarly, regional GVA is calculated as the sum of GVA in all relevant countries in the region. The share of regional GVA in "high," "medium," or "low" dependency categories is calculated based on the dependency scores of the sectors within that region, weighted by GVA. Source: World Economic Forum and Bernstein analysis

EXHIBIT 180: ...while for other sectors, GVA from the supply chain is highly or moderately dependent on nature, showing potential "hidden dependencies"



Note: The GVA generated in the supply chain of each individual sector (the purchasing sector) was calculated using a multiregional input-output model, with inputs based on the entire country-level intermediate demand from the sector in question. The sum of supply chain GVA is calculated as the sum of GVA created in all sectors that make up the purchasing sector's supply chain – in proportion to demand from the purchasing sector as a share of demand from all other sectors at each tier of the supply chain. Source: World Economic Forum and Bernstein analysis

Some sectors are highly dependent on biodiversity, while others are more at risk from a regulatory and reputational standpoint due to their high impact on biodiversity (see Exhibit 181).

EXHIBIT 181: **Sectors vary in terms of whether they are dependent on biodiversity or impact biodiversity**

	Agricultural products	Apparel, accessories & luxury goods	Brewers	Electric utilities	Independent power producers and energy	Distribution	Mining	Oil & gas E/P	Oil & gas storage & transport
Sectors dependent on biodiversity	X	X	X	X	X				
Sectors impacting biodiversity	X					X	X	X	X

Source: UN Environment Programme (UNEP) and Bernstein analysis

Agriculture: Biodiversity is the basis for agricultural production. On the one hand, it is the origin of all crops and domestic livestock, while on the other, biodiversity helps sustain the ecosystem that is essential for agricultural production.¹⁴⁹ The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPES) identifies land use change and intensive agriculture as the biggest drivers of biodiversity losses globally.¹⁵⁰ The expansion of agriculture is the most important driver of biodiversity and ecosystem decline and is responsible for 80% of global deforestation.¹⁵¹

- **Brazil:** In 2020, Brazil saw the highest amount of deforestation globally (~17,000 square km) in terms of the amount of forest lost, with Congo following at ~4,900 square km (see Exhibit 182). Brazil has historically been in the spotlight around deforestation: the Amazon has lost ~17% of its forest over the past 50 years, mostly due to forest conversion to cattle ranching (see Exhibit 183).¹⁵² Although the pace of deforestation decreased in the early 2000s on the back of stricter government regulations in Brazil, it has picked up momentum in recent years, with the level of deforestation reaching a 12-year high in 2020.¹⁵³ Relating back to the relationship between climate change and biodiversity, deforestation not only impacts ecosystems and habitats, but also reduces the carbon "sink," i.e., the amount of natural resources (e.g., plants and trees) available to absorb CO₂ from the atmosphere.

¹⁴⁹ https://ec.europa.eu/environment/archives/business/assets/pdf/sectors/FINAL_Agriculture.pdf

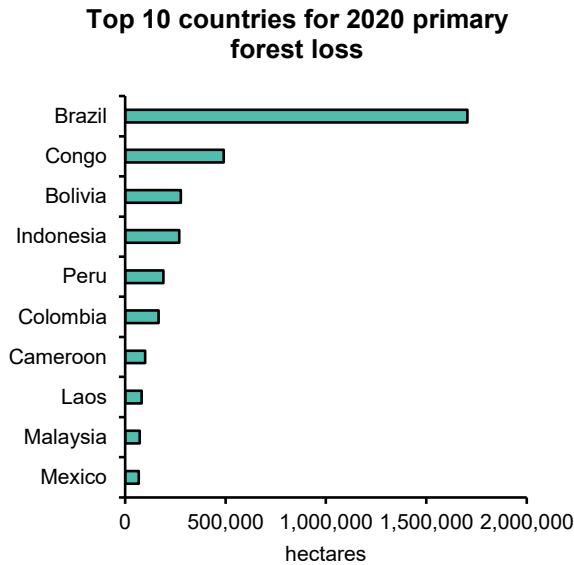
¹⁵⁰ IPES, 2019.

¹⁵¹ https://foes.de/publikationen/2021/2021-04_FOES_Taxonomy_BE.pdf

¹⁵² <https://www.worldwildlife.org/threats/deforestation-and-forest-degradation#:~:text=In%20the%20Amazon%2C%20around%2017,land%20area%20on%20our%20planet.>

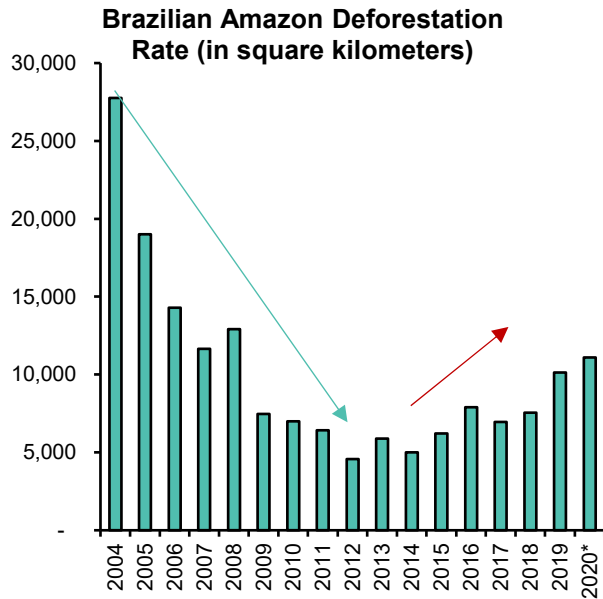
¹⁵³ <https://earthobservatory.nasa.gov/images/145988/tracking-amazon-deforestation-from-above>

EXHIBIT 182: In 2020, Brazil lost ~17,000 square km of forest...



Source: World Resources Institute and Bernstein analysis

EXHIBIT 183: ...setting a 12-year record high, although conservation efforts have lowered deforestation in the Amazon significantly since 2004



*2020 data was through November.

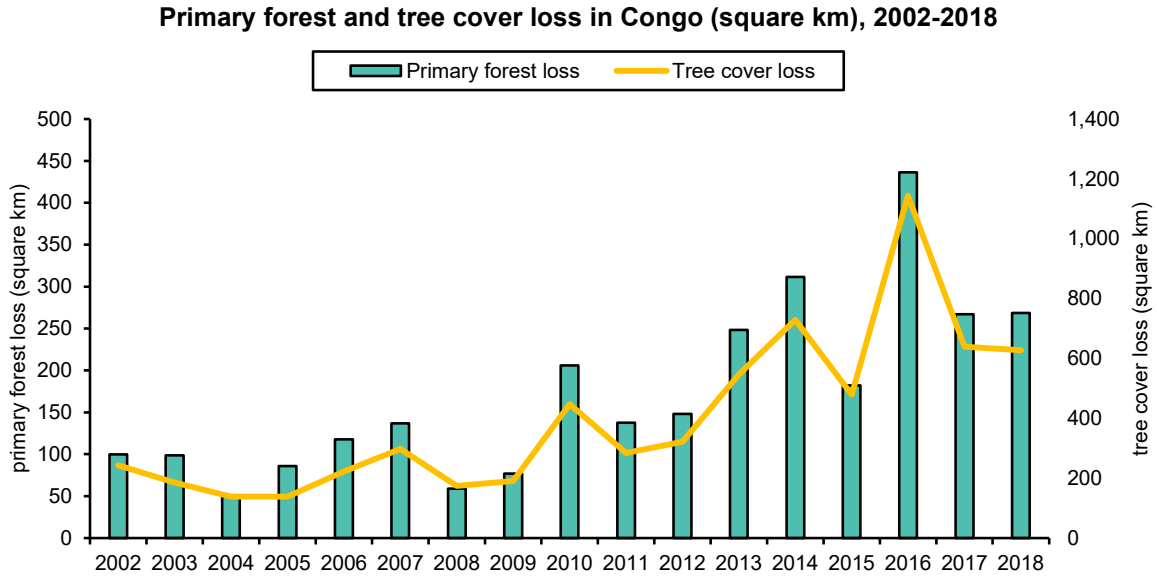
Source: PRODES and Bernstein analysis

- Congo:** Congo saw the second-highest rate of deforestation in 2020 (see Exhibit 182). The Congo rainforest is known for its high levels of biodiversity, including more than 600 tree species and 10,000 animal species. In addition, old-growth forests in Central Africa store huge volumes of carbon in their vegetation and tree trunks (39 billion tons, according to a [2012 study](#)), serving as an important buffer against climate change. The biggest drivers of deforestation in the Congo rainforest over the past 20 years have been small-scale subsistence agriculture, clearing for charcoal and fuelwood, urban expansion, and mining.¹⁵⁴ Industrial logging has been the biggest driver of forest degradation: logging roads have opened up vast areas of the Congo to commercial hunting, leading to a poaching epidemic in some areas and a more than 60% drop in the region's forest elephant population in less than a decade. Over the past 16 years, the Congo has seen a total of ~2,930 square km of primary forest loss and ~6,800 square km of tree cover loss (see Exhibit 184). For reference, the state of Connecticut is ~6,000 square km.¹⁵⁵

¹⁵⁴ <https://rainforests.mongabay.com/congo/deforestation.html>

¹⁵⁵ <https://www.enchantedlearning.com/usa/states/area.shtml>

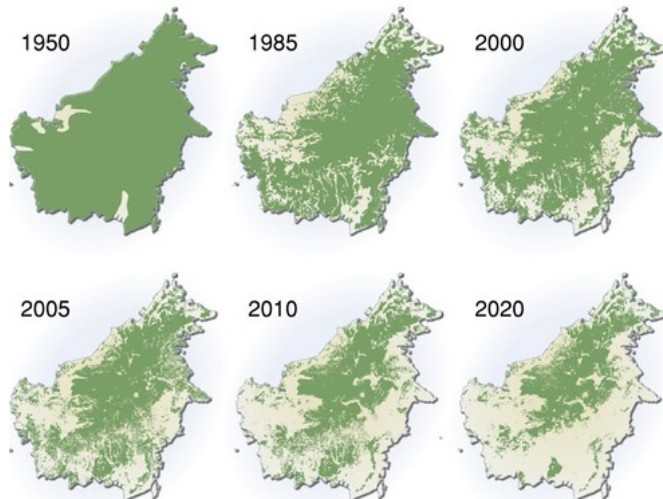
EXHIBIT 184: **Over the past 16 years, the Congo has seen a total of ~2,930 square km of primary forest loss and ~6,800 square km of tree cover loss**



Source: Monagabay Rainforests and Bernstein analysis

- Southeast Asia:** Lastly, Southeast Asia has also seen major deforestation in the past 70 years. Borneo is one of the most biologically diverse areas in the world, and the rate of deforestation since 1960 is unprecedented (see Exhibit 185).¹⁵⁶ Forests are burned, logged, and cleared, and commonly replaced with agricultural land, built-up areas, or palm oil plantations.

EXHIBIT 185: **Extent of deforestation in Borneo, 1950-2020**



Source: [Grid Ardenal](#), UNEP, and Bernstein analysis

¹⁵⁶ Our Planet, UNEP.

- **Palm oil, rubber, and sugar production:** The biggest threats to rainforests come from industrial plantations, especially for palm oil, rubber, and sugar production.¹⁵⁷ The expanded production of palm oil — used in day-to-day products such as packaged foods, household products, and cosmetics — has led to massive deforestation in biodiversity-rich tropical areas, affecting at least 193 threatened species.¹⁵⁸ In addition, industrial logging has been a large driver of forest degradation. As mentioned earlier, logging roads have opened up vast areas of the Congo to commercial hunting, leading to a poaching epidemic in some areas and a more than 60% drop in the region's forest elephant population in less than a decade. Furthermore, logging roads have provided access to speculators and small farm holders who clear land for agriculture.¹⁵⁹

- **Natural ingredients used in drugs:** Natural products are a source of inspiration for a large part of today's pharmaceutical industry, and 25-50% of currently marketed drugs owe their origins to natural products.¹⁶⁰ Many clinically used drugs derived from natural products originated from microbial species (i.e., microscopic organisms including bacteria, archaea, fungi, protozoa, algae, and viruses),¹⁶¹ particularly for fighting infections, but plant-derived drugs have also made significant contributions, such as the development of morphine.¹⁶² While many drugs are dependent on nature, such as plants and fungi, over the past four years the percentage of plants and fungi facing extinction has doubled to 40%.¹⁶³

- **Pollination:** Bees are some of the most important crop pollinators. They increase production of about 75% of our crop species. Habitat fragmentation due to human activity reduces bee diversity and creates a shift in natural seasonal changes that influences the number and type of bees present, affecting pollination services.¹⁶⁴ In a world without bees, society would face direct consequences as one out of every three bites of food we eat is dependent on bees for pollination.¹⁶⁵

Chemicals and materials: While our ecosystems are clearly under threat, this does not mean the demand for raw materials and ingredients in food production will slow,¹⁶⁶ given the global population is expected to increase by 1% annually on average.¹⁶⁷ In addition, we've clearly seen the health and wellness trend truly picking up steam, with more consumers

¹⁵⁷ Our Planet, Mongabay Rainforests.

¹⁵⁸ <https://www.iucn.org/resources/issues-briefs/palm-oil-and-biodiversity>

¹⁵⁹ <https://rainforests.mongabay.com/congo/>

¹⁶⁰ Kingston DG. Modern natural products drug discovery and its relevance to biodiversity conservation. *J Nat Prod.* 2011;74(3):496-511. doi:10.1021/np100550t.

¹⁶¹ <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbes-and-the-world/>

¹⁶² Kingston DG. Modern natural products drug discovery and its relevance to biodiversity conservation. *J Nat Prod.* 2011;74(3):496-511. doi:10.1021/np100550t; <https://www.dw.com/en/medicinal-plants-fungi-species-biodiversity-extinction-threatens-human-health/a-55217183>.

¹⁶³ <https://www.kew.org/science/state-of-the-worlds-plants-and-fungi>

¹⁶⁴ https://nsf.gov/discoveries/disc_summ.jsp?cntn_id=295868

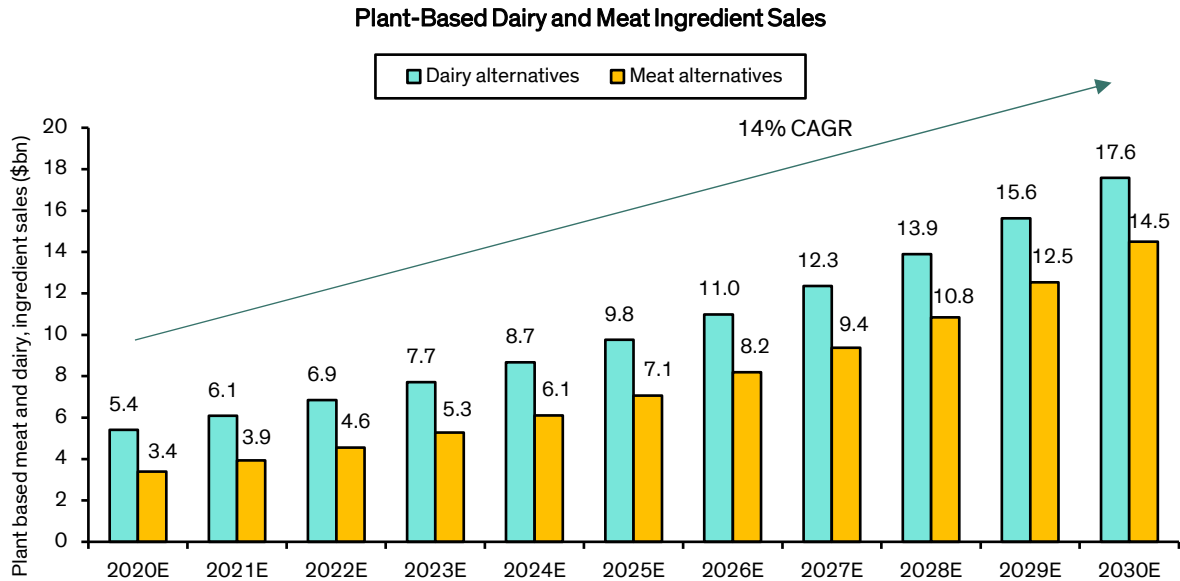
¹⁶⁵ <https://www.nrdc.org/stories/without-bees-foods-we-love-will-be-lost>

¹⁶⁶ [Consumer Chemicals: Plant-based Food & Beverage ingredients primer](#)

¹⁶⁷ Steen, 2019. Monetary Valuation of Environmental Impacts: Models and Data.

demanding plant-based products, which inherently will require raw materials from plant sources (see Exhibit 186).

EXHIBIT 186: While our ecosystem services are threatened with falling biodiversity, the demand for raw materials and ingredients for plant-based dairy and meat is expected to grow in the coming years



Source: Bernstein estimates and analysis

Notably, plant-based products demand more natural ingredients than animal based-products. Almond milk, coconut milk, and oat milk require raw ingredients such as almonds, coconuts, and oats as well as sunflower lecithin and other minerals (see Exhibit 187). These products are reliant on a larger number of natural ingredients, which could be at risk due to biodiversity losses or a decline in the availability of ecosystem services.

EXHIBIT 187: Plant-based milks require more natural raw ingredients than animal-based products

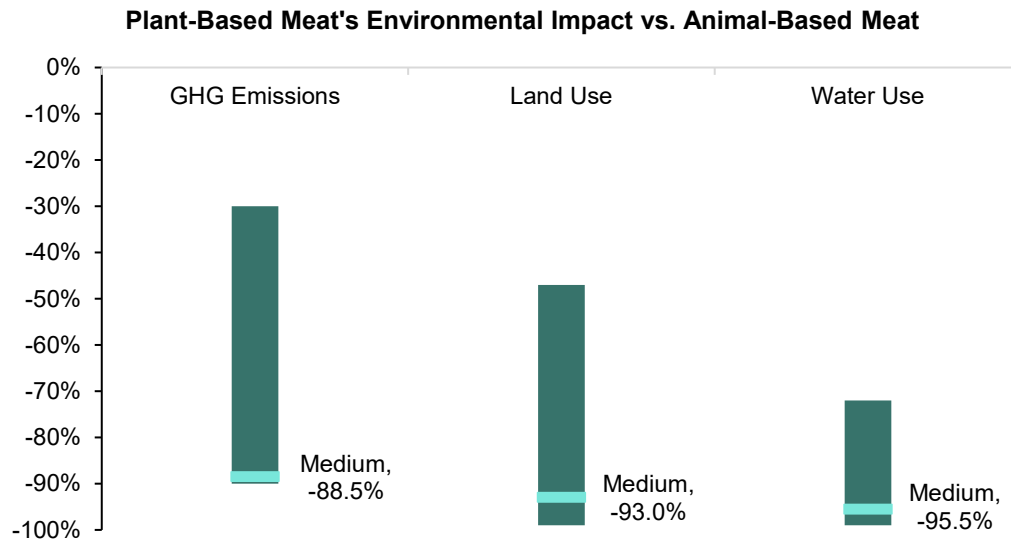
Milk Type	Brand	Ingredients	Sugar per 8 fl oz
Plant-based	Califa Farms Almond Milk (unsweetened)	Almondmilk (Water, Almonds), Calcium Carbonate, Sunflower Lecithin, Sea Salt, Potassium Citrate, Natural Flavors, Locust Bean Gum, Gellan Gum.	0g
Plant-based	Califa Farms Almond Milk (original)	Almondmilk (Water, Almonds), Pure Cane Sugar, Sunflower Lecithin, Sea Salt, Potassium Citrate, Natural Flavors, Locust Bean Gum, Gellan Gum.	5g
Plant-based	Califa Farms Coconut Milk	Coconut Milk (Water, Coconut Cream), Coconut Water, Calcium Carbonate, Sunflower Lecithin, Sea Salt, Locust Bean Gum, Gellan Gum, Potassium Citrate.	2g
Plant-based	Califa Farms Oat Milk	Oatmilk (Water, Oats), Sunflower Oil, Dipotassium Phosphate, Calcium Carbonate, Tricalcium Phosphate, Sea Salt	4g
Animal-based	2% Milk (added vitamin A & D)	Grade A Reduced Fat Organic Milk, Vitamin A Palmitate, Vitamin D3	12g

Source: Califa Farms, Horizon Organics, and Bernstein analysis

While plant-based products are likely dependent on more natural ingredients than animal-based products, which could be a potential risk, plant-based products could also provide solutions to reduce biodiversity loss as a way to offset risks due to lower land use and the potential for more sustainable farming practices.

- **Lower land use:** Plant-based products promote environmental benefits in the form of lower land use, water use, and GHG emissions compared to animal-based meats (see Exhibit 188). Since land use is the biggest driver of biodiversity loss globally,¹⁶⁸ a shift to plant-based products could ultimately reduce the amount of deforestation and biodiversity loss.
- **More sustainable farming:** Existing agricultural subsidies (such as in the US) incentivize farmers to produce monocrops, such as corn.¹⁶⁹ In 2013, nearly half (48.7%) of the corn grown was used as animal feed.¹⁷⁰ Lower animal meat consumption could mean lower corn demand for feeding animals. A shift away from monocrop cultures to more sustainable agriculture practices (such as regenerative agriculture) could help lower biodiversity loss since monoculture crops contribute to a large portion of soil erosion while also increasing fertilizer use and pesticide use.¹⁷¹

EXHIBIT 188: **Plant-based meat has a lower environmental footprint than animal-based meat**



Source: Storhaug et al. and Bernstein analysis

Forestry: Wood supports a large downstream value chain, including industries such as furniture, construction, printing, and packaging. In addition, forests mitigate climate change by capturing and storing carbon, known as a "sink." Biologically diverse forests also

¹⁶⁸ [Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services](#)

¹⁶⁹ <https://usafacts.org/articles/federal-farm-subsidies-what-data-says/>

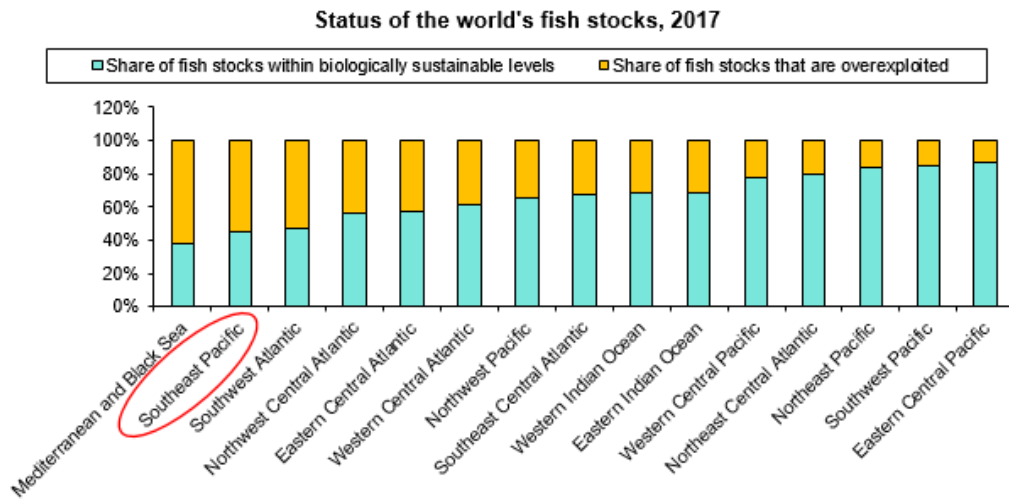
¹⁷⁰ [USDA Coexistence Fact Sheets Corn](#)

¹⁷¹ <https://www.ehn.org/monoculture-farming-is-not-good-for-the-bees-study-2639154525.html>

provide important ecosystem services, protecting soils, preventing erosion, and regulating freshwater supplies.¹⁷²

Fishery: Fishery contributes to biodiversity loss due to overfishing and illegal, unreported, and unregulated fishing.¹⁷³ Overfishing can impact entire ecosystems as it changes the amount of fish remaining, as well as how they reproduce and the speed at which they mature. When too many fish are taken out of the ocean, it creates an imbalance in the food web and leads to a loss of other important marine life, including vulnerable species.¹⁷⁴ Globally, an average of ~34% of fish stocks are overexploited, with the Mediterranean Black Sea (63%), the Southeast Pacific (55%), and the Southwest Atlantic (53%) seeing the highest percentages of overexploitation (see Exhibit 189).

EXHIBIT 189: Globally, an average of ~34% of fish stocks are overexploited, with the Mediterranean Black Sea (63%), the Southeast Pacific (55%), and the Southwest Atlantic (53%) seeing the highest percentages of overexploitation



Note: Fish stocks are overexploited when fish catch exceeds the maximum sustainable yield (MSY), the rate at which fish populations can regenerate.

Source: UN Sustainable Development Goals Tracker, Food and Agriculture Organization of the United Nations, and Bernstein analysis

Bycatch — an inefficient use of natural resources, time, and money: Bycatch is a major issue when it comes to industrial fishing. Large industrial nets span thousands of miles and result in bycatch — the capture of non-target species such as dolphins, whales, marine turtles, and seabirds — which are discarded by fishermen if they do not want or cannot sell the animals.¹⁷⁵ Every year, 250,000 turtles, 100 million sharks, and 300,000 small whales and dolphins are killed as bycatch. 90% of marine life caught as bycatch are discarded, and only 10% are kept. In addition, it's not just natural capital that's wasted: sorting through bycatch

¹⁷² Steen, 2019. Monetary Valuation of Environmental Impacts: Models and Data https://ec.europa.eu/environment/archives/business/assets/pdf/sectors/Forestry_Best%20Pratice%20Benchmarking_Final.pdf.

¹⁷³ <https://sdg-tracker.org/oceans>

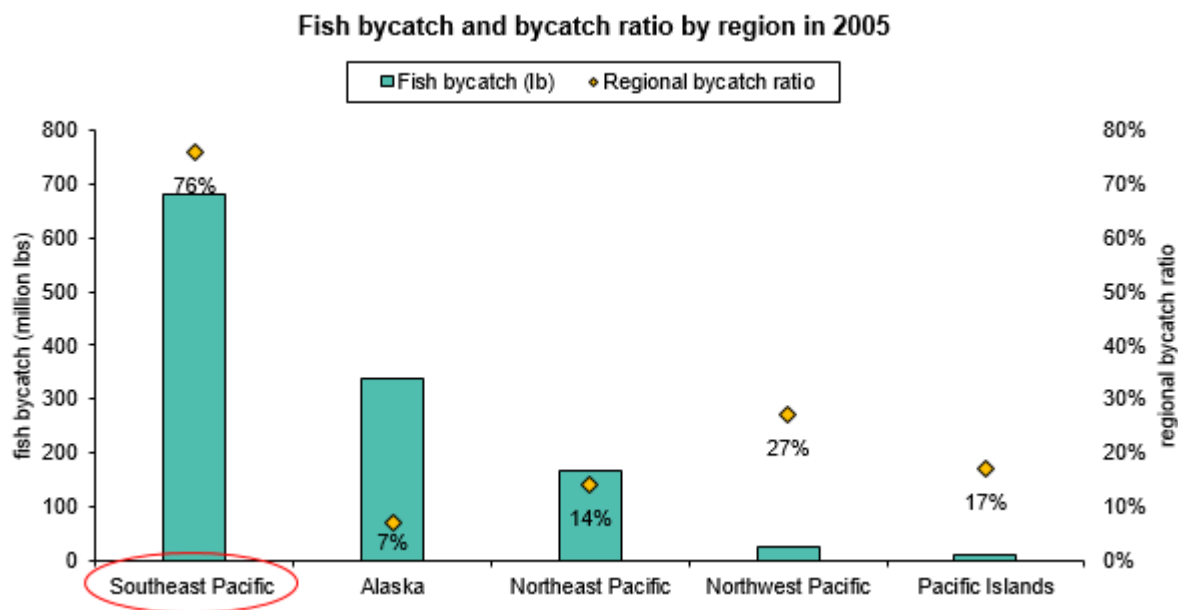
¹⁷⁴ World Wildlife Foundation.

¹⁷⁵ <https://www.fisheries.noaa.gov/insight/understanding-bycatch>

takes incremental time and labor.¹⁷⁶ In the US, bycatch in the form of regulatory discards (meaning fish that are caught but discarded because regulations do not allow fishermen to retain the fish)¹⁷⁷ reduce the yield of fisheries since the catch cannot be converted into seafood sales.¹⁷⁸

Bycatch is highly correlated with overfishing or overexploitation, which doesn't just mean that we're catching too many fish that ultimately go toward food production, but also that we're capturing non-target species, which can cause ecosystem damages, and ultimately waste resources. Oceans with higher rates of overexploitation, such as the Southeast Pacific (55%) as seen in Exhibit 189, also have the highest amount of bycatch in terms of total weight (~800 million pounds of bycatch in 2005) and high bycatch ratios (76% of total catch identified as bycatch) (see Exhibit 190). Overexploitation is most prevalent when large-scale fishing techniques are used — maximizing overall yield but resulting in a waste of resources, time, and labor on the ground, and potentially posing long-term risks to the ecosystem.

EXHIBIT 190: In 2005, the Southeast Pacific saw the highest number of bycatch per pound as well as the highest ratio of bycatch (bycatch divided by total catch)



Source: Brooke et al., Estimating Overall Fish Bycatch in US Commercial Fisheries, and Bernstein analysis

Distribution: The distribution sector has an impact on biodiversity and ecosystems due to emissions of greenhouse gases and other air pollutants (as well as water and soil pollutants) from vehicles and ships, and the potential spread of invasive species through vehicles and ships.¹⁷⁹ The Inventory of Alien Invasive Species in Europe estimates that

¹⁷⁶ <https://oceana.org/blog/we-waste-almost-half-what-we-catch-5-reasons-%E2%80%99s-disastrous-oceans>

¹⁷⁷ <https://www.fisheries.noaa.gov/international/bycatch/national-bycatch-reduction-strategy>

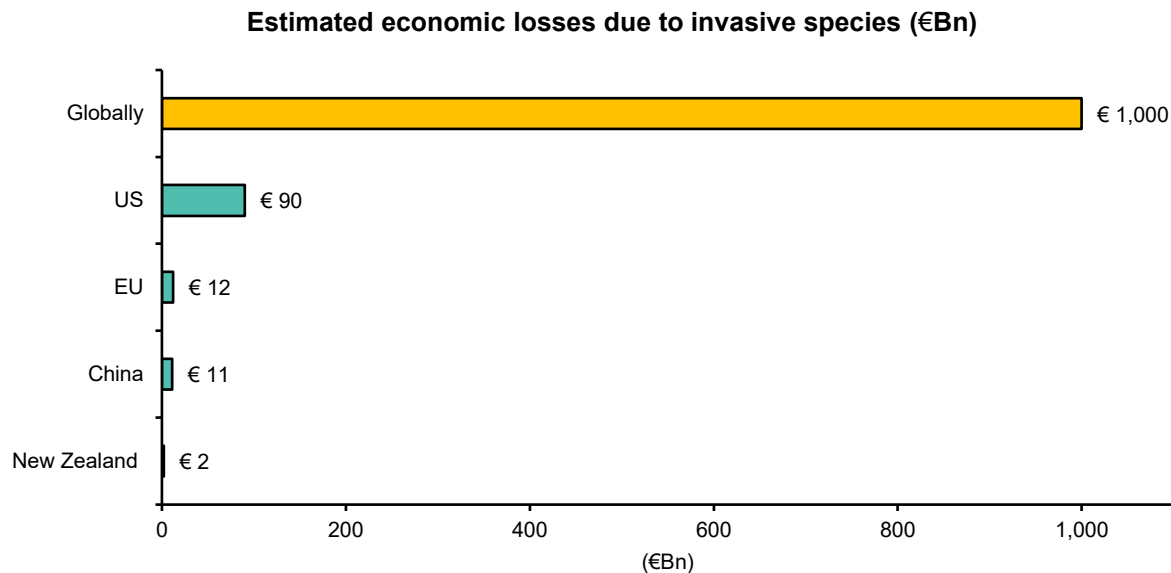
¹⁷⁸ Patrick and Benaka, 2013. "Estimating the economic impacts of bycatch in U.S. commercial fisheries," *Marine Policy*, Volume 38, March 2013, Pages 470-475

¹⁷⁹ UNEP 2020, https://foes.de/publikationen/2021/2021-04_FOES_Taxonomy_BE.pdf.

globally, economic losses were ~€1tn in 2013, with the US seeing the greatest cost at ~€90bn and the EU following at ~€12bn (see Exhibit 191). Key sectors such as agriculture, fisheries/aquaculture, forestry, and health incurred costs more than €6bn per year in the EU due to damages (e.g., lost revenue, health costs, and damage to riverbanks and infrastructure) and management costs (control measures to tackle the invasive species).¹⁸⁰

More than half the world's food comes from just three staples — rice, wheat, and maize — which already suffer annual losses of up to 16% of total production (valued at US\$96bn) due to invasive species. **Agricultural crop diversification** can improve resilience to pest and disease outbreaks, as well as buffer crop production against the effects of greater climate change.¹⁸¹ However, monocultures, induced mostly by economic incentives, are still the dominant form of industrial agriculture.¹⁸²

EXHIBIT 191: In 2013, estimated economic losses globally due to invasive species were ~€1tn



Source: European Commission 2013, Delivering Alien Invasive Species Inventories for Europe (DAISIE), and Bernstein analysis

Some invasive species cause more economic damage than others. Researchers analyzed published data from the past few decades to rank the 10 costliest species or species groups from 1970 to 2017. Total costs are broken down into damages, costs of managing invasive species, and costs that don't fit neatly into one of those categories. Most of the top offenders are insects — mosquitoes head the list, while screw-worm flies round it out — but

¹⁸⁰ <https://epthinktank.eu/2013/12/03/tackling-invasive-alien-species-in-europe/estimated-economic-losses-due-to-invasive-species-across-the-globe/>

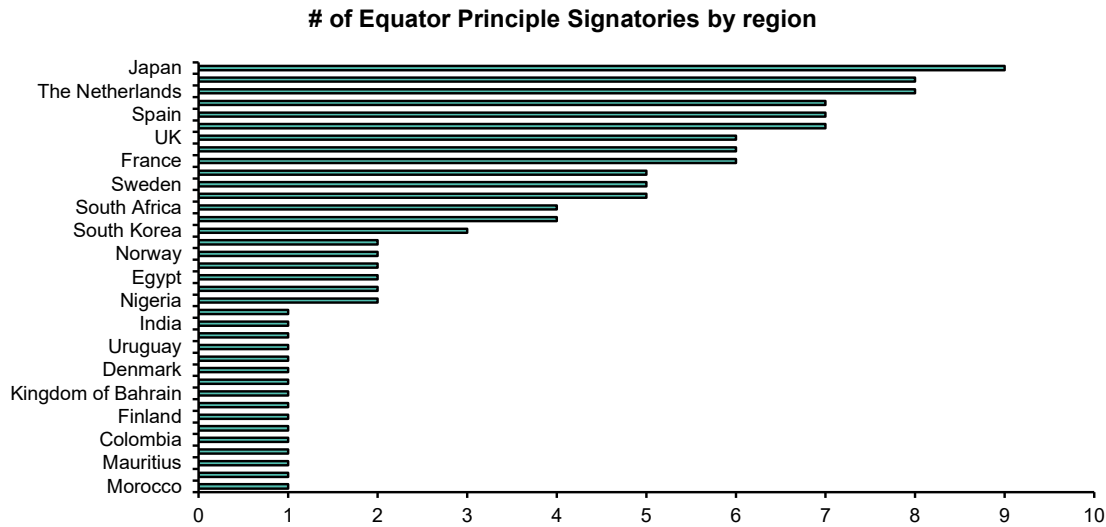
¹⁸¹ M.A. Altieri et al., 2015, "Agroecology and the design of climate change-resilient farming systems", *Agronomy, Sustainable Development*, 35, 869–890, <https://doi:10.1007/s13593-015-0285-2> (link as of 7th Jan 2020).

¹⁸² B. Lin, 2011, "Resilience in agriculture through crop diversification: Adaptive management for environmental change," *BioScience*, 61 (3), 183–193, <https://academic.oup.com/bioscience/article/61/3/183/238071>.

cats, rats, and some snakes are big troublemakers, too. Gaps in data — on plants, for instance — likely skew these rankings.¹⁸³

Mining and extraction: Mining poses threats to biodiversity as it results in habitat loss and environmental degradation.¹⁸⁴ Due to the continuing demand for minerals and the depletion of resources in readily accessible areas, mining is increasingly being proposed in remote and biodiversity-rich ecosystems that were previously unexplored and undeveloped for minerals.¹⁸⁵ There are also business reasons for mining companies to address biodiversity, including securing and maintaining access to land, protecting reputation and public perception, and gaining access to capital — particularly where project finance is expected to be obtained from investment banks that are signatories to the Equator Principles,¹⁸⁶ which apply the Biodiversity Performance Standard of the International Finance Corporation (IFC) to all investments in excess of US\$10mn; as of 2020, 118 banks globally were signatories (see Exhibit 192). As mining demand is expected to increase significantly with the rise of electric vehicles and renewable energy penetration, initiating dialogue between mining companies, policy makers, and conservation organizations can enable solutions to meet mineral demand while also preserving biodiversity.¹⁸⁷

EXHIBIT 192: **As of 2020, 118 banks are part of the Equator Principles Signatories across various regions**



Source: Equator Principles and Bernstein analysis

Oil & gas E&Ps: Oil and gas exploration, development, and production activities can affect the natural and social environments in which they take place. In addition, industry

¹⁸³ <https://www.sciencenews.org/article/invasive-species-cost-billions-damages-global-economy>

¹⁸⁴ Sonter et al. 2018. Mining and biodiversity: key issues and research needs in conservation science, *Royal Publishing Society*.

¹⁸⁵ <https://www.cbd.int/development/doc/Minining-and-Biodiversity.pdf>

¹⁸⁶ <https://equator-principles.com/members-reporting/>

¹⁸⁷ Sonter et al. 2018. Mining and biodiversity: key issues and research needs in conservation science, *Royal Publishing Society*.

operations and activities may also rely on ecosystem services provided by the natural environment, such as freshwater supply or coastal storm-surge protection. Potential impacts and dependency on ecosystem services, as well as the need to manage risks, are important factors to be taken into consideration across the life cycle of industry assets.¹⁸⁸

Oil & gas storage and transportation: The industry uses terrestrial, freshwater, and marine areas and, thus, can have a major impact on the state of ecosystems and biodiversity through the spread of invasive species and GHG emissions.¹⁸⁹ Accidents such as oil spills can also weigh on biodiversity due to leaks, fires, and explosions.

BIODIVERSITY-RELATED INVESTMENT OPPORTUNITIES

It's not all doom and gloom: A better understanding of businesses' reliance on natural capital could provide value-generating opportunities down the line for companies best positioned in a world of declining supplies of natural resources, heightened regulatory scrutiny, and increasing consumer demand for better environmental practices.

OCEAN, AGRICULTURE, AND
FOREST

Regenerative agriculture/biotechnology: Regenerative agriculture refers to farming and grazing practices that, among other benefits, reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity, resulting in both a carbon drawdown and an improved water cycle.¹⁹⁰ The key to regenerative agriculture is that it not only "does no harm" to the land but actually improves it, using technologies that regenerate and revitalize the soil and the environment. Regenerative agriculture leads to healthy soil that is capable of producing high-quality, nutrient-dense food, while simultaneously improving rather than degrading land. It incorporates permaculture and organic farming practices, including conservation tillage, cover crops, crop rotation, composting, mobile animal shelters, and pasture cropping, to increase food production, farmers' income, and especially, topsoil. Topsoil is the upper, outermost layer of soil, usually the top 5-10 inches (13-25 cm). It has the highest concentration of organic matter and microorganisms and is where most of the Earth's biological soil activity occurs.¹⁹¹

Existing research evaluates the relative effects of regenerative versus conventional corn production systems on pest management services, soil conservation, and farmer profitability and productivity throughout the Northern Plains of the US.¹⁹² Regenerative farming systems provided greater ecosystem services and profitability for farmers than an input-intensive model of corn production.

- **Reduced number of pests:** The study finds pest abundance is lower in cornfields that have a greater insect diversity, enhanced biological network strength, and greater

¹⁸⁸ https://www.ipieca.org/media/1256/bes_fundamentals_2016_05.pdf

¹⁸⁹ UNEP 2020, https://foes.de/publikationen/2021/2021-04_FOES_Taxonomy_BE.pdf.

¹⁹⁰ <https://regenerationinternational.org/why-regenerative-agriculture/>

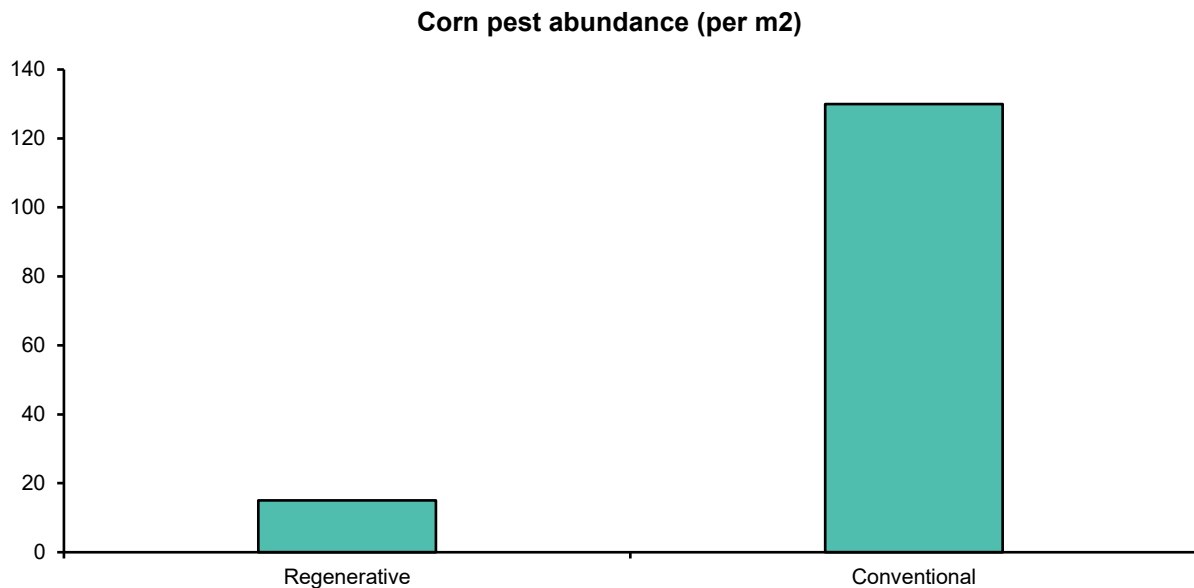
¹⁹¹ <https://www.kelloggsgarden.com/blog/soil/what-is-topsoil-and-what-is-it-used-for/>

¹⁹² LaCanne CE, Lundgren JG. 2018. "Regenerative agriculture: merging farming and natural resource conservation profitably," *PeerJ*. <https://doi.org/10.7717/peerj.4428>.

community evenness. Diversity and network interactions reduce pests through predation and competition¹⁹³ (see Exhibit 193).

- Higher profits:** Despite having lower grain yields, the regenerative system was nearly twice as profitable as conventional corn farms. Regenerative farms produced 29% less corn grain than conventional operations. Yield reductions are commonly reported in more ecologically based food production systems relative to conventional systems. However, regenerative farmers reduced their fertilizer costs by including legume-based cover crops on their fields during the fallow period, adopting no-till practices, and having livestock graze the crop field. They also received higher value for their crop by receiving an organic premium, by selling their grain directly to consumers as seed or feed, and by extracting more than just corn revenue from their field (e.g., by grazing cover mixes with livestock).¹⁹⁴

EXHIBIT 193: Corn pest abundance is much lower when using regenerative agricultural methods due to predation and competition compared to conventional methods



Source: LaCanne and Lundgren, and Bernstein analysis

- Supply chain traceability:** One major obstacle to assessing biodiversity impact is the serious data deficiencies across the supply chain.¹⁹⁵ Satellite remote sensing has the potential to fill these gaps. NASA's Applied Sciences Program aims to develop a scientifically robust set of environmental indicators that would help policymakers make informed decisions, and ultimately support policies and programs to protect the

¹⁹³ LaCanne CE, Lundgren JG. 2018. "Regenerative agriculture: merging farming and natural resource conservation profitably," *PeerJ*. <https://doi.org/10.7717/peerj.4428>.

¹⁹⁴ LaCanne CE, Lundgren JG. 2018. "Regenerative agriculture: merging farming and natural resource conservation profitably," *PeerJ*. <https://doi.org/10.7717/peerj.4428>.

¹⁹⁵ <https://iopscience.iop.org/article/10.1088/1748-9326/9/8/084013>

environment. In the context of biodiversity, the program addresses two important issues: biomass burning and coastal chlorophyll trends.

- **Biomass burning:** Biomass burning has a number of environmental impacts, including GHG emissions, health impacts from fire-related pollution, and ecosystem effects. While this area still needs further development, satellite data can potentially examine biomass burning (the burning of living or dead vegetation),¹⁹⁶ deforestation and land degradation, sustainable agriculture and land use processes, and peatland. In addition, future research could address the nature of burning activity in geographically disparate regions such as the boreal and tropical forests.
- **Coastal chlorophyll trends:** The flow of nutrients into coastal waters from land-based sources has increased worldwide over the past few decades. The resulting change in water quality has many potential impacts on coastal and marine ecosystems. Phosphorus and nitrogen contribute to enhanced algae growth, and subsequent decomposition reduces oxygen availability to benthic sea creatures such as fish, shellfish, and crustaceans. Satellite ocean color sensors provide coverage of global ocean chlorophyll with a combined record length of ~ 20 years, allowing scientists to produce estimates of ocean chlorophyll trends.¹⁹⁷

INFRASTRUCTURE

Metals and mining: Although metals and mining can have major impacts on biodiversity, there are also ways to lower the impact and plan for less harm in advance, including greater mineral governance and stronger infrastructure of new mines by utilizing technology and environmental management systems to reduce potential biodiversity loss.

- **Greater mineral governance:** Emerging economies (especially those with the highest proportion of the world's rare earths) often have weak governance in terms of environmental regulations and management capabilities. Nonetheless, businesses can implement stronger governance practices around biodiversity within their own operations to minimize potential regulatory headwinds down the road.
- **Stronger infrastructure for new mines:** In emerging economies with mining capacity, development of new mines can be planned for in a biodiversity-friendly manner by increasing the infrastructure efficiency to extract, process, and transport minerals.
- **Technology:** Technological development is seen as a key enabler to provide new conservation opportunities as engineering advances are improving mineral extraction efficiencies. In the exploration phase, mining companies can limit land clearing by using technologies and mining practices to minimize habitat disturbance.
- **Environmental Management Systems (EMS):** Formal EMS have been adopted across much of the mining industry, predominantly the International Standards Organization (ISO)14001 series. Many companies require that their operations are either ISO

¹⁹⁶ <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/biomass-burning#:~:text=Biomass%20burning%20refers%20to%20the,be%20natural%20or%20man%20made>

¹⁹⁷ <https://www.nature.com/articles/s41598-020-72073-9>

14001 certified or maintain systems that are compliant with ISO 14001. EMS provide the overarching framework for the management of biodiversity during mining operations and closure planning.¹⁹⁸

BIODIVERSITY TOOLS FOR INVESTORS

Developing a risk management approach for nature-related risks: Nature-related risks and opportunities can be managed by building on the same core TCFD elements, including governance and strategy, risk management, and metrics and targets. Exhibit 194 provides guidance on the organizational basics for nature risk management. We also include a shortlist of potential data sources and tools for investors at the end of this chapter.

EXHIBIT 194: **Fit-for-purpose nature-based risk management approach**



Source: UN Principles for Responsible Investment (PRI) and Bernstein analysis

¹⁹⁸ ISO 14000 family, <https://www.cbd.int/development/doc/Minining-and-Biodiversity.pdf>.

RESOURCES

- [Exploring Natural Capital Opportunities, Risks and Exposure \(ENCORE\)](#): A web-based tool designed to help financial institutions such as global banks, investors, and insurance firms assess the risks that environmental degradation, such as the pollution of oceans or destruction of forests, causes. It is being further developed to enable the tracking of investors' biodiversity commitments.
- [Integrated Biodiversity Assessment Tool \(IBAT\)](#): Brings together three authoritative global data sets — the World Database on Protected Areas, the World Database on Key Biodiversity Areas, and the International Union for Conservation of Nature (IUCN) Red List.
- [Satelligence](#): Tracks progress toward deforestation commitments using satellite data and artificial intelligence.
- [Global Forest Watch](#): An open-source web application to monitor global forests in near real time. The forest change data has been used to measure global deforestation rates and to detect and monitor illegal clearing activity, primarily in Indonesia. Provides data points from 100 global and local sources.
- [Natural Capital Protocol Finance sector supplement](#): Developed by the Natural Capital Coalition, the Natural Capital Finance Alliance, and the Dutch Social Investment Forum (VBDO), it guides financial institutions through the process of identifying, measuring, and valuing material risks and opportunities as a means of informing financial decision-making. Provides a framework for financial institutions to assess the natural capital impacts and dependencies of the entities and portfolios they support.
- [Transparent supply chains for sustainable economies](#): Links the trade of commodities that drive deforestation to financial markets. Provides a comprehensive picture of the ownership structures of global and local commodity traders, and the financial flows to these companies.
- [Sustainability policy transparency toolkit](#): Supports the finance sector and supply chain stakeholders to manage ESG risks by publishing transparency assessments of soft commodity producers and traders.

TARGETS AND STANDARDS

- [Zero Draft of the Post-2020 Global Biodiversity Framework](#)
- [EU Biodiversity Strategy for 2030](#)
- [Task Force for Nature-Related Financial Disclosures](#)

BLOCKCHAIN

The missing link to fight climate change and biodiversity loss?

HIGHLIGHTS

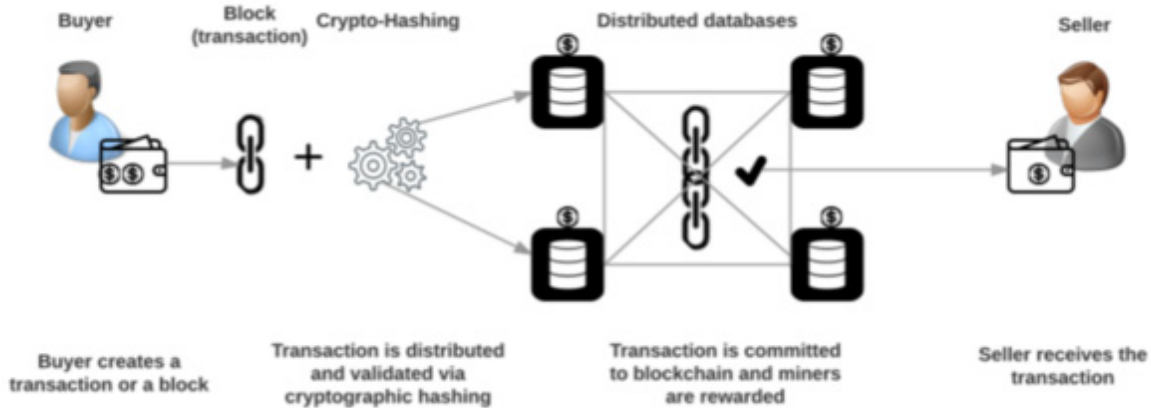
Speaking of blockchain, the first thing that comes to mind is Bitcoin and its enormous energy consumption. However, blockchain — the technology behind Bitcoin — has applications much wider than cryptocurrencies. In this chapter, we explore blockchain technology as an emerging mechanism to improve supply chain transparency and traceability and hold key players accountable for their environmental and biodiversity impacts.

- **Blockchain is a decentralized ledger technology that enhances transparency and credibility of record keeping.** Bitcoin is by far the most well-known use case of blockchain technology, but blockchain's application is much more than cryptocurrencies. In particular, it has the potential to redefine supply chain transparency and traceability across sectors.
- **Doesn't blockchain use a lot of energy?** It's well understood that Bitcoin mining is highly energy intensive. However, there are other less energy-intensive forms of blockchain consensus mechanisms. In the context of using blockchain to improve supply chain traceability where the blockchain is private and all participants are known, much simpler mechanisms (such as a **round-robin protocol**) can be used to determine who can add the next block to the chain. The energy consumption of such blockchain applications is a tiny fraction of that of Bitcoin mining.
- **Blockchain can be a solution to fight climate change and biodiversity loss.** In the **agriculture supply chain**, palm oil is a prime example where existing certification programs are labor intensive and rather ineffective. In response, blockchain is an emerging mechanism to improve supply chain transparency and traceability. Blockchain can also be leveraged to safeguard the ocean from harmful practices such as overfishing and the resulting biodiversity loss. Further, blockchain can help develop a **circular economy** through improving the traceability of recycled plastics.

WHAT IS BLOCKCHAIN?

Blockchain is a decentralized ledger technology that enhances transparency and credibility of record keeping. Each block in the chain contains a number of transactions, and each time a new transaction occurs, a record of that transaction is added to every participant's ledger and cannot be changed (see Exhibit 195).¹⁹⁹

¹⁹⁹ <https://www.euromoney.com/learning/blockchain-explained/what-is-blockchain>

EXHIBIT 195: **Blockchain process map**

Source: Wikimedia Commons and Bernstein analysis

The idea of blockchain started taking shape in 1991 when Stuart Haber and W. Scott Stornetta introduced the idea of the immutability of digital records. They proposed tying a digital document to a hash, which changes when even one bit of the original document changes. They later evolved the idea to include a series of time stamps to track changes in the document and to distribute the certification responsibility across multiple certifiers rather than one person or organization to prevent fraud, which gave rise to the idea of a decentralized system that is tamper proof.²⁰⁰

However, blockchain really started coming into the public eye in 2008 when Satoshi Nakamoto, whose real identity is unknown, released a white paper called "Bitcoin: A Peer to Peer Electronic Cash System."²⁰¹ Bitcoin is by far the most well-known use case of blockchain technology, but blockchain's application potential is much more than cryptocurrencies.

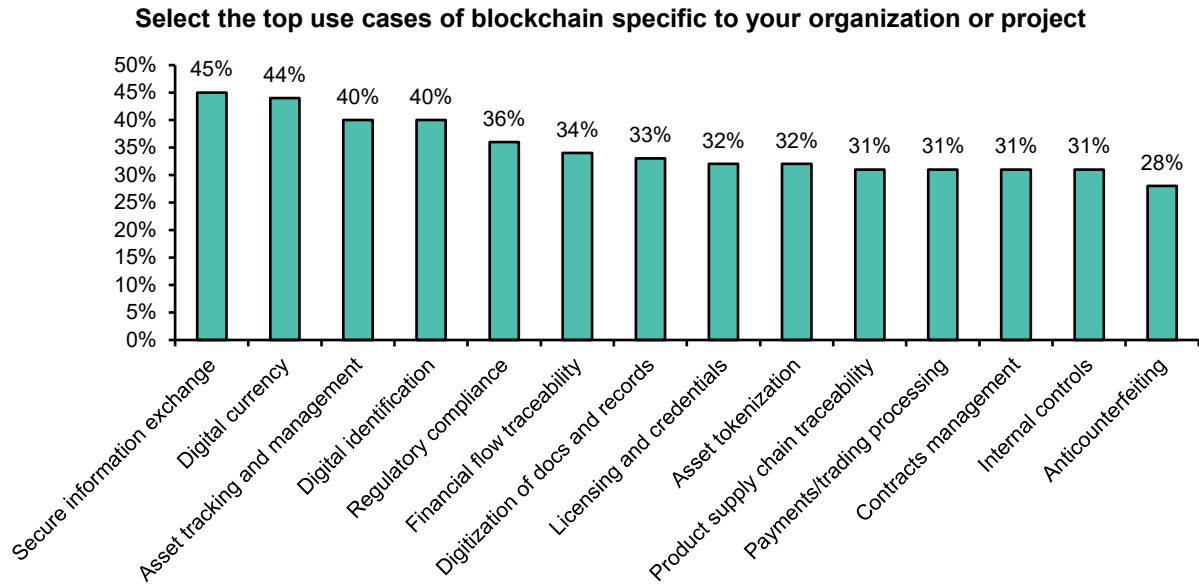
Today, nearly 15% of financial institutions use blockchain technology. According to a Deloitte survey of 1,280 senior executives and practitioners globally, secure information exchange, digital currency, asset tracking and management, and digital identification are the top use cases of the blockchain technology (see Exhibit 196).²⁰² Beyond the financial industry, blockchain could redefine supply chain transparency and traceability across a wide range of sectors in the coming years.

²⁰⁰ <https://www.forbes.com/sites/vipinbharathan/2020/06/01/the-blockchain-was-born-20-years-before-bitcoin/?sh=2ae1d9fa5d71>

²⁰¹ <https://www.forbes.com/sites/bernardmarr/2018/02/16/a-very-brief-history-of-blockchain-technology-everyone-should-read/?sh=35c5e0097bc4>

²⁰² https://www2.deloitte.com/content/dam/insights/articles/US144337_Blockchain-survey/DI_Blockchain-survey.pdf

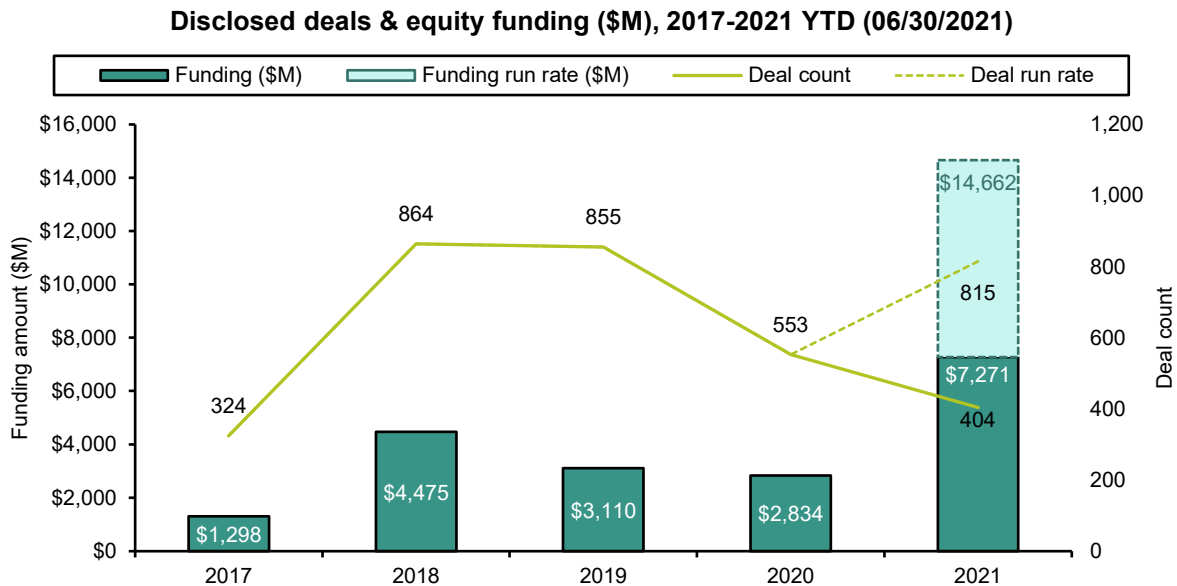
EXHIBIT 196: **Secure information exchange and digital currency are the top use cases of blockchain technology**



Source: Deloitte's 2021 Global Blockchain Survey (N=1,280) and Bernstein analysis

Funding into blockchain companies reached a record high at ~US\$7.3bn in the first half of 2021. At this run rate, blockchain funding could reach over ~US\$14.6bn by year end versus the previous record of ~US\$4.5bn in 2018 (see Exhibit 197).

EXHIBIT 197: **Funding into blockchain companies reached a record high at ~US\$7.3bn in the first half of 2021**



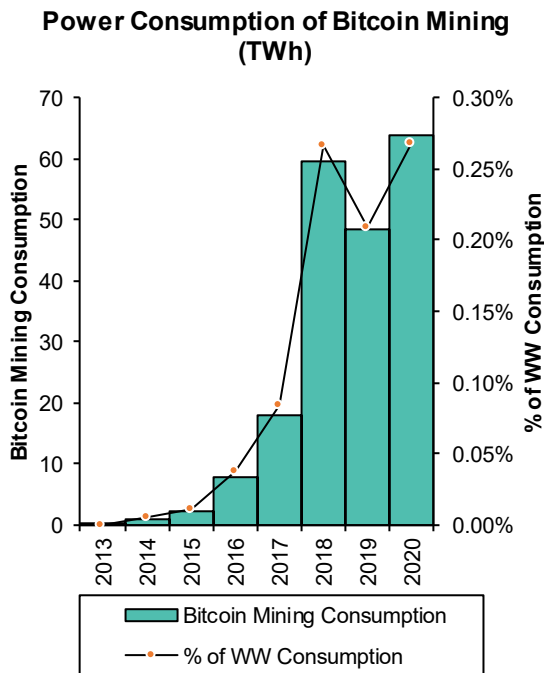
Source: CB Insights and Bernstein analysis

+ DOESN'T BLOCKCHAIN USE A LOT OF ENERGY?

It depends on what type of blockchain application we are talking about.

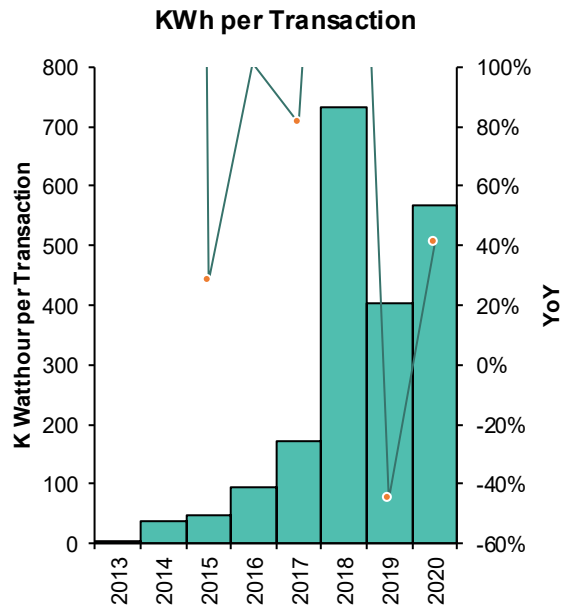
It's fairly well understood by now that Bitcoin mining is highly energy intensive. Our semiconductor team estimates Bitcoin mining consumed 64TWh (terawatt-hour = one trillion watts for an hour) in 2020, amounting to 0.3% of the total electricity consumption in the world (see Exhibit 198), close to what Cambridge University found in a similar study.²⁰³ On a per transaction basis, it takes 660kWh (kilowatt-hour) to execute a transaction, according to Digiconomist,²⁰⁴ slightly higher than our estimate of 567kWh (see Exhibit 199). Regardless of which one is used to compare, as one VISA transaction is estimated to consume only 1.48Wh, Bitcoin is about five to six orders of magnitude more wasteful than VISA in terms of power consumption. Some analysts estimated the global banking system consumes 100TWh per year, but handles ~500 billion transactions.²⁰⁵ Should this estimate be right, it implies Bitcoin consumes three to four orders of magnitude more energy than the existing banking system on a per transaction basis.²⁰⁶

EXHIBIT 198: **We estimate Bitcoin mining represented 0.3% of global electricity consumption in 2020...**



Source: Bernstein estimates (all data) and analysis

EXHIBIT 199: **...and consumes 567kWh/transaction, about five to six orders of magnitude more wasteful than VISA**



Source: Bernstein estimates (all data) and analysis

²⁰³ <https://www.cbeci.org/>

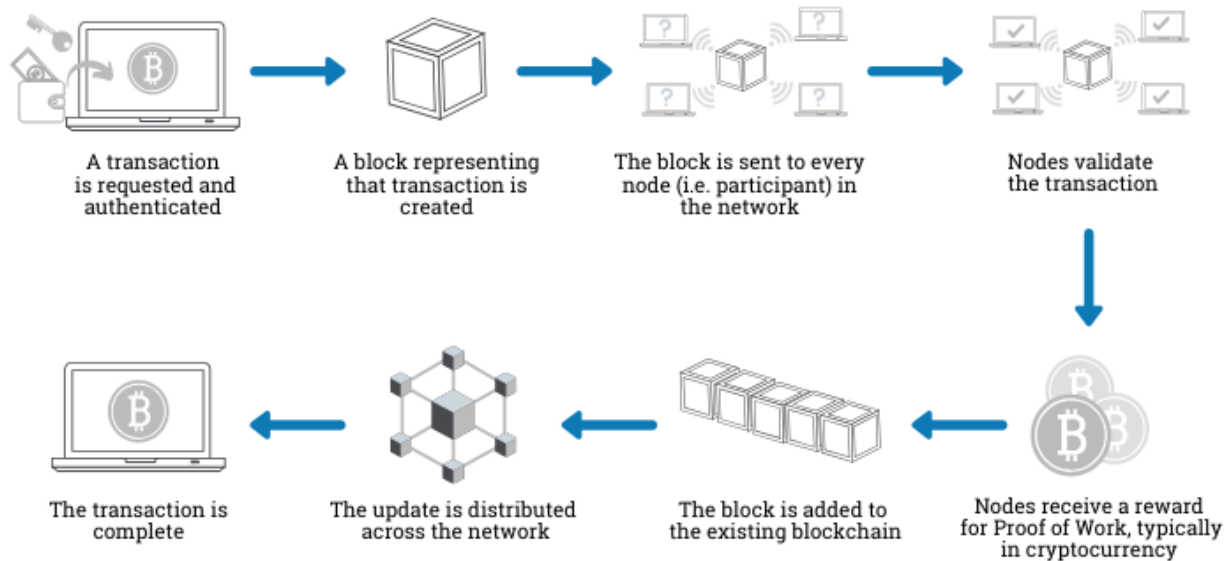
²⁰⁴ <https://digiconomist.net/bitcoin-energy-consumption/>

²⁰⁵ <https://hackernoon.com/the-bitcoin-vs-visa-electricity-consumption-fallacy-8cf194987a50>

²⁰⁶ See report: [Global Semiconductors: Bitcoin back on the stage? How about ESG considerations?](#)

This energy-intensive mining process is part of the (in)famous **Proof of Work (PoW)** mechanism (see Exhibit 200). Under the PoW mechanism, participants need to solve a complex math problem through trial and error to add a block to the chain. Solving the problem is known as mining, which requires substantial computing power and energy consumption. The first miner who solves the problem is usually rewarded in cryptocurrency in exchange for their work.²⁰⁷ As a blockchain grows, more computers join to try to solve the problem. As the problem gets harder and the network gets larger, it is theoretically harder to sabotage the chain, but energy consumption increases exponentially as well.

EXHIBIT 200: The Proof of Work (PoW) mechanism is by far the most energy intensive, requiring participants to solve complex math problems through trial and error to add a block to the chain, which requires substantial computing power and energy consumption



Source: Euromoney and Bernstein analysis

However, there are other less energy-intensive forms of blockchain consensus mechanisms. **Proof of Stake (PoS)** is the most prominent alternative to PoW, where participants must own a stake in the blockchain to have a chance to validate a new block. The probability of validating a new block is determined by how large a stake a person owns.²⁰⁸ The PoS mechanism is much less energy intensive as it doesn't require mining. However, PoS is less widely adopted for now and hasn't been as rigorously tested as PoW from a security perspective, though Ethereum does appear set to adopt it as its new consensus mechanism soon.

In the context of using blockchain to improve supply chain traceability where the blockchain is private and all participants are known, even simpler mechanisms can be used to determine who has the right to add the next block to the chain. One such method is a **round-robin protocol**, where the right to add a block rotates among the participants in a fixed order

²⁰⁷ <https://www.euromoney.com/learning/blockchain-explained/how-transactions-get-into-the-blockchain>

²⁰⁸ <https://hackernoon.com/consensus-mechanisms-explained-pow-vs-pos-89951c66ae10>

(e.g., farmer to wholesaler to manufacturer to distributor to retailer).²⁰⁹ Information cannot be changed once entered into the blockchain, which ensures traceability and accountability. Disputes can also be resolved fairly easily by participants' validating blocks.

Smart contracts can also be used to automatically execute agreements on blockchain-based platforms. These contracts are best suited to automatically execute two types of transactions: (1) ensuring the payment of funds upon certain triggering events, and (2) imposing financial penalties if certain objective conditions are not satisfied.²¹⁰

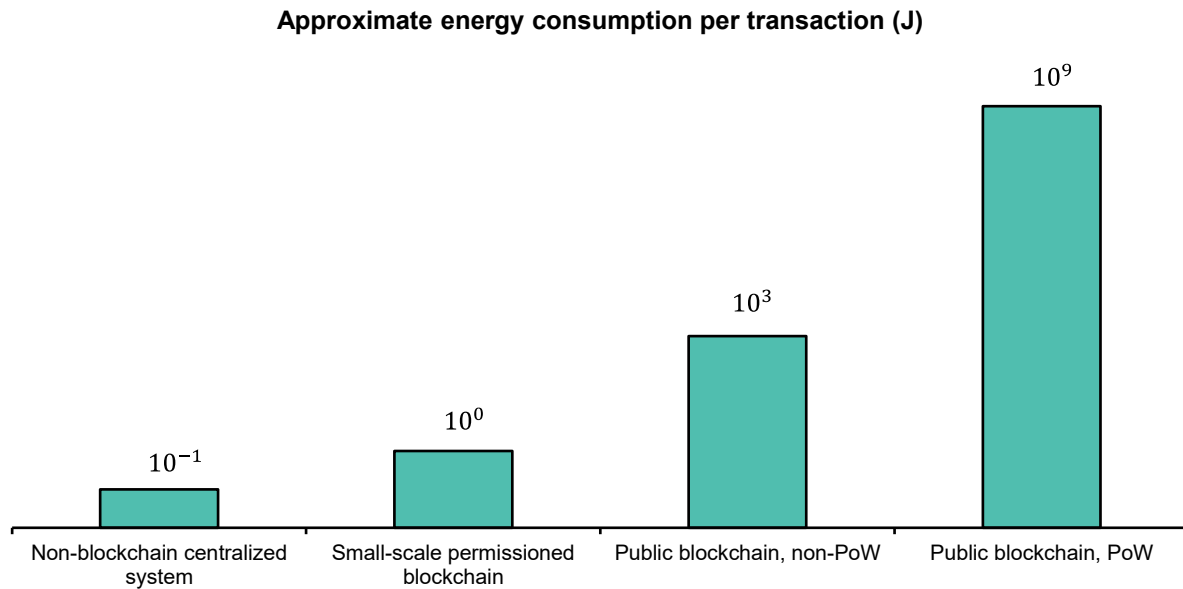
Such private, permissioned blockchains (some leveraging smart contracts) consume significantly less energy than public blockchains, especially those that rely on the PoW mechanism. A study estimates the energy consumption of a small-scale permissioned blockchain to be roughly 1 J per transaction, compared to the energy consumption of a non-PoW public blockchain of about 10^3 J per transaction and that of a PoW public blockchain in the order of magnitude of 10^9 J per transaction (see Exhibit 201).²¹¹ Note that figures in Exhibit 7 are ballpark estimates, and the specific energy use is dependent on the precise architecture and security measures of the blockchain. Nonetheless, these rough estimates suggest the energy consumption of blockchain applications for improving supply chain transparency and traceability is a tiny fraction of the energy use of Bitcoin mining. Conversely, there could be meaningful upside if we can leverage blockchain technologies to better monitor and trace products' environmental and biodiversity impacts across the supply chain.

²⁰⁹ <https://hbr.org/2020/05/building-a-transparent-supply-chain>

²¹⁰ <https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/>

²¹¹ <https://link.springer.com/article/10.1007/s12599-020-00656-x#Fig2>

EXHIBIT 201: **A study estimates the energy consumption of a small-scale permissioned blockchain to be roughly 1 J per transaction, compared to the energy consumption of a non-PoW public blockchain of about 10^3 J per transaction and that of a PoW public blockchain in the order of magnitude of 10^9 J per transaction**



Source: Sedlmeir et al. (2020) and Bernstein analysis

+ BLOCKCHAIN FOR THE ENVIRONMENT AND BIODIVERSITY

In the next section, we explore how blockchain can be used to address our environmental and biodiversity impacts, from tracing products in the agricultural supply chain to enabling a circular economy to improving the credibility of voluntary carbon credits.

BLOCKCHAIN IN THE AGRICULTURAL SUPPLY CHAIN

A prime example of blockchain application is in the palm oil supply chain. Palm oil is an extremely versatile oil that comes from the fruit of oil palm trees. It is used in close to 50% of the packaged products we find in supermarkets — from pizza, doughnuts, and chocolate, to deodorant, shampoo, and toothpaste.²¹² Yet, it has also been a major driver of deforestation in some of the world's most biodiversity-rich areas, destroying the habitat of already endangered species and contributing to climate change.

The Roundtable on Sustainably Sourced Palm Oil (RSPO) was established in 2004 and currently has 4,000 members across the palm oil supply chain who have committed to produce, source, and/or use sustainable palm oil certified by the RSPO.²¹³

However, only 19% of palm oil globally is certified by the RSPO, and some recent studies have shown that the RSPO has not been as effective as hoped to reduce deforestation and

²¹² <https://www.wwf.org.uk/updates/8-things-know-about-palm-oil>

²¹³ <https://rspo.org/about#history-and-milestone>

biodiversity loss on the ground. One study analyzed satellite images from 1984 to 2020, covering 78 plantations in Indonesia and 173 in Malaysian Borneo that have been certified by the RSPO. According to the study, ~75% of RSPO concessions and supply bases are located in areas that have experienced deforestation and biodiversity loss over the last 30 years. 49% of Sumatran and 99% of Bornean certified supply bases were completely covered by tropical forests between 1984 and 1990, before being converted into oil palm plantations from 1990 to 2000 (see Exhibit 202 and Exhibit 203).²¹⁴

EXHIBIT 202: In 1973, Borneo had few palm oil plantations and higher rainforest density...

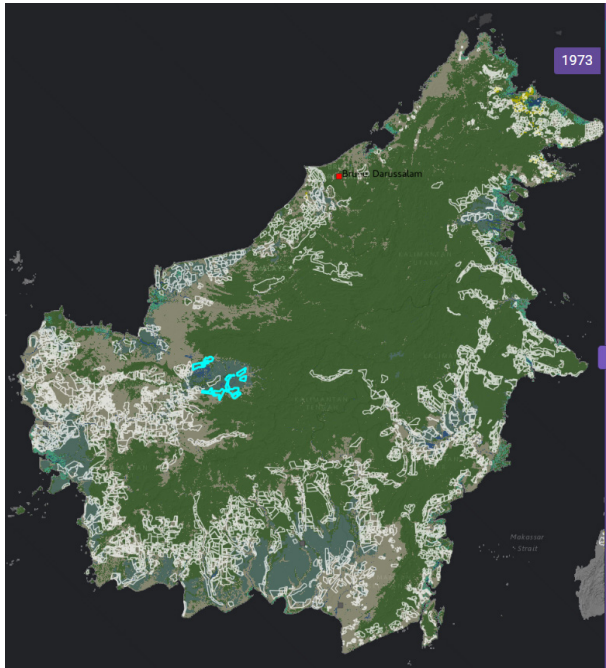


EXHIBIT 203: ... compared to 2020 where the light green represents palm oil plantations and the rainforest is far less dense as a result of deforestation



Note: Red lines indicate roads, light green patches represent palm oil plantations, white lines represent palm oil concessions, dark green represents forest (see online version for colors).

Source: [Nusantara Atlas](#) (available for public use) and Bernstein analysis

Source: [Nusantara Atlas](#) (available for public use) and Bernstein analysis

The RSPO acknowledges that it doesn't account for past deforestation before November 2005. And the current certification process by the RSPO is labor intensive and carried out on a lagged basis. Growers will be assessed for certification once every five years and, if certified, will be assessed annually for continued compliance.

Blockchain technology could offer a solution to improve transparency and traceability in the palm oil supply chain by providing a tamper-proof, more real-time way to track products' environmental and biodiversity impacts (see Exhibit 204).²¹⁵

²¹⁴ <https://news.mongabay.com/2020/08/palm-oil-certification-sustainable-rspo-deforestation-habitat-study/>

²¹⁵ <https://www.wipro.com/consulting/build-it-on-blockchain-a-sustainable-palm-oil-industry/>

- The process starts with a plantation worker tagging the fresh fruit bunches on the palm tree using a mobile device. Information captured includes the tree's location, plantation identity, worker identity, date, and time harvested. This information, coupled with geospatial imaging technologies to track local deforestation and biodiversity loss, can introduce more accountability to the supply chain and differentiate leaders from laggards in a transparent, real-time fashion. The identification of workers in this process can also help protect working conditions and the legal employment status of field workers.
- As the fruit leaves the plantation and moves further along the supply chain, oil mills, crushers, refineries, and manufacturers can tag and scan products at each stage for quality control and to minimize spoilage of the oil.
 - During the shipping process, shipping companies can use tamper-proof GPS-enabled seals to lock containers and mobile devices to record product shipment information. Once the shipment reaches the destination, only authorized personnel with access to the blockchain application can open the seal and verify receipt of the shipment. This ensures the trustworthiness of the blockchain data and removes the need for external auditing in this process.
- Lastly, retailers can display product information via a QR code to provide enhanced transparency to consumers, who can now trace the product all the way back to the palm tree and make more informed purchasing decisions.

In practice, there are a number of pilot programs that leverage blockchain to improve traceability in the palm oil supply chain:

- For example, the **Malaysian Palm Oil Council (MPOC)** has partnered with blockchain firm BloomBloc²¹⁶ to introduce more transparency to the palm oil supply chain. Malaysia is the second-largest palm oil producer in the world, just behind Indonesia. As part of the pilot program, BloomBloc has developed a mobile app and a web interface for recording information such as details of each tree, fruits harvested, and extraction processes. Producers, including smallholder farmers, can also use this platform to address the environmental, social, and economic aspects of palm oil production.²¹⁷
- **Nestle**²¹⁸ also ran a pilot program with OpenSC, a blockchain platform founded by WWF-Australia and BCG Digital Ventures, to test the use of blockchain and satellite imaging technologies to track palm fruits from farm to mill in Latin America and onward to Nestle.²¹⁹ The company expects to test the outcome of this collaboration with consumers on at least one Nestle product in 2021.

It's worth noting that there are still many challenges in fully embracing blockchain technology in the palm oil supply chain, which requires coordination across all key stakeholders and technological readiness that's oftentimes lacking, especially in emerging

²¹⁶ Private, not covered.

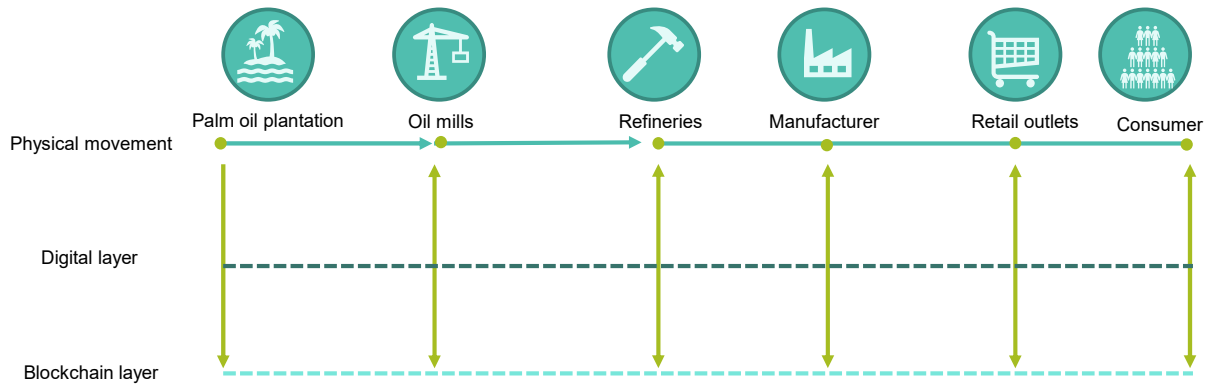
²¹⁷ <https://www.ledgerinsights.com/palm-oil-blockchain-traceability-malaysia-sustainable/>

²¹⁸ Covered by Bernstein's European Food analyst Bruno Monteyne.

²¹⁹ <https://www.nestle.com/csv/raw-materials/palm-oil>

markets. That said, large consumer packaged goods (CPG) companies and retailers should be incentivized to invest in these pilot programs that could help provide more transparency to consumers, support their sustainability claims, and ultimately differentiate their product offerings. In fact, we see a number of such blockchain pilot programs across the agricultural supply chain beyond palm oil sourcing, which we review in further sections.

EXHIBIT 204: Blockchain could improve transparency and traceability in the palm oil supply chain by providing a tamper-proof, real-time way to track products' environmental and biodiversity impacts across every step of the supply chain



Note: Digital layer includes tagging of products, scanning using multiple devices, IoT device/sensor powered by mobile devices, and Blockchain application.

Source: Wipro and Bernstein analysis

Beyond palm oil, blockchain technology has wide applications across the agriculture supply chain.

For example, the IBM²²⁰ Food Trust has worked with a number of manufacturers and retailers to provide greater traceability of its products:

- **Walmart**²²¹ ran two blockchain pilots using IBM's blockchain solution based on Hyperledger Fabric to trace pork in China and mangoes in the US. The technology was mainly aimed at addressing food safety issues, but can well be extended to track products' environmental and biodiversity impacts.²²²
 - **Pork in China:** China is a major consumer and producer of nearly half the world's pork. As Chinese consumers started to focus more on food safety and as regulators placed a greater emphasis on modernizing the pork industry, Walmart had an incentive to explore new technologies to create trust in the food system in China. In October 2016, Walmart launched the Food Safety Collaboration Center in China to bring key stakeholders together to address food safety issues. With support from local regulators, Walmart applied features of the blockchain technology to manage the pork supply chain. The process started with tagging every pig with a barcode to track the product all the way to the packaged pork. Walmart also used radio frequency identification and cameras to track pigs'

²²⁰ Covered by Bernstein's U.S. IT Hardware analyst Toni Sacconaghi.

²²¹ Covered by Bernstein's U.S. Broadlines & Hardlines Retail analyst Brandon Fletcher.

²²² https://pdfs.semanticscholar.org/b1cd/65230aac83803a398e2a288915854c3bf010.pdf?_ga=2.14975350.1708755892.1632781681-1485573503.1632781681

movement and the entire production process. Further, shipping trucks deployed temperature and humidity sensors along with GPS systems to ensure the quality and safety of meat products. Walmart's procurement managers can trace all information from farm origination, batch numbers, soil quality, and fertilizer use, to storage temperature and shipping details.

- **Mangoes in the US:** Walmart concurrently conducted a pilot program to trace mangoes from South and Central America to the US. Mangoes are susceptible to listeria and salmonella contaminations. By working with its suppliers to trace the fruit's quality throughout the supply chain, Walmart was able to reduce the time for tracking mango origins from seven days to 2.2 seconds.
- Another notable program is **Farmer Connect**,²²³ which leverages IBM's blockchain technology to increase visibility and fairness in the coffee supply chain, especially for smallholder farmers. A program introduced a mobile app called Thank My Farmer, which allows consumers to trace the origin of the coffee they buy (including Smucker's 1850 brand) back to its original source and allows consumers to donate to sustainability programs in the farmers' local communities.²²⁴
- Elsewhere, **Angol Brewery**,²²⁵ a Swedish microbrewer, released Helt Sparat in 2021, which is Sweden's first blockchain-traceable beer enabled by IBM's blockchain technology. The beer is made using only locally and sustainably sourced ingredients, and the increased traceability allows consumers to fully appreciate the sustainable credentials of the brand.²²⁶

BLOCKCHAIN FOR THE OCEAN

Blockchain could also play a key role in protecting our oceans.

The fishing industry is significantly disrupting the ocean ecosystem without a proper oversight system currently in place. Globally, an average of ~34% of fish stocks are overexploited, with the Mediterranean Black Sea (63%), the Southeast Pacific (55%), and the Southwest Atlantic (53%) seeing the highest percentages of overexploitation (see Exhibit 205).

- In particular, bycatch is a major issue when it comes to industrial fishing. Large industrial nets span thousands of miles and result in bycatch — the capture of non-target species such as dolphins, whales, marine turtles, and seabirds — which are discarded by fishermen if they do not want or cannot sell the animals.²²⁷ Every year, 250,000 turtles, 100 million sharks, and 300,000 small whales and dolphins are killed as bycatch. 90% of marine life caught as bycatch are discarded, and only 10% are kept. In addition, it's not just natural capital that's wasted: sorting through bycatch

²²³ Private, not covered.

²²⁴ <https://www.ibm.com/blogs/blockchain/2020/07/bringing-region-to-cup-traced-coffee-to-u-s-stores-with-1850-coffee/>

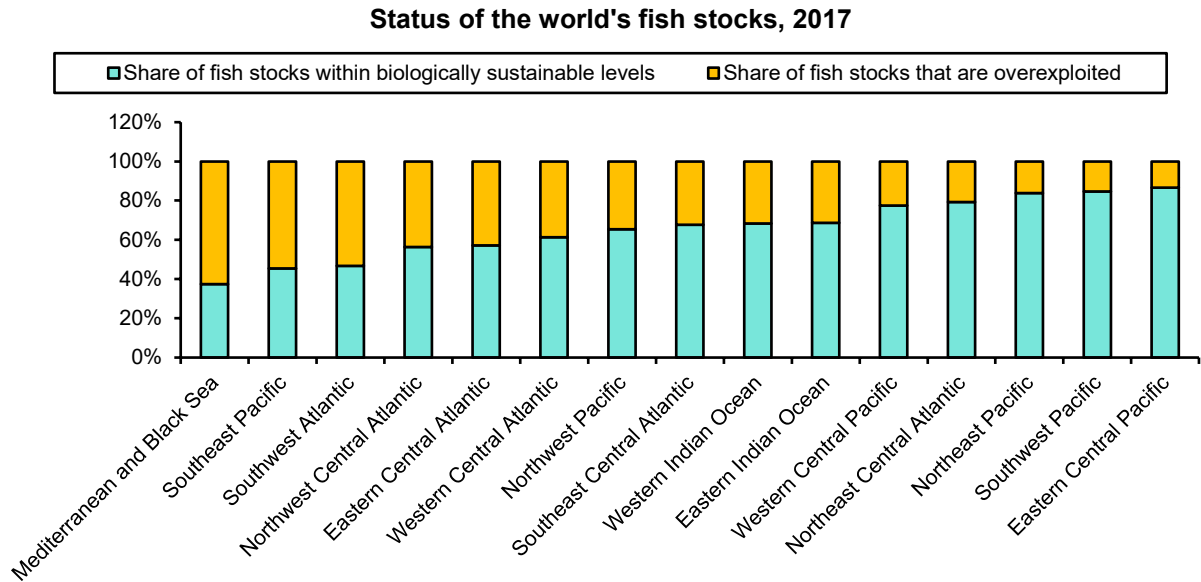
²²⁵ Private, not covered.

²²⁶ <https://www.ibm.com/blogs/blockchain/2021/07/brewing-a-more-traceable-and-sustainable-beer-industry-with-blockchain/>

²²⁷ <https://www.fisheries.noaa.gov/insight/understanding-bycatch>

takes incremental time and labor.²²⁸ In the US, bycatch in the form of regulatory discards (meaning fish that are caught but discarded because regulations do not allow fishermen to retain the fish)²²⁹ reduce the yield of fisheries since the catch cannot be converted into seafood sales.²³⁰

EXHIBIT 205: Globally, an average of ~34% of fish stocks are overexploited, with the Mediterranean Black Sea (63%), the Southeast Pacific (55%) and the Southwest Atlantic (53%) seeing the highest percentages of overexploitation



Note: Fish stocks are overexploited when fish catch exceeds the maximum sustainable yield (MSY) – the rate at which fish populations can regenerate.

Source: UN Sustainable Development Goals Tracker, Food and Agriculture Organization of the United Nations, and Bernstein analysis

Blockchain could provide much-needed technology to establish an end-to-end supply chain monitoring system to introduce more transparency and accountability to the fishing industry.²³¹

- One such example is the **Blockchain Tuna Project** supported by WWF, ConsenSys, Traseable, and Sea Quest Fiji Ltd. A combination of radio-frequency identification (RFID) and QR codes is used to capture information throughout the supply chain. In particular, an RFID tag is affixed to the fish once it comes on board the vessel, which will follow the fish from the vessel to the dock to the processing facility. Once the fish enters the processing facility and is partitioned into various products, QR codes are

²²⁸ <https://oceana.org/blog/we-waste-almost-half-what-we-catch-5-reasons-%E2%80%99s-disastrous-oceans>

²²⁹ <https://www.fisheries.noaa.gov/international/bycatch/national-bycatch-reduction-strategy>

²³⁰ Patrick and Benaka, 2013. "Estimating the economic impacts of bycatch in U.S. commercial fisheries," *Marine Policy*. Volume 38, March 2013, Pages 470-475.

²³¹ <https://theblockchainland.com/2019/11/04/fighting-overfishing-waste-blockchain/>

attached to the products to provide traceability all the way to the retailer and end consumer.²³²

- Another example is **Fishcoin**, a peer-to-peer network that incentivizes key stakeholders in the supply chain to capture and communicate data by rewarding them with a digital voucher (tokens). Downstream players such as hotels, restaurants, and retailers can choose to pay a premium to procure products with increased levels of traceability, especially as their customers are increasingly demanding greater transparency around food products they consume. The price of traceability is determined by market supply and demand dynamics.²³³
- IBM has also been active in applying blockchain to the fishing industry. In collaboration with Atea²³⁴ and the Norwegian Seafood Association, IBM helped launch the **Norwegian Seafood Trust**, a cross-industry initiative to transform Norway's seafood industry. Brands that have joined the initiative are able to leverage blockchain technology to trace their sustainably farmed salmon and the feed the fish were raised on. Because the distributed ledger cannot be tampered with, companies can earn greater consumer trust by providing product information all the way back to its origin.

CIRCULAR ECONOMY

Blockchain can also be a key enabler to drive the development of a circular economy. A circular economy is an industrial system that reuses and recycles materials to reduce waste and our environmental footprint. According to the Ellen MacArthur Foundation, only 55% of climate change emissions can be dealt with through the energy transition. The remaining 45% needs to come from rethinking the products and the waste through the lens of a circular economy (see Exhibit 206).²³⁵ Blockchain can play a key role in improving the traceability of materials as they go through multiple product life cycles to provide greater transparency to end consumers, and to create stronger incentives for producers to embed a circular design mindset in the manufacturing process.

²³² https://www.wwf.org.nz/what_we_do/marine/blockchain_tuna_project/

²³³ <https://medium.com/fishcoin/blockchain-traceability-this-time-its-personal-ab68875d2aa4>

²³⁴ Public, not covered.

²³⁵ See report: [Beyond Boilerplate ESG: Ellen MacArthur Foundation - Redesigning our economy for circularity.](#)

EXHIBIT 206: **A circular economy helps deliver on goals related to climate change and other ESG issues**

Source: Ellen MacArthur Foundation

- For example, **BASF**²³⁶ launched a pilot program called **reciChain** initially in Brazil, which was then expanded to Canada, to improve the traceability of recycled plastics. To track a product, a marker is embedded into the plastic material and is homogeneously dispersed such that it can be read with a scanner even if the material goes through mechanical recycling. For the initial phase of the reciChain Canada pilot, the marker was coded with four data points: the type of plastic, the manufacturer, percentage of recycled content, and the number of times the material has gone through the entire value chain (or loop count). When the information is uploaded to the blockchain platform, all members of the value chain can verify their data is accurate. Over time, BASF expects to build in an incentive system whereby a credit or digital token is generated each time the plastic material moves along to the next supply chain actor. The token increases in value with each additional loop count and could provide incentives for producers to design for recyclability.²³⁷
- Meanwhile, the **Circularise PLASTICS** initiative helps the shift to a circular economy by digitizing and tracing materials across supply chains on a public blockchain without risking confidentiality. In the EU, Circularise Plastics partnered with the European Plastics Converters Association (EuPC) to develop standards and tools to help realize the European Commission's pledge to increase the use of recycled content to 10 million tons by 2025.²³⁸

²³⁶ Covered by Bernstein's European Industrial & Consumer Chemicals analyst Gunther Zechmann.

²³⁷ <https://www.basf.com/ca/en/who-we-are/sustainability/Sustainability-in-Canada/reciChain.html>

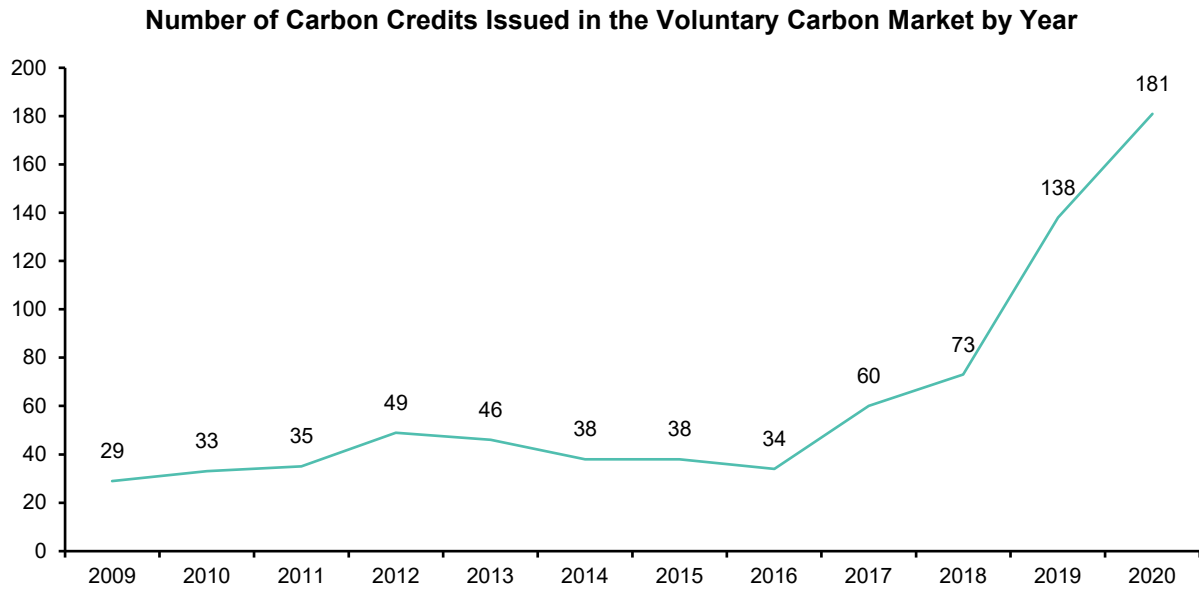
²³⁸ https://uploads-ssl.webflow.com/605b4d6308d1c40972116d02/608a72c9b653513e3be6e769_Press%2BRelease_EuPC%2BCircularise%2BDomo%2BCovestro%2BE.pdf

- Elsewhere, **Dow**²³⁹ also launched a pilot program to improve transparency and circularity in the mattress supply chain. The pilot uses a blockchain platform developed by ChemChain to transfer verified product information securely within the RENUVA mattress recycling program. Using the platform, Dow generates digital assets containing key encrypted information on the chemical composition of its solutions. At the end of the product lifecycle, recyclers can easily access this information and identify the most appropriate action for the disposal or recycling of end-of-life mattresses.²⁴⁰

CARBON OFFSETS

The carbon offset market is another area where blockchain technology can play a key role to introduce much-needed transparency. Today, major corporations across the world are using carbon offsets as an interim way to achieve their longer-term net zero targets.²⁴¹ The number of offsets issued has more than doubled in the past two years (see Exhibit 207).²⁴² However, the quality of these carbon offsets varies significantly, and the market remains very opaque, making it difficult to verify the impact of these offsets.

EXHIBIT 207: **The number of carbon offsets issued has more than doubled in the past two years**



Source: Taskforce on Scaling Voluntary Carbon Markets (TSVCM) and Bernstein analysis

The TSVCM has recommended that stakeholders develop new infrastructure to support carbon credit markets at scale. Blockchain technology could play a key role in increasing the integrity of carbon markets and in making the markets more efficient. There are a

²³⁹ Not covered.

²⁴⁰ <https://corporate.dow.com/en-us/news/press-releases/dow-launched-blockchain-pilot.html>

²⁴¹ It's also worth noting that the most stringent definition of net zero requires companies to decarbonize within their value chain rather than relying on avoidance or reduction through carbon offsets at the end stage. During the transition to net zero, however, companies may use carbon offsets to compensate for emissions that are still being released into the atmosphere.

²⁴² https://www.iif.com/Portals/1/Files/TSVCM_Report.pdf

number of pilot projects in the market today where blockchain technology is being tested to improve the transparency and credibility of the voluntary carbon market:

- Canadian Imperial Bank of Commerce (CIBCO), Itau Unibanco, National Australian Bank, and NatWest Group have partnered to launch **Project Carbon**, a voluntary carbon marketplace to help the banks' clients achieve their net zero goals. The platform is built on the private Ethereum platform to provide a digital ledger that records all transactions with the ability to trace any transaction back to the source of the credit, which helps address double counting issues.²⁴³
- **Interwork Alliance**, a group that looks to standardize tokenized assets and multi-party contracts, has set up a sustainable working group with the initial aim to standardize carbon offsets. The working group looks to establish standards for carbon trading (both in the regulated and in the voluntary market) by using distributed ledger techniques to create an auditable system. This could increase the credibility of carbon offsets that are currently trading in the market. The primary focus of the group will be voluntary carbon market architectures, which will later expand to regulated markets.²⁴⁴
- At a more granular level, Spanish renewable company Acciona²⁴⁵ has developed **GreenH2Chain**, a blockchain platform to guarantee the renewable origin of green hydrogen. The tool will also allow clients to verify the transportation and delivery process of green hydrogen.²⁴⁶

There are still many challenges in adopting blockchain technology more broadly to reduce environmental and biodiversity impacts. In this process, we will need to bring all key stakeholders on board, make sure they have the right level of training and tech support, and incentivize businesses to make upfront investments in technology and personnel, which will only pay off over the longer term. Nonetheless, the majority of senior executives surveyed globally believe blockchain will be critical and in their organization's top-five strategic priorities in the coming 24 months (see Exhibit 208). 88% of executives believe blockchain technology will be broadly scalable and will eventually achieve mainstream adoption, versus 84% in 2018 (see Exhibit 209). However, there is also a growing level of skepticism, with 54% of executives finding blockchain to be overhyped, up from 39% in 2018.

Despite such skepticism and various hurdles to a wider adoption of blockchain technology, we believe blockchain technology will be a critical part of supply chain management to hold all stakeholders accountable for their environmental and biodiversity impacts.

²⁴³ <https://www.ledgerinsights.com/cibc-natwest-nab-blockchain-for-voluntary-carbon-marketplace/>

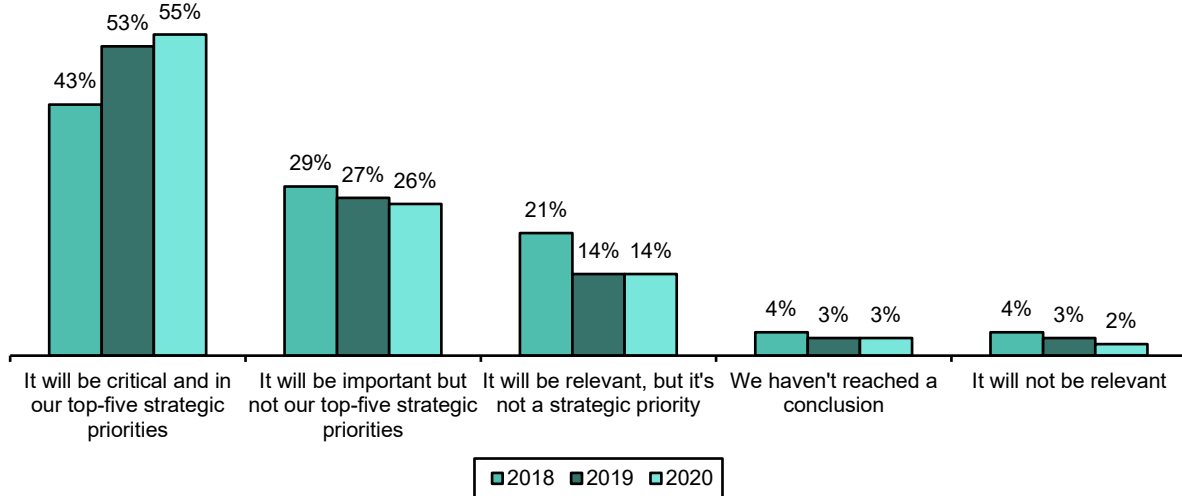
²⁴⁴ <https://interwork.org/standardizing-sustainability-how-the-iwa-will-make-this-happen/>

²⁴⁵ Not covered.

²⁴⁶ https://www.acciona.com/updates/news/acciona-develops-first-platform-guarantee-renewable-origin-green-hydrogen/?_adin=02021864894

EXHIBIT 208: 55% of senior executives surveyed globally believe blockchain will be critical and in their organization's top-five strategic priorities in the coming 24 months

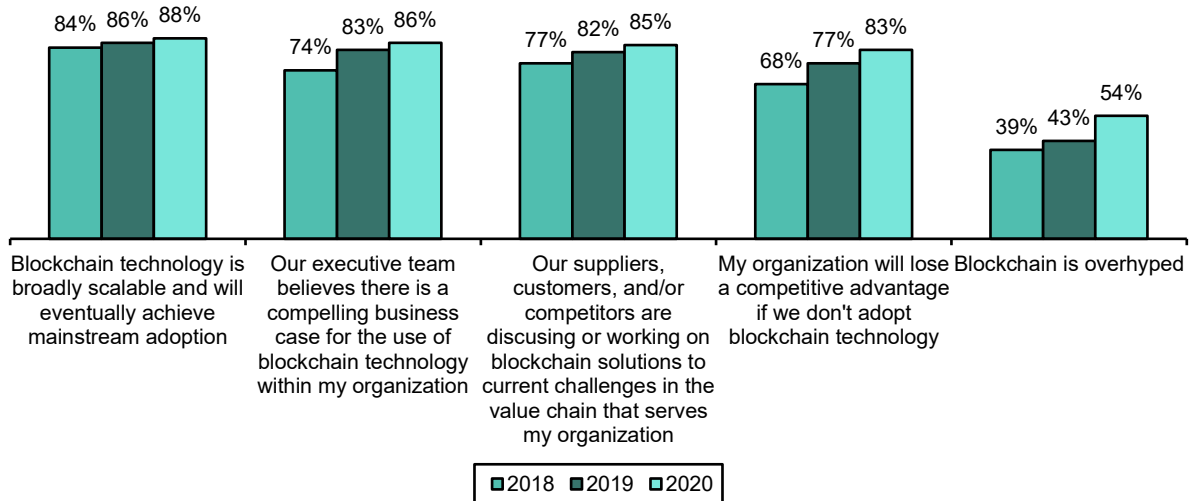
Which of the following best describes how you view the relevance of blockchain to your organization in the coming 24 months?



Source: Deloitte's Global Blockchain Survey (N=1,488 in 2020, N=1,386 in 2019, N=1,053 in 2018), and Bernstein analysis

EXHIBIT 209: 88% of executives believe blockchain technology will be broadly scalable and will eventually achieve mainstream adoption, while 54% find blockchain to be overhyped

What is your level of agreement or disagreement with the following statements (Figures represent % who strongly or somewhat agree)



Source: Deloitte's Global Blockchain Survey (N=1,488 in 2020, N=1,386 in 2019, N=1,053 in 2018), and Bernstein analysis

BERNSTEIN

SIN STOCKS

From exclusion to integration, responsibly

HIGHLIGHTS

Alcohol, tobacco, and gambling date back to before written history. As these industries flourished, regulators started to turn a critical eye to their health and social costs. ESG-aware investors also started excluding alcohol, tobacco, and gambling (or "sin stocks") over 200 years ago,²⁴⁷ which remains a popular ESG strategy. However, exclusion could be costly to financial returns, and more investors are gravitating toward ESG integration.

- **Alcohol:** The cost of excessive alcohol use was estimated to be US\$249bn in the US in 2010, which compares to total industry revenue of US\$186bn. Given the negative consequences, regulators have adopted excise tax and marketing restrictions to curb alcohol consumption. **For China's brewers, we view excise tax as the most pressing ESG risk**, especially for mainstream+ and premium beer if the government introduces additional beer excise tax scaled by ex-factory price. We see a more limited excise tax risk for ultra-premium Baijiu. Elsewhere, **advertising bans on social media could pose further risks to alcohol sales.**
- **Tobacco:** Research started linked smoking to lung cancer in the 1950s, which led to tobacco control programs in the 1960s-1970s. However, global tobacco consumption continued to grow as the industry lobbied against regulations and expanded globally. In response, the WHO developed the Framework Convention on Tobacco Control (FCTC) and introduced demand reduction measures in 2007. Since then, global (ex-China) cigarette volume growth has been negative at a CAGR of -2.1%. However, **regulations such as advertising bans have largely benefited incumbents** by making it extremely difficult for new entrants to compete. These barriers to entry and the consolidated industry structure confer very strong **pricing power**, allowing the industry to grow cigarette prices (net of excise tax) year on year. In comparison, alcohol brands do not enjoy the same level of pricing power as the market is more fragmented.
- **Gaming:** In 2019, the US gaming (gambling) industry is estimated to have contributed ~US\$115bn directly to the US economy, and the industry directly employed over 560k people, with another 420k people employed to support the indirect supply chain. **Gambling may be viewed by some as a "sin," but the benefit of having such a "sin" industry under proper government supervision and regulation is clear — jobs, taxes, and consumer protection.** While individual problem gamblers experience difficulties that often impact their family and others (1% of US adults are classified as pathological gamblers), the overall net benefit supports having a legal, well-regulated gaming industry.

²⁴⁷ <https://www.thebalance.com/a-short-history-of-socially-responsible-investing-3025578>

ALCOHOL, TOBACCO, AND
GAMBLING HAVE BEEN WITH US
FOR THOUSANDS OF YEARS

- **Alcohol:** Fermented beverages existed in early Egyptian civilization, and there's evidence of fermented drinks from China dating back to 7,000BC.²⁴⁸ Various cultures have embraced alcohol throughout history for religious, medicinal, and social purposes.
- **Tobacco:** Mayan people of Central America started using tobacco leaves for smoking in religious ceremonies around the first century BC.²⁴⁹ The use of tobacco started spreading across Native American communities between 470 and 630 AD. In 1492, Christopher Columbus set foot in the Americas and was greeted by Native Americans who offered tobacco leaves as gifts. His introduction of tobacco to Europe marked the start of the global tobacco trade.
- **Gambling** can be traced back to ancient China, Egypt, Greece, and Rome. The game "white pigeon ticket" was played in gambling houses in China around 200BC, and playing cards are believed to have first appeared in China in the 9th century BC.²⁵⁰ The first casinos appeared in Italy in the 17th century and they started spreading across Europe in the 19th century. All of this happened well before Bugsy Siegal spotted a gold mine on a road in the middle of the Nevada desert and before a swampy peninsula in China became the biggest gaming destination in the world.

As these industries flourished, regulators started to turn a critical eye to the health and social costs of these industries, especially as modern science uncovered the health consequences of smoking and excessive consumption of alcohol. Along with this, early-day socially responsible investors — dating back over 200 years — started excluding "sin stocks" such as alcohol, tobacco, and gambling for religious reasons.²⁵¹ The exclusion list expanded beyond these original sin stocks on the back of civil rights, environmental concerns, and the global anti-apartheid movement from the 1960s to the 1990s.

THE COST OF EXCLUSION

To date, exclusion or negative screening remains a popular ESG investing strategy. According to the 2018 Global Sustainable Investment Review, the exclusionary approach was deployed across US\$19.8tn of assets in 2018 (or ~64% of total ESG AUM, see Exhibit 210).²⁵² In particular, exclusion was the most commonly adopted approach in Europe, representing 77% of ESG AUM.

²⁴⁸ <https://www.drugfreeworld.org/drugfacts/alcohol/a-short-history.html>

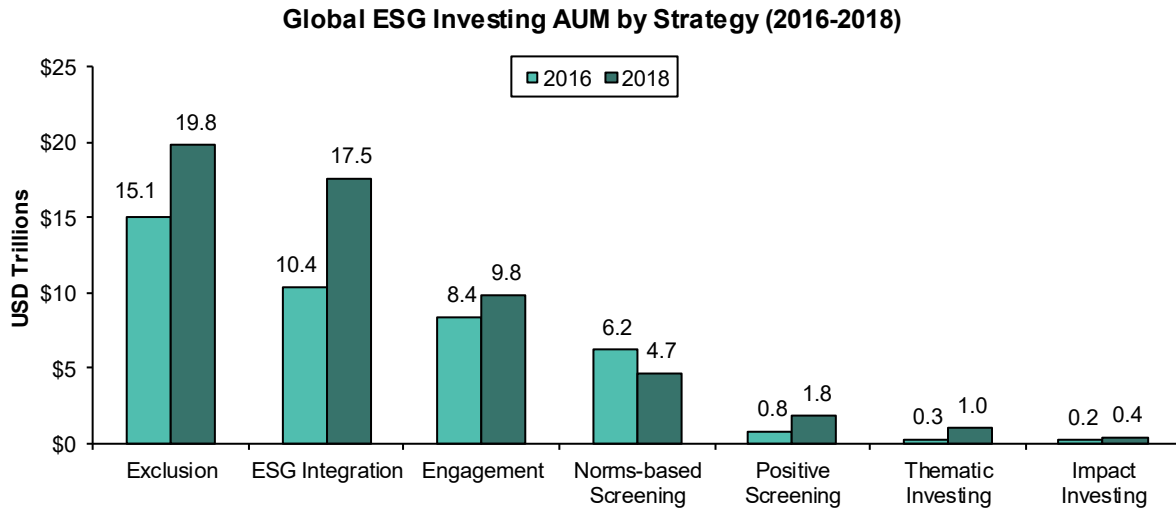
²⁴⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3894096/#:~:text=Tobacco%20is%20derived%20from%20the,in%20sacred%20and%20religious%20ceremonies.>

²⁵⁰ <https://medium.com/edgefund/a-brief-history-of-gambling-a7f46dbf4403>

²⁵¹ <https://www.thebalance.com/a-short-history-of-socially-responsible-investing-3025578>

²⁵² http://www.gsi-alliance.org/wp-content/uploads/2019/06/GSIR_Review2018F.pdf

EXHIBIT 210: **According to the 2018 Global Sustainable Investment Review, the exclusionary approach was deployed across US\$19.8tn of ESG assets in 2018**



Note: These ESG strategies are not mutually exclusive (i.e., one fund can adopt an exclusion, ESG integration, and engagement strategy at the same time).

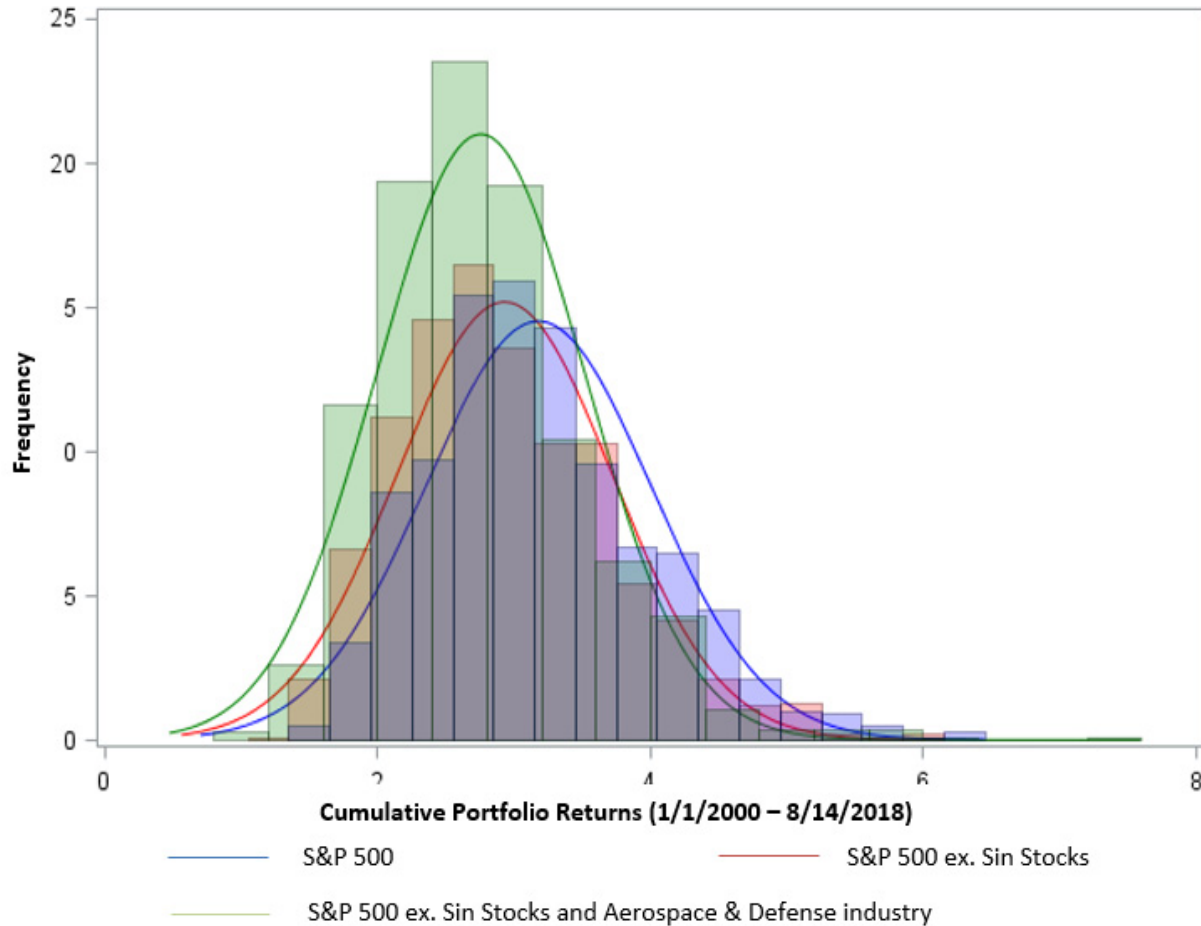
Note: **Exclusion** = the exclusion of certain sectors, companies or practices based on specific ESG criteria; **ESG integration** = the systematic and explicit inclusion of ESG factors into financial analysis; **Engagement** = the user of shareholder power to influence corporate behavior; **Norms-based screening** = screening of investments against minimum standards of business practice based on international norms (e.g., by the OECD, ILO, or UN); **Positive screening** = investment in sectors, companies or projects selected for positive ESG performance; **Thematic investing** = investment in themes or assets specifically related to sustainability; **Impact investing** = investments aimed at social or environmental problems.

Source: 2018 Global Sustainable Investment Review and Bernstein analysis

Excluding sin stocks could be costly, however. Our Quant team's analysis shows unconstrained portfolios are more likely to generate higher returns versus constrained portfolios. And the distribution of returns moves to the left (lower returns) as the portfolio gets more constrained²⁵³ (see Exhibit 211).

²⁵³ See report: [ESG Strategies and Defense: Why it has to be done right - The price of exclusion \(AMENDED\)](#).

EXHIBIT 211: Our Quant team's analysis shows portfolios with a greater number of exclusions underperformed those with fewer exclusions; best returns accrued to portfolios chosen from the unconstrained opportunity set



Note: "Sin" stocks=Tobacco-, Alcohol-, and Gaming-related stocks

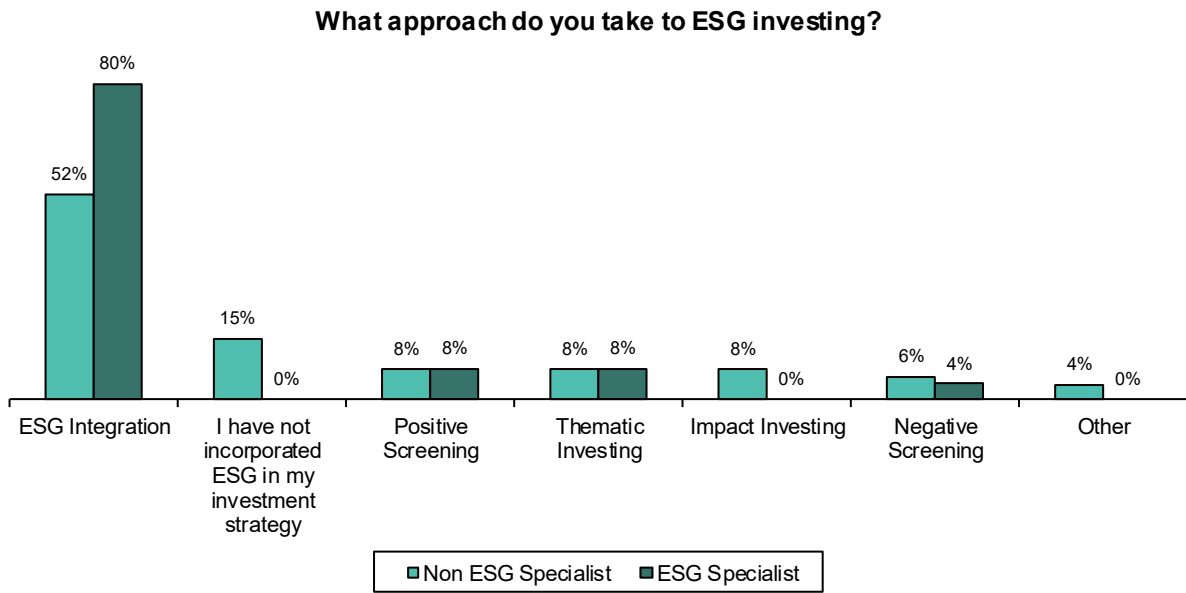
Source: FactSet, Center for Research in Security Prices (CRSP), and Bernstein analysis

Instead of artificially limiting the investable universe, more investors have moved away from the simple exclusion approach to ESG integration. According to the Global Sustainable Investment Alliance's survey, the ESG integration approach was deployed across US\$17.5tn of assets in 2018 versus US\$10.4tn 2016, which represented a ~70% growth over the two-year period. More recently, our survey of institutional investors in January 2021 shows a more significant shift away from exclusion to integration. 80% of ESG specialists and over half of non-ESG specialists said they've adopted the ESG integration approach, while exclusion or negative screening appears to have fallen out of favor (see Exhibit 212).

After all, there is not one company that's perfectly positioned on all ESG issues. If we decide to exclude sin stocks, shall we also exclude junk food companies? Where should we draw the line? Meanwhile, many industries that end up on exclusion lists generate a considerable amount of cash flows and do not rely solely on equity capital to operate, which undermines the impact of the exclusion approach. Instead, more investors have started integrating ESG

considerations in their research process to identify potential risks and opportunities.²⁵⁴ Others have taken it to the next level and leveraged their ESG insights to engage with companies to advocate for better ESG practices and disclosures, which in our mind is a more effective way of driving change.

EXHIBIT 212: Based on our investor survey, 80% of ESG specialists and over half of non-ESG specialists have adopted the ESG integration approach, while exclusion or negative screening appears to have fallen out of favor



Note: We defined ESG integration as incorporating material ESG considerations in investment analysis and decisions, positive screening as selecting companies that are considered best in class based on specific ESG criteria, thematic investing as investing in companies that stand to benefit from thematic ESG trends, and negative screening as excluding companies that don't comply with specific ESG criteria.

Source: Procensus and Bernstein analysis

If we take an integrated approach and examine the alcohol, tobacco, and gaming sectors from an ESG lens, what are the risks that we should take into consideration? Given these sectors' impact on public health and welfare, more stringent regulations could pose the greatest amount of ESG risk to sin stocks. Have these regulatory risks been priced in? How should investors identify companies that are more or less exposed to these risks going forward? We take a closer look at various regulatory risks (e.g., advertising bans and excise tax for alcohol and tobacco, and responsible gaming and other regulatory interventions for casino operators), which are highlighted as top ESG considerations by our alcohol, tobacco, and gaming analysts.

²⁵⁴ <https://www.schroders.com/en/sysglobalassets/digital/insights/2018/thought-leadership/demystifying-negative-screens---the-full-implications-of-esg-exclusions.pdf>

ALCOHOL

Alcohol has been used and abused by humankind since before the dawn of written history. The industry is based on the sale of a psychoactive drug, but one that is deeply engrained in human culture. Although there have been success stories in partly reducing harmful consumption of alcohol, such as the significant multi-country drop in underage drinking (see [European Beverages: What should keep our CEOs awake? What will Generation Z drink or will they drink at all?](#)), the misuse of alcohol still takes a massive toll on society. According to the WHO, the harmful use of alcohol resulted in ~3 million deaths globally in 2016 (5.3% of all deaths).²⁵⁵ The WHO also finds the effect of alcohol consumption on mortality is greater than that of digestive diseases (4.5%), diabetes (2.8%), road injuries (2.5%), tuberculosis (2.3%), and HIV/AIDS (1.8%). Alcohol also cost us 132.6 million disease-adjusted life years (DALYs) in 2016, accounting for 5.1% of all DALYs worldwide. Given the cost of the harmful use of alcohol, if we were starting from scratch, alcohol would likely be high on the control list or illegal. However, such is the global cultural ubiquity of alcohol that prohibition, when tried, has been a miserable failure.

In the US, the Centers for Disease Control and Prevention (CDC) estimated the cost of excessive alcohol use was US\$249bn in 2010, or US\$2.05 per drink.²⁵⁶ 72% of the cost came from losses of workplace productivity, 11% from healthcare expenses, 10% from law enforcement and other criminal justice expenses, while losses from motor vehicle crashes related to excessive alcohol consumption made up another 5% (see Exhibit 213). To put this into context, total alcoholic beverage industry revenue was US\$186bn (at retail selling price) in 2010, according to Euromonitor. US state and local governments collected US\$7.3bn in alcohol taxes in 2017, rather insignificant in comparison to the social cost of excessive drinking.²⁵⁷ But other countries, e.g., NW European countries and India, have much higher taxes on alcohol and hence capture much more of the consumer spend on alcohol.

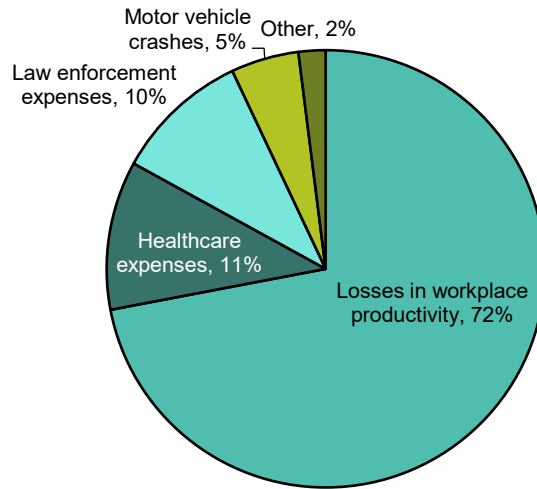
²⁵⁵ <https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1&ua=1>

²⁵⁶ <https://www.cdc.gov/alcohol/features/excessive-drinking.html>

²⁵⁷ <https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/state-and-local-backgrounders/alcohol-taxes#revenue>

EXHIBIT 213: **In the US, the CDC estimated the cost of excessive alcohol use was US\$249bn in 2010, or US\$2.05 per drink, primarily reflecting losses in productivity and healthcare expenses**

The Social Cost of Excessive Alcohol Consumption (by cause)



Source: CDC and Bernstein analysis

Given the negative consequences of excessive drinking, regulation of alcohol consumption can be dated back to ancient times. However, the history is much shorter when it comes to controlling the harmful use of alcohol at the international level. Neither alcohol nor tobacco was included in modern international drug control treaties. When the FCTC came into place in 2003, alcohol remained the only psychoactive substance with a significant global impact that was not regulated at the international level. As international consensus started forming around the health and social implications of alcohol, WHO member states agreed upon the Global Strategy to Reduce the Harmful Use of Alcohol in 2010, which then gave rise to the development and adoption of a series of regional strategies in the following years. The WHO estimated 43% of the world population (aged 15 years and older) were alcohol drinkers in 2016 (i.e., consumed alcohol over the past 12 months), down from 47.6% in 2000.²⁵⁸

At the country/regional level, alcohol consumption in developed markets has largely declined or held steady over the past 50 years on the back of stricter regulations (see Exhibit 214). At one extreme end, the US banned the production and sale of alcoholic beverages altogether in 1920.²⁵⁹ However, the use of alcohol did not stop but instead went underground and created vast criminal enterprises, which eventually led to the end of prohibition in 1933. In the following decades with the Great Depression and World War II, legal alcohol once again became an important part of American life.²⁶⁰ In the 1980s, anti-alcohol sentiment began to rise in the US, which led to a decline in per capita alcohol consumption in the US in subsequent years (see Exhibit 214). In particular, the National

²⁵⁸ <https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1&ua=1>

²⁵⁹ <https://www.ncbi.nlm.nih.gov/books/NBK217463/>

²⁶⁰ <https://daily.jstor.org/a-brief-history-of-drinking-alcohol/>

Minimum Drinking Age Act was passed in 1984 that established the legal drinking age as 21 years, one of the highest in the world.²⁶¹

In Europe, **France** had among the highest levels of per capita alcohol consumption in the 1960s. France accelerated a reduction in per capita alcohol consumption, which was already underway to a level closer to other European countries, by implementing a range of alcohol control policies in the subsequent decades (e.g., prohibiting the sale of alcohol to anyone under 18, banning "happy hours" unless non-alcoholic beverages were also offered at promotional prices, reducing the authorized blood alcohol concentration level for drivers, and restricting alcohol advertising).²⁶² In **Germany**, per capita alcohol consumption rose in the 1960s-1970s, and then steadily declined in the following decades on the back of labeling and age limits regulations as well as laws prohibiting drunk driving.²⁶³

Although per capita alcohol consumption levels have broadly decreased across developed markets, alcohol consumption has increased in a number of emerging markets (see Exhibit 215). In particular, **China** saw a major uptick in its per capita alcohol consumption in the 1980s, which coincided with its economic development and per capita income growth. The government introduced additional liquor and beer taxes in 2001, which led to a decline in alcohol production and consumption, although consumption started rising again a few years after the 2001 regulation.²⁶⁴

However, although **Russia** historically had among the highest levels of per capita alcohol consumption in emerging markets, the government responded to the WHO initiative and implemented a number of alcohol control policies in 2011 (e.g., increasing excise taxes, raising the minimum unit price of alcohol, and reducing the availability of retail alcohol), resulting in a meaningful decrease in per capita consumption.²⁶⁵

²⁶¹ <https://www.alcoholproblemsandsolutions.org/timeline/Anti-Alcohol-Sentiment-Begins-to-Increase.html>

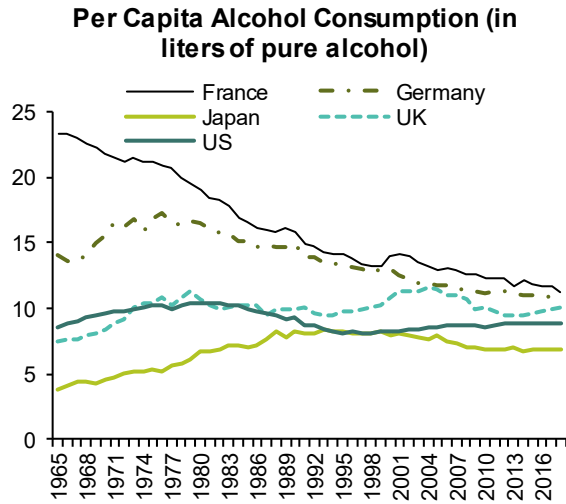
²⁶² <https://onlinelibrary.wiley.com/doi/full/10.1111/add.13431>

²⁶³ https://ec.europa.eu/health/ph_projects/1998/promotion/fp_promotion_1998_a01_27_en.pdf

²⁶⁴ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3629448/>

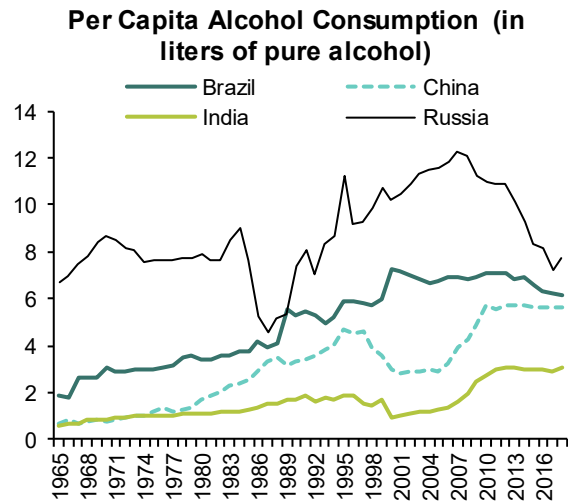
²⁶⁵ [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(19\)32265-2/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)32265-2/fulltext)

EXHIBIT 214: Alcohol consumption in developed markets has declined or held steady over the past 50 years on the back of stricter regulations



Source: WHO and Bernstein analysis

EXHIBIT 215: Conversely, alcohol consumption has increased in a number of emerging markets

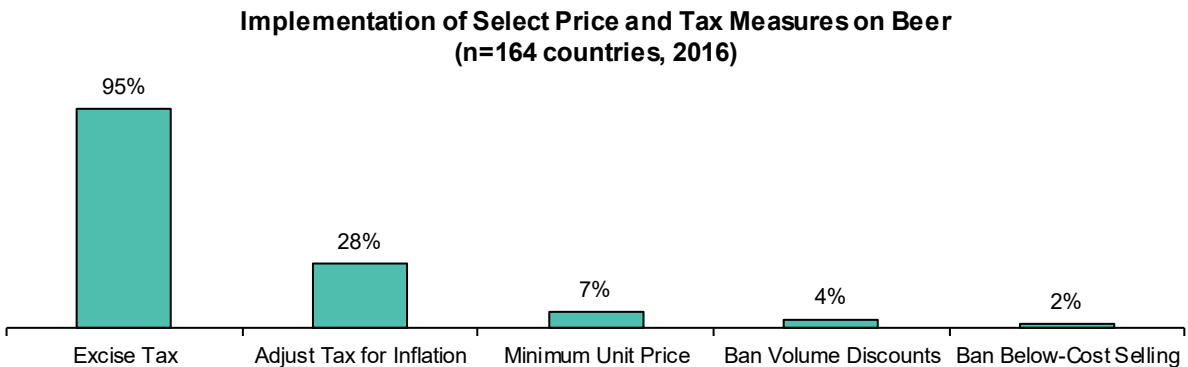


Source: WHO and Bernstein analysis

EXCISE TAX

Increasing the price of alcohol through excise tax or setting a minimum price is one of the most effective measures to reduce the use of alcohol. Studies have repeatedly found increasing the price of alcohol is associated with reductions in alcohol-related morbidity and mortality, including liver cirrhosis deaths, violence, teenage pregnancy, and sexually transmitted diseases.²⁶⁶ According to the WHO, 95% of countries that reported their alcohol policies had alcohol excise taxes on beer as of 2016, although less than half used other pricing strategies (e.g., adjusting taxes to keep up with inflation, imposing minimum pricing policies, and/or banning below-cost selling or volume discounts, see Exhibit 216).

EXHIBIT 216: 95% of countries that reported their alcohol policies had alcohol excise taxes on beer as of 2016, although less than half used other pricing strategies



Source: WHO and Bernstein analysis

²⁶⁶ <https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1&ua=1>

What are the implications for alcohol demand when countries increase the excise tax? A systematic review of 112 studies shows average price elasticities of -0.46 for beer, -0.69 for wine, and -0.80 for spirits (i.e., a 1% price increase could lead to a -0.5% volume decline in beer, -0.7% in wine, and -0.8% in spirits).²⁶⁷

At the country level, **China** saw its per capita alcohol consumption decrease by -6.6% in 2001 when the country levied additional excise taxes on Baijiu (taxing an additional RMB0.5 per 500ml) and beer (increasing the tax from RMB220 to RMB250 per ton for ex-factory price over RMB3,000 per ton, see Exhibit 217).²⁶⁸ However, we note this consumption decline followed three years of double digit percentage declines resulting from weak consumer incomes following state-owned enterprise (SOE) reform, which resulted in widespread closure of SOEs and significant layoffs.

Although the 2001 excise tax changes were intended to increase fiscal revenue rather than improve public health outcomes, the impact on alcohol consumption — particularly on low-end alcohol consumption — was meaningful. The volume of Baijiu selling at <RMB100 per 500ml declined by 10% YoY in 2001 (versus a flat CAGR over 2002-06), whereas Baijiu selling for >RMB100 per 500ml grew by 24% YoY in the same year and overall Baijiu volumes declined by 9%. This asymmetry was driven by the volumetric component to the tax (i.e., 1RMB per liter), which was passed on to consumers and represented a materially higher increase for lower-priced products.

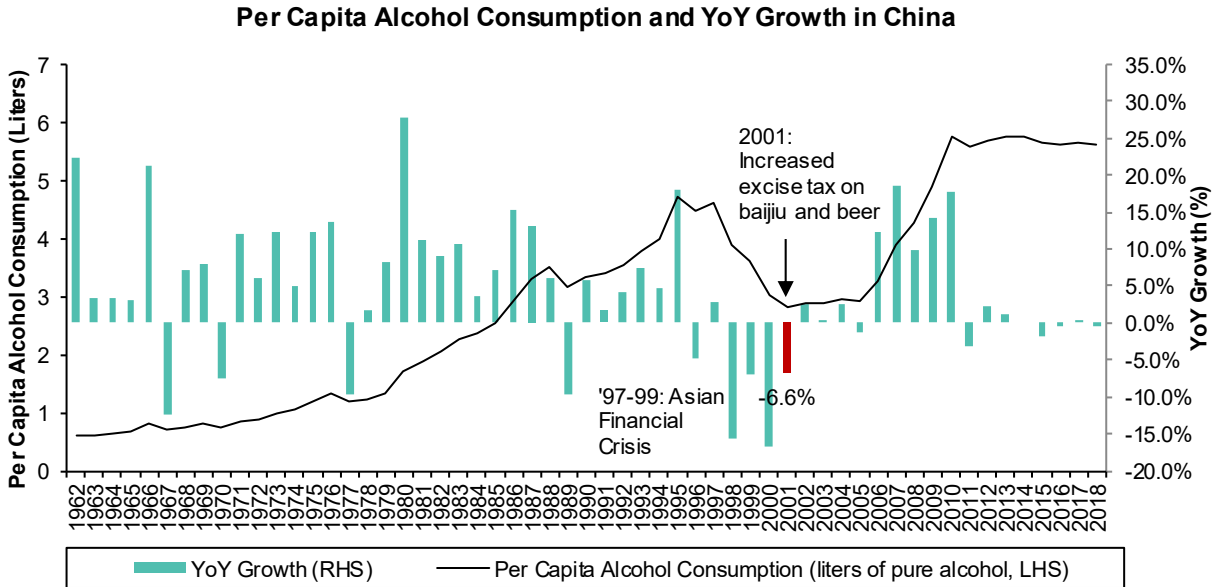
For beer, the 2001 tax hike was less impactful, as the government only raised tax rates for higher-priced beer products, which accounted for ~5% of the industry. In 2001, total beer volumes grew 3% YoY, representing a slowdown from ~7% CAGR over 1995-2000.

In 2006, China updated its policy to unify the tax rate on grain-based and potato-based Baijiu (20% of ex-factory price), while maintaining the RMB0.5 per 500ml charge on top of that. However, companies quickly found loopholes in the system by selling products at relatively low prices to subsidiaries or related parties to avoid taxation. This was later addressed by a 2009 regulation, according to which if the ex-factory price is below 70% of the wholesale price to external parties (i.e., excluding subsidiaries and related parties), the tax base should be 50-70% of the wholesale price. The rules were further tightened in 2017 (see Exhibit 218 and Exhibit 219).

²⁶⁷ <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.470.493&rep=rep1&type=pdf>

²⁶⁸ <https://www.sciencedirect.com/science/article/pii/S1021949814000866>

EXHIBIT 217: China saw its per capita alcohol consumption decrease by -6.6% when the country levied additional excise taxes on Baijiu and beer



Source: WHO and Bernstein analysis

EXHIBIT 218: Baijiu excise tax was increased in 2017 when the calculation methodology was standardized

Date	Historical Baijiu Excise Tax Changes
January 1, 1994	25/15% of Ex-factory Price for Baijiu produced with grains/potatoes
May 1, 2001	25/15% of Ex-factory Price for Baijiu produced with grains/potatoes + RMB1 per L
April 1, 2006	20% of Ex-factory Price + RMB1 per L
July 1, 2009	If ex-factory price is lower than 70% of wholesale price, tax base should be 50-70% of wholesale price
May 1, 2017	If ex-factory price is lower than 70% of wholesale price, tax base should be 60% of wholesale price

Source: Government websites and news, and Bernstein analysis

EXHIBIT 219: The last beer excise tax took place in 2001

Date	Historical Beer Excise Tax Changes
January 1, 1994	RMB220 per ton
May 1, 2001	RMB250 per ton for ex-factory price over RMB3,000 per ton RMB220 per ton for ex-factory price below RMB3,000 per ton

Source: Government websites and news, and Bernstein analysis

For China's brewers, we view excise tax as the most pressing ESG risk from both a likelihood and a financial impact perspective. We consider this an ESG risk because of the propensity for governments to use tax as a social policy tool or to justify increasing tax

revenues under the guise of offsetting the negative health and social implications of excessive drinking.²⁶⁹

Currently, beer excise tax is low (on average 2.8% of the consumer price) and has not varied for close to 20 years. The structure of the tax means it is regressive against SOE brewers, and the government's share of the value chain diminishes as the industry sees higher levels of premiumization. We see short- to medium-term risk that the government looks to remedy these issues under the guise of social policy. The tax is currently levied at a rate of RMB0.125 per 500ml bottle, which means it represents a 2x higher proportion of the consumer price of a mainstream versus a premium Beer (see Exhibit 220). SOE brewers such as CRBeer and Tsingtao (~66-78% of volume) have a materially higher exposure to mainstream and economy beer than internationally owned brewers such as Bud China and Carlsberg (~40-56% of volume, <50% of revenue; see Exhibit 222).

Introducing beer excise rates scaled by ex-factory price would have an immediate negative impact on mainstream+ and premium beer profitability, with a potential higher impact on international brewers initially (depending on rate structures), but such a change could have a more material long-term impact on the premiumization efforts of SOE brewers whose premium offerings currently lack scale and whose development could be curtailed.

We see a more limited excise tax risk for ultra-premium Baijiu. The calculation basis for the value-related portion of Baijiu excise taxes has been standardized over recent years with the effect of increasing the government's revenues. Also, tax increases on Baijiu have a more limited net impact on overall government finances than increases on other alcohol types, given the higher degree of state ownership in Baijiu compared to brewers. On average, the state owns ~60% of the five largest Baijiu companies compared to ~26% of the top 5 brewers (see Exhibit 221).

Over the longer term, we expect the Chinese government to become actively concerned about the negative health and societal impact of excessive alcohol consumption. To improve health outcomes, the most impactful tax change would be to increase the RMB1 per liter component of Baijiu excise. This part of the tax is meaningful in the context of value, low-price, and standard Baijiu (~90% of volumes) but is *de minimis* in the context of ultra-premium, whose burden is largely driven by the value-based component of excise. An increase in volume-based Baijiu tax would likely increase the consumer price of low-end products and enhance the relative affordability of beer, so we would expect a positive impact on beer consumption and a negative impact on Baijiu consumption (see Exhibit 223).

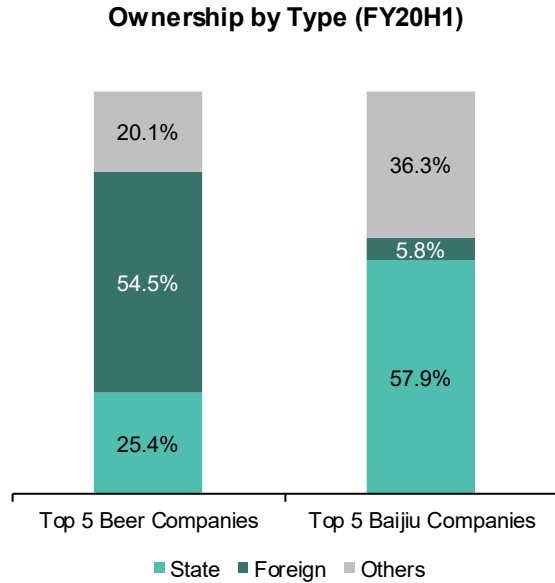
²⁶⁹ See report: [China Beer & Baijiu: Key risks beyond COVID](#).

EXHIBIT 220: **Government's share of beer value chain declines as the industry premiumizes**



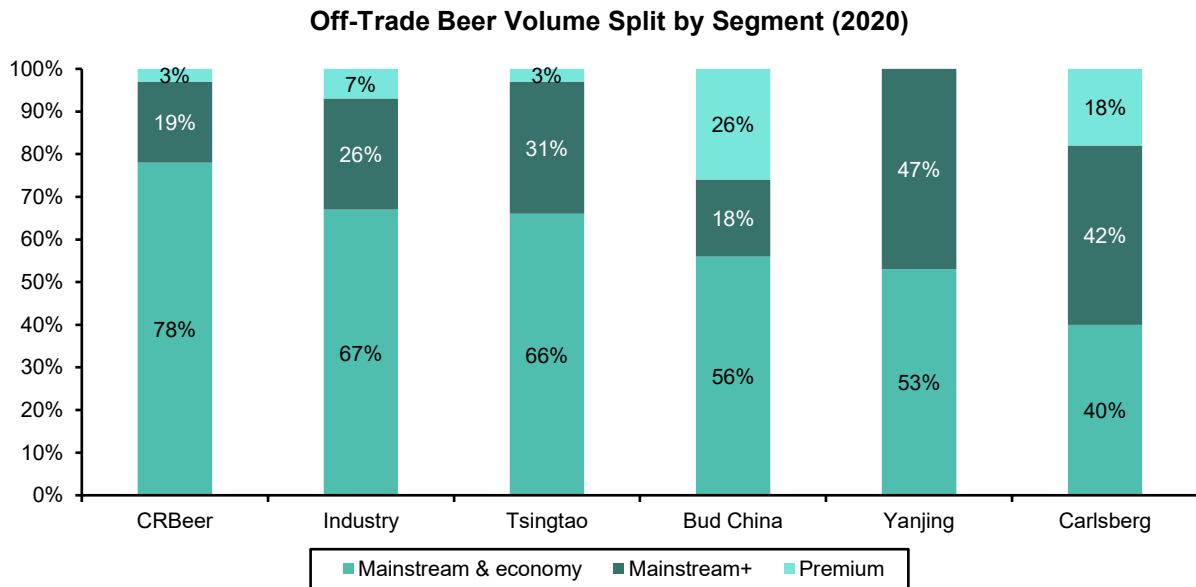
Source: State Tax Office and Bernstein analysis

EXHIBIT 221: **Baijiu companies have higher degree of state ownership than beer companies**



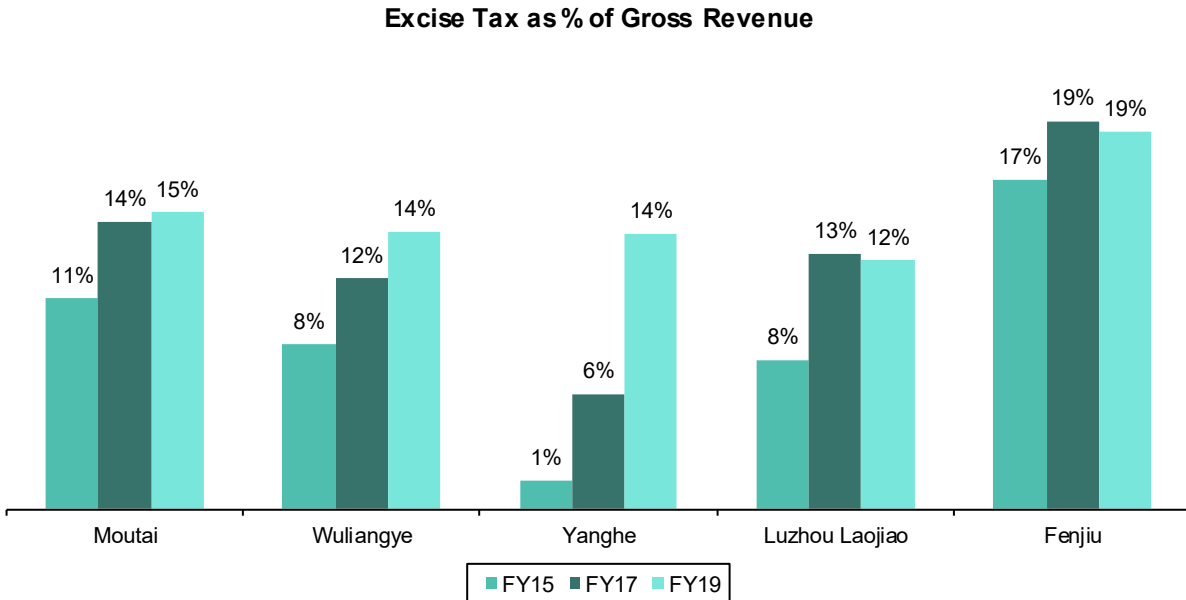
Source: Company reports and Bernstein analysis

EXHIBIT 222: **CRBeer and Tsingtao have highest exposure to mainstream and economy beer**



Source: Nielsen and Bernstein analysis

EXHIBIT 223: **Excise tax as percentage of gross revenue has already increased for Baijiu companies over recent years**



Note: Yanghe FY17 reflects Bernstein estimates of pro forma excise tax following changes in the consolidation of sales company results. Previously, the majority of Yanghe excise tax was included in COGS.

Source: Company reports and Bernstein analysis

MARKETING REGULATIONS

Another effective policy lever to reduce the harmful use of alcohol is to restrict alcohol marketing, especially to under-age consumers. While it is difficult to determine causality, the majority of evidence links industry-driven alcohol marketing to adolescent drinking.²⁷⁰ A longitudinal study by Collins et al.²⁷¹ found that 12-year-olds who are highly exposed to alcohol advertising are more likely to start drinking a year later, compared to 12-year-olds who are only slightly exposed.²⁷² Similarly, a study by Pasch et al. found the exposure of sixth graders to outdoor alcohol advertisements was associated with subsequent intentions to drink alcohol.²⁷³

Adolescents spend an average of 7.5 hours a day interacting with various types of media. A study using Nielsen data found underage drinkers are exposed to alcohol advertisements more frequently than of-age drinkers through various media channels.²⁷⁴ Beyond traditional media such as TV, newspapers, and magazines, over 90% of adolescents report daily activities online. Research found college students' use of social media that carries alcohol advertisements was a significant predictor of drinking frequency and problem

²⁷⁰ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5169036/>

²⁷¹ Collins RL, Ellickson PL, McCaffrey D (2007). Early adolescent exposure to alcohol advertising and its relationship to underage drinking. *Journal of Adolescent Health*, 40(6):527–534.

²⁷² https://www.euro.who.int/_data/assets/pdf_file/0003/191370/10-The-impact-of-alcohol-marketing.pdf

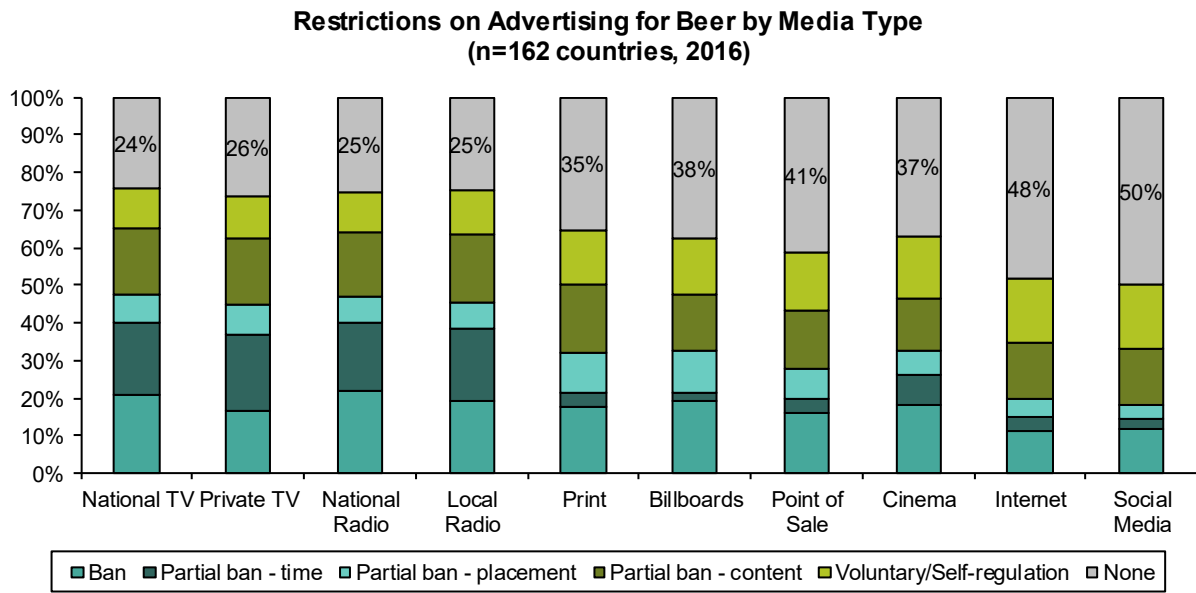
²⁷³ Pasch KE et al. (2007). Outdoor alcohol advertising near schools: what does it advertise and how is it related to intentions and use of alcohol among young adolescents? *Journal of Studies on Alcohol and Drugs*, 68(4):587–596.

²⁷⁴ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5724569/>

drinking, whereas general social media use was not. Meanwhile, restrictions on alcohol advertising to minors, especially through the online channel, fall short of expectations.

According to the WHO, most countries have some type of advertising restriction for beer, with the exception of the internet and social media, where ~50% of countries have adopted no mandatory or voluntary restrictions of any sort (see Exhibit 224). **With social media becoming a much more important marketing channel, especially for young consumers, could we expect more advertising regulations? And what are the financial implications for alcohol companies?**

EXHIBIT 224: Most countries have some types of advertising restriction for beer, with the exception of the internet and social media where ~50% countries have adopted no mandatory or voluntary restrictions of any sort



Note: Partial bans and voluntary/self-regulation are not mutually exclusive categories, and countries may be counted more than once. The percentage in each colored bar indicates the percentage of countries in that category, including the potential double counting impact.

Source: WHO and Bernstein analysis

In the **US**, the First Amendment provides substantial protection to the freedom of speech, which limits the federal government's ability to regulate truthful, non-deceptive alcohol advertising. Instead, most alcohol advertisers have pledged to comply with one of three voluntary self-regulatory codes designed to limit the targeting of teens. In particular, these codes direct that no more than 28.4% of the audience for an ad may consist of people under 21, and that the ad content should not appeal primarily to people under 21.²⁷⁵ According to a Federal Trade Commission (FTC) study, 93% of all measured media met the industry standard as of 2011 and 99.5% of alcohol advertisements online met the

²⁷⁵ <https://www.consumer.ftc.gov/articles/0391-alcohol-advertising>

industry's placement standard (e.g., consumers must enter a date of birth or certify being over 21 years old to enter the site).²⁷⁶

- However, this so-called "age gating" does little to prevent underage consumers from accessing alcohol information online. A recent news article suggests a dummy Instagram profile claiming to be 15 years old was able to follow a number of global and US alcohol brands.²⁷⁷ Instagram even suggested this dummy underage account to follow other alcohol-related accounts. Although we may not have a federal law governing alcohol advertising in the US anytime soon, greater consumer awareness of this issue could drive the industry to work more closely with social media platforms to reduce youths' exposure to alcohol content.

In Europe, **France** has one of the strictest alcohol advertising regulations. With the passage of the Evin Law of 1991, France essentially banned all alcohol advertising on TV, in cinemas, or through sports sponsorships.²⁷⁸ Meanwhile, for any permitted advertising, the content is limited to objective product information (e.g., origin, composition, strength, how it's produced, etc.) and warning messages must be visible and clearly presented.²⁷⁹

- Online advertising is largely permitted in France with the exception of sports websites and websites that target young people. However, a recent court case supported the strict application of the Evin Law online. In particular, the Grimbergen beer website referenced the *Game of Thrones* series in its advertising content, which the court ruled to be promotional in nature and to have nothing to do with objective product information, such as the origin or composition of the product.²⁸⁰

Alcohol advertising regulation in **China** is relatively weak compared to that in many developed markets. The country issued regulations on alcohol advertising in 1995, which bans advertisement that links alcohol to unsubstantiated positive effects (e.g., stress relief or personal success) or that targets young consumers (there is no age limit in China, however).²⁸¹ Each TV channel is allocated at most two slots for alcohol advertising from 7 PM to 9 PM per day, and 10 slots per day for the remainder of the day. Other media channels such as radio, newspaper, and magazines face similar constraints.

- However, studies have found meaningful violations of the advertising regulation, both in terms of the frequency and the content of such advertisement.²⁸² A Chinese alcohol brand, Jinliufu, was a sponsor of the Chinese Olympic Committee in 2004 and aired advertisements linking its brand to good luck on major TV channels. On the positive side, China requires all alcohol products ($\geq 0.5\%$ alcohol concentration) to display

²⁷⁶ <https://www.ftc.gov/system/files/documents/reports/self-regulation-alcohol-industry-report-federal-trade-commission/140320alcoholreport.pdf>

²⁷⁷ <https://www.wsj.com/articles/booze-ads-on-social-media-stir-controversy-11580659200>

²⁷⁸ <https://movendi.ngo/news/2020/06/19/france-alcohol-advertising-ban-wins-case-in-high-court/>

²⁷⁹ https://iris.paho.org/bitstream/handle/10665.2/28424/PAHONMH16001_eng.pdf?sequence=1&isAllowed=y

²⁸⁰ <https://movendi.ngo/news/2020/06/19/france-alcohol-advertising-ban-wins-case-in-high-court/>

²⁸¹ China does not have an age limit on drinking alcohol. However, the Law on Protections of Minors specifies that: (1) parents should not let their children drink alcohol, (2) alcohol should not be sold around schools and kindergartens, (3) liquor stores should not sell alcohol to minors, and (4) drinking at schools and kindergartens is strictly prohibited. This is a big step up from the initial version released in 1991, which only specified that "parents should prevent their children from excessive drinking."

²⁸² http://apapaonline.org/APAPAnetwork/Meeting_Reports/files/Auckland_Sept04/Alcohol_Marketing_China.pdf

warning messages that "excessive drinking is harmful to health" and that "pregnant women and young children should not drink."²⁸³

- In 2018, the original alcohol advertising regulations were replaced by a cross-sector advertising law, which still bans advertisement that links alcohol to positive feelings/personal success or that targets adolescents. However, the TV advertising restriction is limited to liquor only now.
- Overall, there is still a lot of room for improvement in the enforcement of China's alcohol advertising regulation. The WHO has called for a thorough review of China's alcohol policies from a public health perspective, including a complete ban on alcohol marketing.²⁸⁴

Financial implications of alcohol advertising regulations

While alcohol advertising regulations vary across the world, we could see more regulations in the coming years, especially in light of the emergence of alcohol advertising on social media, which appears to be largely unregulated now. What are the potential financial implications for alcohol companies? And what can we learn from historical precedents?

Studies on advertising's impact on alcohol consumption have yielded mixed results. For example, one study found either no relationship or a weak one between advertising and the total consumption of beer, wine, and liquor. However, it found advertising could affect consumers' choice of brands.²⁸⁵ Another study found a small but significant positive correlation between alcohol advertising and consumption, although only in the spirits category.²⁸⁶ This may be because advertising has a diminishing rate of return. When evaluated at the total market level, an incremental advertising dollar's impact on population-level alcohol consumption can be quite limited, especially in saturated markets.

Many studies have not found a link between advertising and overall alcohol consumption. But one study on alcohol advertising restrictions in 20 countries for populations over 26 years estimated that each incremental restriction reduced population-level alcohol consumption by 5-8%.²⁸⁷

- In line with this, the Evin Law of 1991 reduced **France's** per capita alcohol consumption by -5.6% in the same year it was issued (see Exhibit 225).
- In **Russia** (or the Soviet Union prior to 1991), a combination of alcohol control measures as part of the Gorbachev Anti-Alcohol Campaign (including state production control, point-of-sale restrictions, price increases, and a media campaign for healthy lifestyles) reduced its per capita alcohol consumption by over -40% in 1985 and

²⁸³ <https://www.sciencedirect.com/science/article/pii/S1021949814000866?via%3Dihub#bib37>

²⁸⁴ <https://www.who.int/bulletin/volumes/91/4/12-107318/en/#:~:text=For%20example%2C%20China%20has%20no,consumption%20and%20alcohol%2Drelated%20problems.>

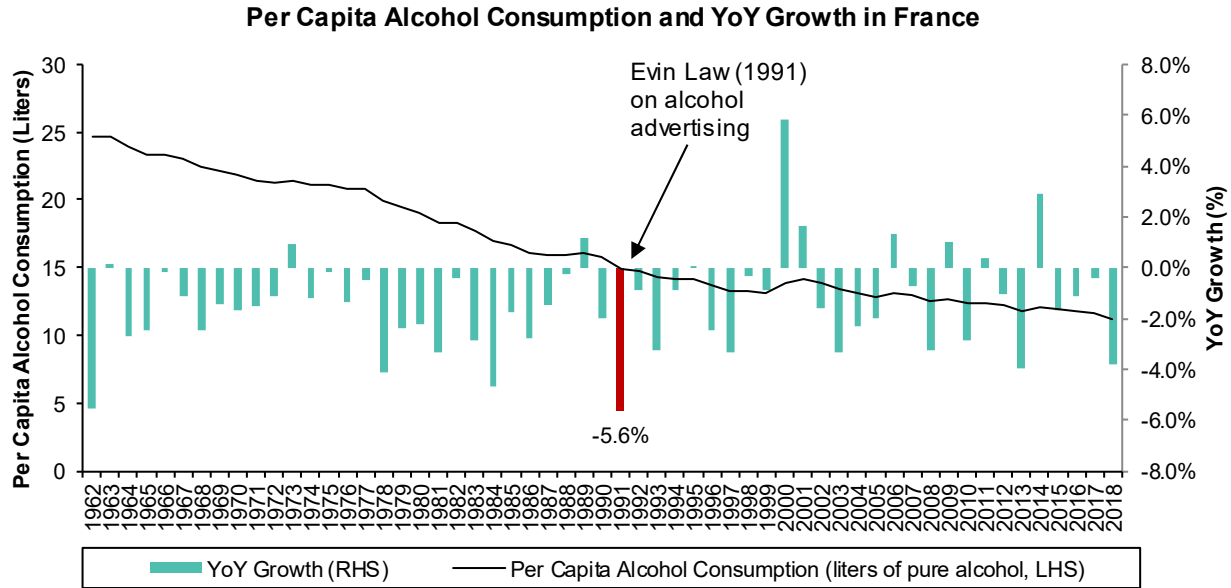
²⁸⁵ <https://news.utexas.edu/2015/03/25/alcohol-advertising-has-little-effect-on-overall-consumption/>

²⁸⁶ <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-8489.2007.00365.x>

²⁸⁷ https://www.nber.org/system/files/working_papers/w7758/w7758.pdf

1986.²⁸⁸ Following the dissolution of the Soviet Union, as alcohol consumption was on the rise once again, Russia introduced a federal law in November 1995, including measures such as alcohol licensing, excise tax, and marketing restrictions, which led to an -18% decline in its per capita alcohol consumption in the following year.²⁸⁹ Another set of measures to reduce alcohol consumption in 2009 led to a -7% decline in per capita consumption. But it is hard to separate the impact of marketing restrictions from other measures (see Exhibit 226).

EXHIBIT 225: **The Evin Law on alcohol marketing reduced France's per capita alcohol consumption by -5.6% in 1991**

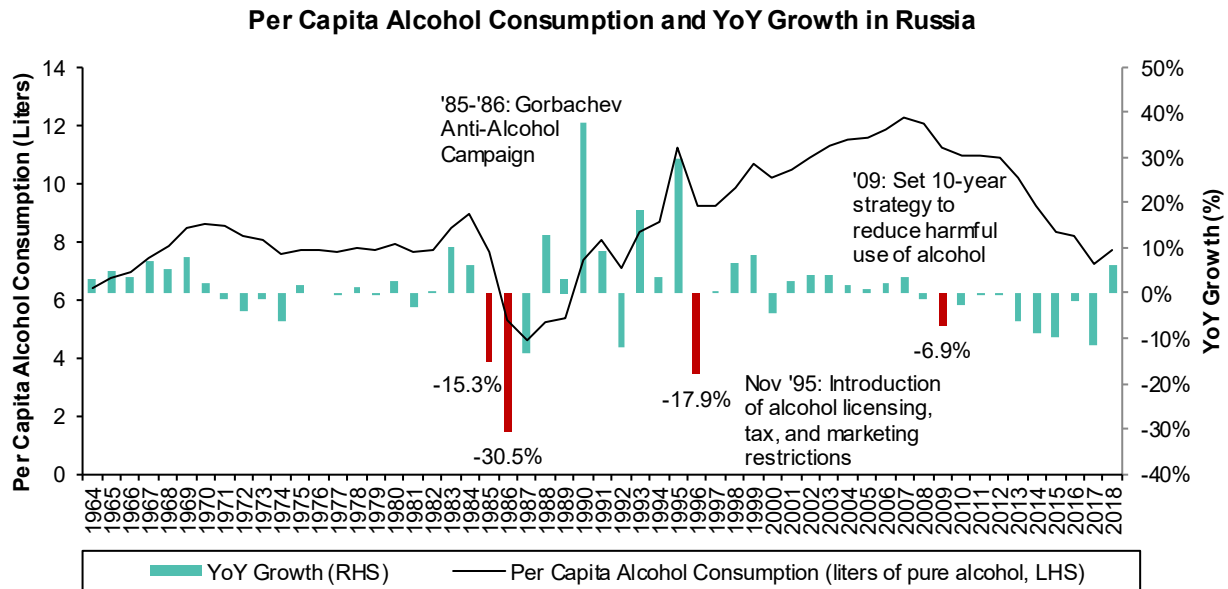


Source: WHO and Bernstein analysis

²⁸⁸ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3818525/>

²⁸⁹ <https://apps.who.int/iris/bitstream/handle/10665/328167/9789289054379-eng.pdf?sequence=1&isAllowed=y>

EXHIBIT 226: **While it's difficult to isolate marketing restrictions' impact on alcohol consumption in Russia, a combination of measures including alcohol licensing, excise tax, and marketing restrictions in 1995 led to an -18% decline in per capita alcohol consumption in the following year**



Source: WHO and Bernstein analysis

STOCK IMPLICATIONS

European Beverages (Trevor Stirling)

The beverage alcohol industry is based on the sale of a psychoactive drug. Harmful use can lead to death, disease, violence, and road accidents. If society turns against alcohol, it can lead to onerous regulation, retail restrictions, high taxation, and potentially even prohibition. If investors turn against beverage alcohol, the companies can be placed on blacklists.

Alcohol has been used and abused by humankind since before the dawn of written history. Some countries have tried prohibition, and most have decided that the negative side-effects of illicit alcohol and associated criminality outweigh the health benefits. The critical challenge for the beverage alcohol industry is to help it structure and operate in a regulated ecosystem, which supports conviviality but minimizes alcohol-related harm and at the same time is squeaky clean on all other ESG dimensions (water, sustainable sourcing/agriculture, diversity and inclusion, etc.).

Over the recent decades, the industry has become progressively more engaged in addressing the harmful use of alcohol. For example, large companies place a lot of emphasis on trying to strike the right balance in recruiting legal drinking age consumers into their brands without enticing underage drinkers. The tone and content of advertising has changed dramatically (and it needed to), even if there are occasional small rogue companies (see [Weekend Consumer Blast: Sex sells? Not anymore...Why marketing booze to women the right way matters more and more](#)). Most companies set aside a material portion of their ad spend to discourage drunk driving. Increasingly, they are addressing broader misuse head-on. For example, AB InBev has launched pilot programs in six cities around the world with the goal of reducing harmful alcohol consumption in those markets by at least 10% and implementing the best practices from those pilots globally by the end

of 2025. However, the scale of misery caused by the harmful use of alcohol demands ever greater efforts from the industry.

Asia-Pacific Beverages (Euan McLeish)

Although we do view health-driven excise taxes and, potentially, marketing restrictions as risks for China's alcohol companies, the sector is trading at a long-term high P/E relative to MSCI China Consumer Staples Index (+28%), and we see little evidence of an ESG discount being priced in at this stage. In our view, China's brewers face the most material excise tax risk with **Bud APAC, CRBeer and Chongqing (not covered) being most exposed**, given the importance of premium beer to their equity stories.

Similarly, **governance-related ESG risks for Moutai and Luzhou Lao Jiao in particular** (see: [China Beer & Baijiu: Key risks beyond COVID](#)) and **water-related risks for China's SOE brewers, Tsingtao in particular** (see: [Climate change scenarios: What does China Beer look like in a 1.8 degree world? Diving deep into water scarcity implications](#)), are currently underappreciated by investors, in our view.

In Baijiu, Wuliangye is the leader in terms of governance, zero carbon targeting, packaging recycling, and ESG reporting. **In Beer, Bud APAC is the most sophisticated** in terms of responsible practices, water efficiency and ESG reporting.

TOBACCO

Since Christopher Columbus brought tobacco to Europe over 500 years ago, tobacco has become a highly profitable global industry. Research started linking smoking to lung cancer in the 1950s, which led to tobacco control programs in developed countries in the 1960s and 1970s.²⁹⁰ However, global tobacco consumption continued to grow as the industry launched PR campaigns, lobbied against regulations, and sought new markets to offset the volume declines in developed markets.

In particular, on the back of growing medical evidence linking smoking to cancer in the 1960s, the tobacco industry joined forces to establish the Tobacco Industry Research Committee (TIRC) with the goal to stop public panic and reassure the public that the industry would responsibly investigate the health implications of smoking. The TIRC went on to spend millions of dollars in industry-funded research that claimed the link between smoking and cancer could not be proven. This, combined with the intense industry lobbying effort, delayed the ban on cigarette advertising on TV and radio in the US until 1971. A few decades later, in response to evidence that secondhand smoke could be harmful to nonsmokers, the tobacco industry adopted similar tactics and funded research "to keep the environmental tobacco smoke controversy alive."²⁹¹

Beyond funding research, the industry has a long history of lobbying against tobacco control policies. For example, the industry spent more than US\$43mn in the first half of 1998 on lobbying against a tobacco bill in the US sponsored by Senator John McCain that

²⁹⁰ <https://www.annualreviews.org/doi/full/10.1146/annurev-publhealth-032315-021850>

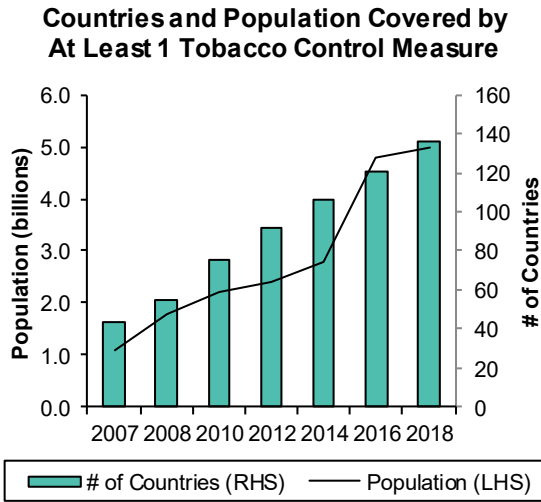
²⁹¹ [https://www.who.int/bulletin/archives/78\(7\)902.pdf](https://www.who.int/bulletin/archives/78(7)902.pdf)

aimed to increase the price of cigarettes and to give the FDA authority to regulate nicotine as a drug. The bill was narrowly defeated in Congress, which reflected the formidable influence of industry lobbying at the time. More recently, in 2009, FDA was granted powers to regulate tobacco products with the support of the industry at the time.

As developed markets became more regulated and saturated, companies looked overseas and focused more actively on expanding into emerging markets, which led to continued global growth in tobacco consumption. Today, China is the world's largest tobacco producer and consumer, with more than 300 million smokers.²⁹² Our Tobacco team notes the Chinese cigarette market has essentially been a state-owned monopoly since the 1950s, so the ongoing prevalence of cigarettes in China is not a relevant indicator to the behavior of the listed international tobacco companies.

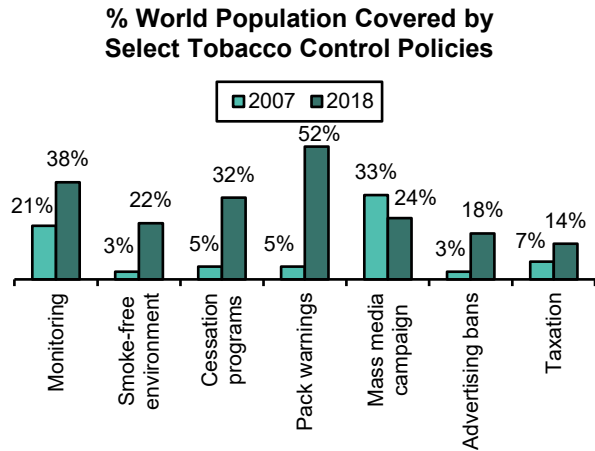
The WHO's first public health treaty — the Framework Convention on Tobacco Control (FCTC) — was enacted in 2005 and introduced demand reduction measures in 2007 to curb global tobacco demand. Since 2007, the number of countries that have implemented at least one tobacco control measure has more than tripled from 43 in 2007 to 136 in 2018 (see Exhibit 227), which covers 5 billion or 64% of global population (see Exhibit 228). Since 2007, global (ex-China) cigarette volume growth has been negative at a CAGR of -2.1% (see Exhibit 229).

EXHIBIT 227: Since introduction of FCTC measures in 2007, the number of countries that have implemented at least one tobacco control measures has more than tripled...



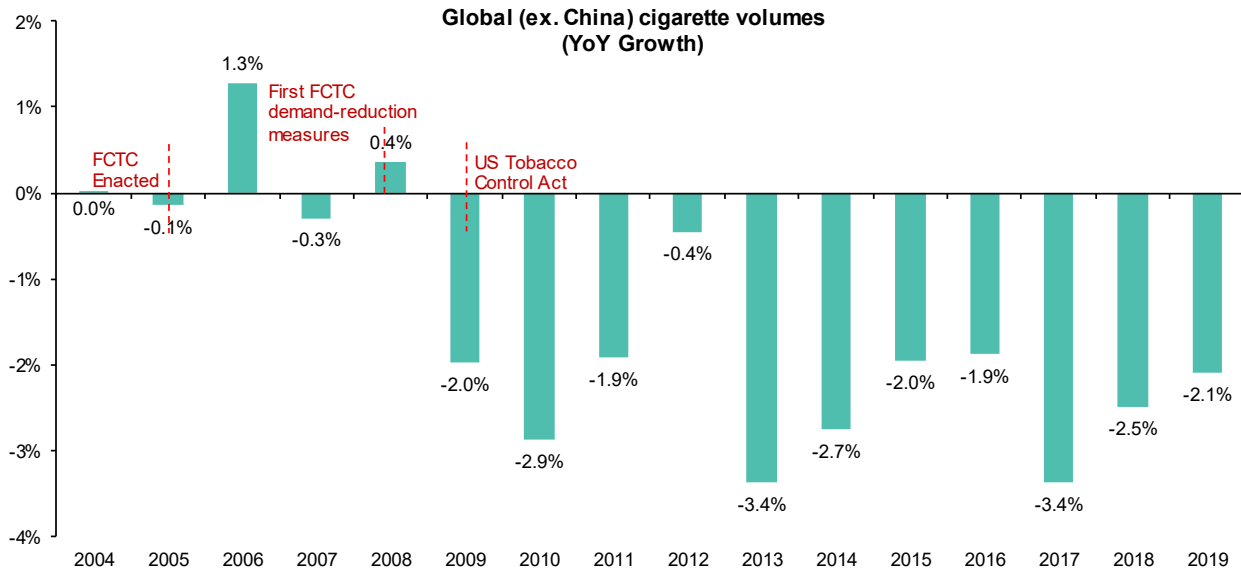
Source: WHO and Bernstein analysis

EXHIBIT 228: ...covering 5 billion or 64% of global population



Source: WHO and Bernstein analysis

²⁹² <https://www.who.int/tobacco/about/partners/bloomberg/chn/en/>

EXHIBIT 229: **Since 2007, the global (ex-China) cigarette volume growth has been negative at a CAGR of -2.1%**

Source: Euromonitor and Bernstein analysis

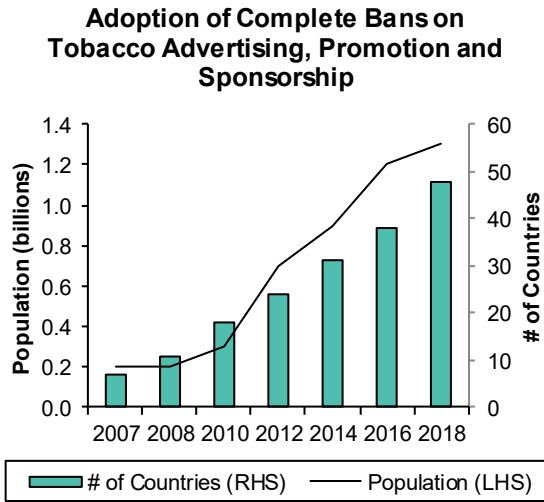
The unintended consequence of tobacco regulations is that they've created significant barriers to entry for smaller players to compete. We look at two case studies to better analyze regulations' implications for tobacco companies.

ADVERTISING BANS

Advertising for cigarettes and tobacco products was once commonplace.²⁹³ The UK was probably the first country to introduce restrictions on tobacco advertising back in 1965. This was some way ahead of other developed markets. In the US, television and radio advertising were banned in the early 1970s. While many developed markets had made significant progress on marketing restrictions by the 1990s, many emerging markets lagged behind. This was where the FCTC came in to introduce a number of tobacco control policies, including recommendations around restricting tobacco marketing. Since 2007, 40+ countries have adopted complete bans on tobacco advertising, promotion, and sponsorship (see Exhibit 230). Interestingly, more low-income countries have adopted complete bans on the back of FCTC recommendations, while the majority of high-income countries have relied on partial bans that cover some but not all forms of direct/indirect advertising (see Exhibit 231). The US itself actually remains fairly liberal with respect to the forms of tobacco marketing permitted across the market.

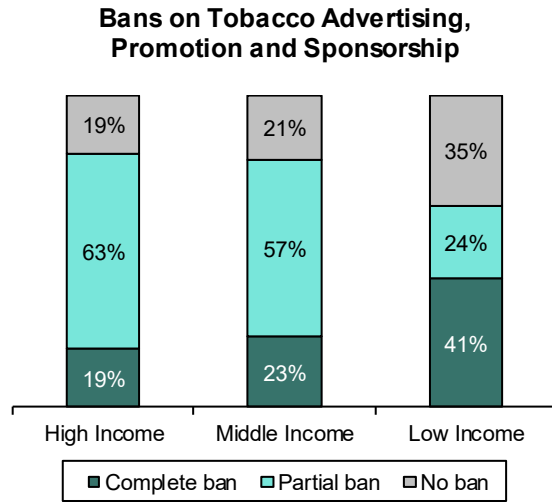
²⁹³ See report: [Weekend Consumer Blast: Are Advertising Bans Really That Bad for Big Tobacco?](#)

EXHIBIT 230: **Since 2007, 40+ countries have adopted complete bans on tobacco advertising, promotion, and sponsorship**



Source: WHO and Bernstein analysis

EXHIBIT 231: **More low-income countries have adopted complete advertising bans while most high-income countries have relied on partial bans**



Note: Complete bans are bans on all forms of direct and indirect advertising (or at least 90% of the population covered by complete subnational bans); partial bans are bans on national TV, radio, and print media as well as some but not all other forms of direct/indirect advertising; and no ban is a complete absence of ban, or ban that doesn't cover national TV, radio, and print media.

Source: WHO and Bernstein analysis

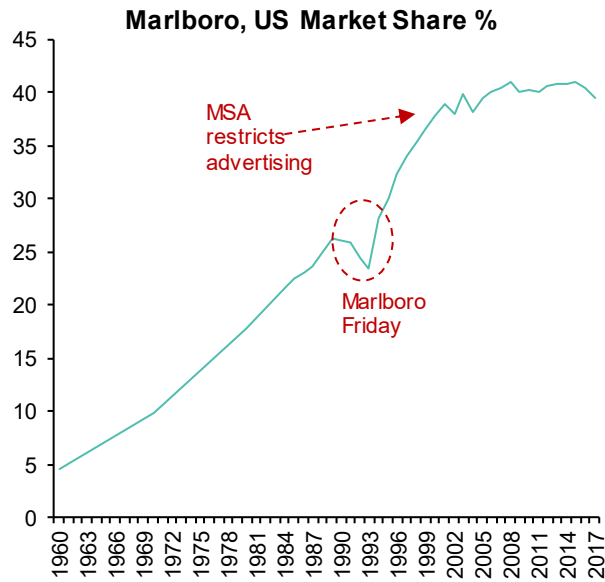
While such advertising bans have perhaps contributed toward declining cigarette volume growth, they have largely benefited incumbents by making it extremely difficult for new entrants to build brand awareness. This has, in turn, led to relatively stable market share, all else being equal. In the US, Marlboro's market share has plateaued since further advertising bans were introduced in the 1990s²⁹⁴ (see Exhibit 232). However, without its hugely successful marketing through the 1960s to the 1980s, Philip Morris (Altria) would likely not be the dominant force in US cigarettes that it is today. Likewise, without the platform that was built in the US and the subsequent marketing that followed globally, Marlboro's (and by definition Philip Morris International's (PMI) international success would surely not have been possible (see Exhibit 233).

How about advertising on social media? In the Wild West of social media where traditional rules fall under the gray area, tobacco companies have been accused of targeting young consumers with deceptive social media marketing. In a petition filed with the US FTC in 2018, a coalition of non-profit and public health organizations analyzed 123 hashtags associated with four big tobacco companies (PMI, British American Tobacco, JT International, and Imperial Brands) and found they had been viewed 8.8 billion times in the

²⁹⁴ In November 1998, the largest cigarette manufacturers in the US entered into the Master Settlement Agreement (MSA) with 46 states, five US territories, and the District of Columbia, which imposed a number of advertising restrictions, including preventing cigarette companies from targeting youth, banning cartoons and most forms of outdoor advertising, and most sponsorships. <https://www.publichealthlawcenter.org/topics/commercial-tobacco-control/commercial-tobacco-control-litigation/master-settlement-agreement>

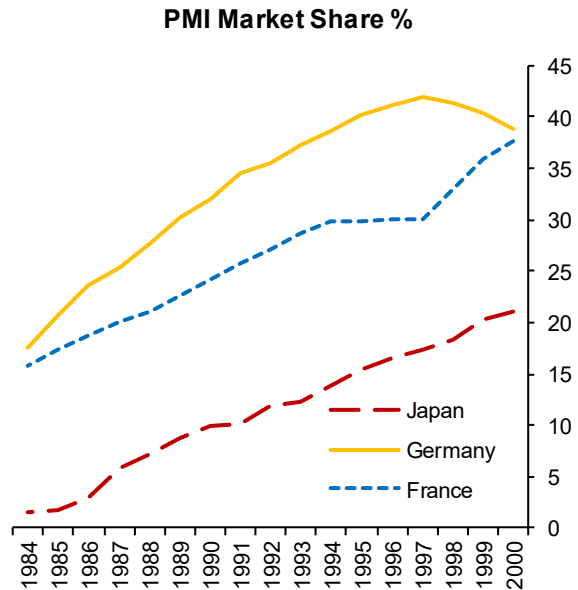
US alone and 25 billion times across the world.²⁹⁵ In December 2019, the UK Advertising Standards Authority ruled against British American Tobacco (BAT) and others for promoting their products on Instagram. Facebook and Instagram announced new policies immediately after to restrict the marketing of branded tobacco and e-cigarette products. However, unbranded advertising is still allowed, while enforcement remains patchy in the online world. We could expect more regulations around tobacco advertising on social media, although this may again largely hurt new entrants while preserving the current market structure for incumbents.

EXHIBIT 232: Marlboro's US market share has plateaued since additional US advertising bans were introduced in 1998



Source: Company reports and Bernstein analysis

EXHIBIT 233: Without the platform built in the US and the marketing that followed globally, PMI's international success would not have been possible



Source: Tobacco Merchants' Association and Bernstein analysis

EXCISE TAX

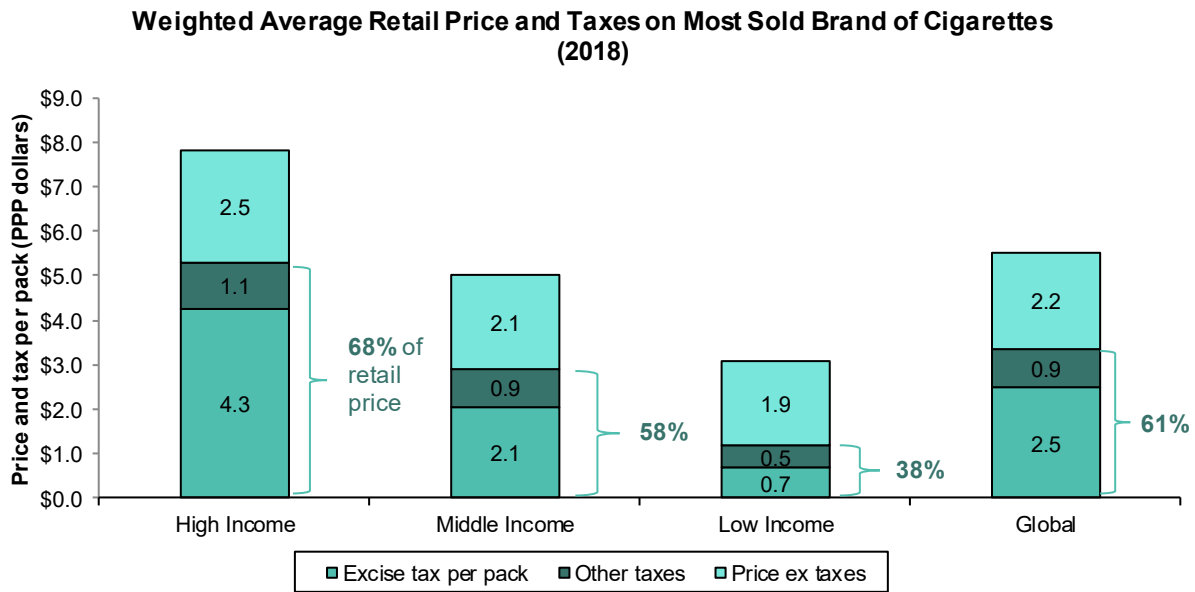
Beyond advertising bans, regulators have also levied excise and other taxes, which have averaged 61% of the retail price of cigarettes globally (see Exhibit 234). While taxation could increase going forward, the tobacco industry has historically demonstrated a very strong pricing power on the back of a highly concentrated and stable market structure. In the US, while taxes as a percentage of price increased from 37% in 2008 to 43% in 2018, the price (net of tax) of the most-sold cigarette brand increased from US\$2.91 to US\$3.91 (international dollars at purchasing power parity). Similarly, in the UK, despite a tax increase from 77% in 2008 to 79% in 2018, the retail price after tax increased from US\$1.92 to US\$2.80 (see Exhibit 235 and Exhibit 236).

²⁹⁵ <https://www.nytimes.com/2018/08/24/health/tobacco-social-media-smoking.html>;
https://www.tobaccofreekids.org/assets/content/press_office/2018/2018_08_ftc_petition.pdf

What's the net financial impact on cigarette producers? Assuming a price elasticity of -0.4 for cigarette products in developed markets (according to the WHO),²⁹⁶ cigarette companies' strong pricing power and after-tax price growth have outweighed the negative volume impact on average in the US and UK (see Exhibit 237). Specifically, using pricing of the most-sold cigarette brand as a proxy, the average cigarette price increased by 50% and 65% in the US and UK, respectively, from 2008 to 2018. This implies a -20% and -26% volume impact, assuming price elasticity of -0.4. On an after-tax basis, given cigarette companies' strong pricing power, the average cigarette pricing (net of tax) increased by 35% and 45% in the US and UK, respectively. As the net-of-tax price increase outweighs the negative volume impact, the average cigarette company has likely generated positive sales and profit growth thanks to its pricing power.

In comparison, alcohol brands, especially mainstream ones, do not enjoy the same level of pricing power. Across North America, Western Europe, and Asia-Pacific, the top 5 cigarette companies control close to or over 90% of market share (see Exhibit 238). The alcohol market is considerably more fragmented, with the top 5 companies typically controlling less than 50% of market share. The one exception is the beer industry in North America, where the top 5 companies control 84% of market share as AB InBev and others led a major wave of consolidation through acquisitions of small craft beer brands.

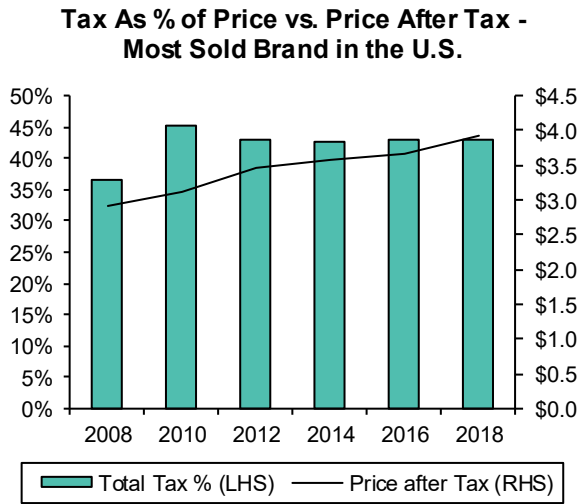
EXHIBIT 234: Beyond advertising bans, regulators have also levied excise and other taxes, which have averaged 61% of the retail price of cigarettes globally



Source: WHO and Bernstein analysis

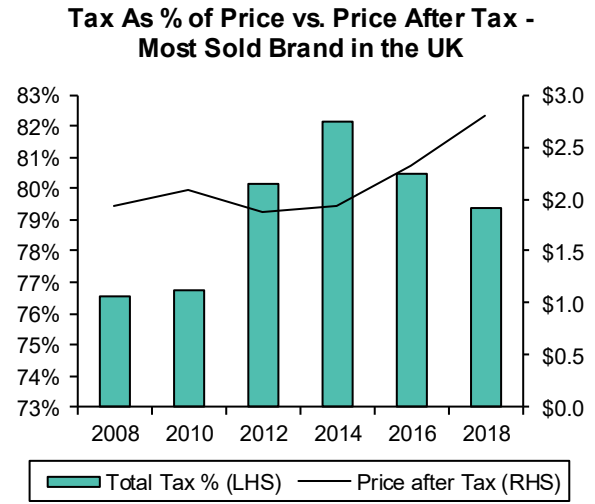
²⁹⁶ https://www.who.int/tobacco/publications/gender/en_tfi_gender_women_taxation_economic_tobacco_control.pdf?ua=1

EXHIBIT 235: In the US, while taxes increased from 37% in 2008 to 43% in 2018, the retail price of cigarettes (net of tax) increased from US\$2.91 to US\$3.91



Source: WHO and Bernstein analysis

EXHIBIT 236: In the UK, despite a tax increase from 77% in 2008 to 79% in 2018, the retail price after tax increased from US\$1.92 to US\$2.80



Source: WHO and Bernstein analysis

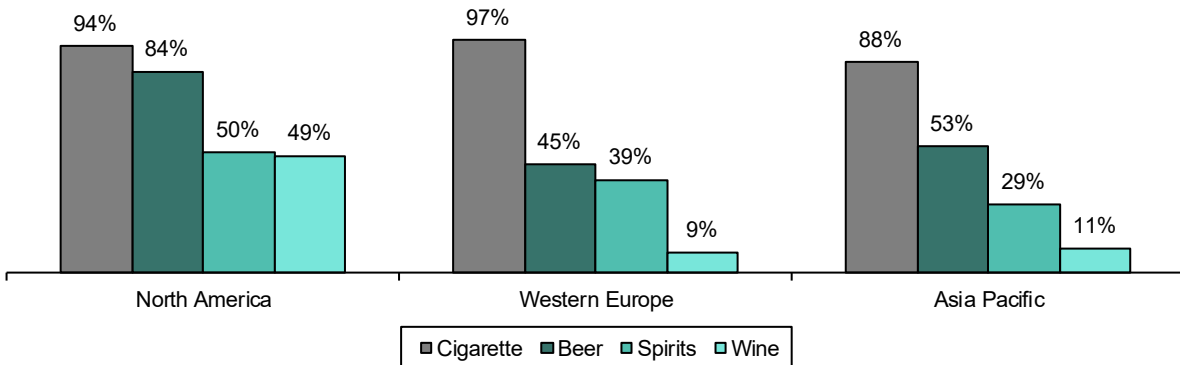
EXHIBIT 237: Assuming a price elasticity of -0.4 for cigarette products in developed markets, cigarette companies' strong pricing power and after-tax price growth have outweighed the negative volume impact in the US and UK

	Price			Price Elasticity (b)	Volume Impact (c) = (a) x (b)	Tax Rate		Price (After Tax)			Sales Impact (e) = (1+c) x (1+d)-1
	2008	2018	Δ (a)			2008	2018	2008	2018	Δ (d)	
US	4.6	6.9	50%	-0.4	-19.9%	37%	43%	2.9	3.9	35%	7.9%
UK	8.2	13.6	65%	-0.4	-26.2%	77%	79%	1.9	2.8	45%	7.4%

Source: WHO, and Bernstein estimates (price elasticity) and analysis

EXHIBIT 238: **The cigarette industry has significant pricing power thanks to its concentrated market structure; in comparison, the alcohol market is considerably more fragmented (with the exception of the North American beer industry)**

**Combined Market Share of Top 5 Companies By Category
(2019)**



Source: Euromonitor and Bernstein analysis

NEXT-GENERATION PRODUCTS (NGPs) AND PRODUCT MARKETING

Traditional cigarettes aside, are next-generation tobacco products (e.g., vapes and heated tobacco products) "ESG friendly"? The tobacco industry argues the burning of nicotine is the main cause of smoking-related health issues. As a result, by replacing the burning process with heating liquids (e.g., e-cigarettes or vapes) or heating (not burning) tobacco leaves (e.g., heated tobacco products), the industry has been promoting the health benefit of NGPs relative to traditional cigarettes.

However, for these relatively new products we simply don't have enough research on their long-term health implications. According to the CDC, e-cigarettes or vapes have the potential to benefit adult smokers who are not pregnant if used as a complete substitute for regular cigarettes. However, they are not safe for youth, pregnant women, and adults who do not currently smoke. Additional research is needed to understand their long-term health implications.²⁹⁷

Using history as a guide, it took us decades to fully grasp the harmful effects of extended X-ray exposure. X-rays were first discovered in 1895. Despite some incidents of X-ray-related injuries, the early use of X-rays was widespread and unconstrained, to the extent that during the 1930s and 1940s, shoe stores offered free X-rays so that customers could see the bones in their feet.²⁹⁸

Our Tobacco team takes a slightly different perspective on this issue:

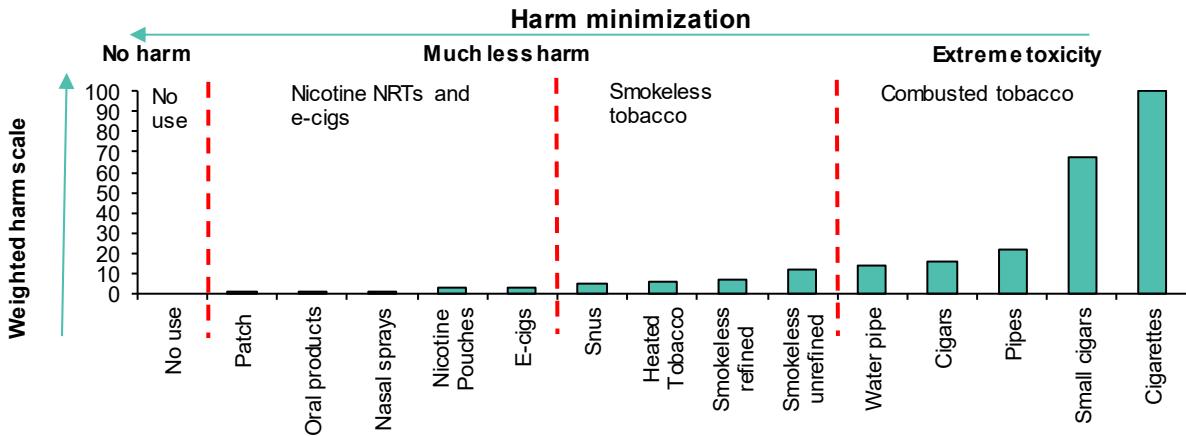
- This issue is hugely complicated and it's difficult to fully do justice in this short space. Nevertheless, for our part, we think the evidence supporting the **relative** reduction in health impacts of NGPs versus the catastrophic health harms of cigarettes has

²⁹⁷ https://www.cdc.gov/tobacco/basic_information/e-cigarettes/index.htm

²⁹⁸ <https://columbiasurgery.org/news/2015/09/17/history-medicine-dr-roentgen-s-accidental-x-rays>

become increasingly clear over the past few years. The FDA itself has recognized this relative reduction in risk with its acceptance of the concept of the "Continuum of Risk" in 2017 (see Exhibit 239).

EXHIBIT 239: **The FDA itself acknowledged the concept of the Continuum of Risk in 2017**



Source: Glasser et al. and Bernstein analysis

We've published some work previously looking at this topic, which we won't repeat here ([Weekend Consumer Blast: Vaping & Health](#)). There are some important caveats to this, however:

- First, we can't stress the word "relative" nearly enough in the previous sentence. Smoking-related diseases kill around 6 million people every year, so the bar for these NGPs to be *less* harmful is extremely low. As mentioned previously in the note by our Global ESG team, it will take time to deliver epidemiological studies that confirm the absolute levels of harm associated with NGPs. Science has come quite a way over the past 125 years since the development of X-rays(!), so I'm not sure these historical examples are so relevant. Nevertheless, it may still take 15-20 years of prolonged use for us to fully understand the long-term impact of vaping/heated tobacco on consumers' health.
- Second, too much of the scientific work still comes from tobacco companies themselves. Public health bodies and NGOs are — rightly — somewhat skeptical of the industry's own studies, especially given the historical background of data obfuscation by the industry. So, it may take longer to have proper, independent, third-party analysis.
- Third, there's an awful lot of confusion in this space, especially as pertains to vaping. We saw this in particular during the vaping health scare of 2019. Vaping is a broad term used to describe the vaporization of a liquid intended for pulmonary delivery (i.e., for that vapor to be inhaled into the lungs). While vaping of nicotine is the predominant use of vaping products today, vaping in general is not limited to vaping of nicotine-based liquids, and we see widespread use of vaping products in the cannabis space as well as increasing use for things like vitamins. This confusion around the vaping

term is acutely seen among consumers and the media, where we saw a conflation of issues in 2019 with the vaping health scare — linked specifically to cannabis vaping products — impacting consumers' perception of the nicotine vape market as well.

- Finally, and importantly, not all these NGPs are necessarily alike. Unlike cigarettes, where the health impacts of using the product is closely aligned across different brands, we don't believe this is the case today for vaping. Outside the US (where the category is regulated by the FDA), there are very few regulations or product standards limiting the types of chemicals or additives that can be included in NGPs. And (as we explain in the note linked earlier) this likely means the impact on consumers' health of using NGPs may differ materially across various product types and brands.

Back to Zhihan and team ESG:

While NGPs have shown some early promise of reducing the harmful impact of smoking for existing smokers, we believe it's prudent to not get ahead of ourselves and claim NGPs will end the cigarette pandemic. However, tobacco companies have gone ahead and marketed many NGPs much in the same way that cigarettes were marketed 30 years ago.²⁹⁹

- This is perhaps most easily seen with some of the e-cigarette marketing in the US over the past few years. For example, we have seen the return of nicotine marketing in New York's iconic Times Square.
- Similarly, if somewhat more subtly, big international tobacco companies have rekindled old relationships with Formula One teams. In 2019, PMI again partnered with Ferrari to place logos for "[Mission Winnow](#)" on Formula One cars (albeit only in certain races — the livery was removed in the first race of the season in Australia and several subsequent races following significant protest by anti-tobacco communities; see Exhibit 240).
- Our Tobacco team also wrote about BAT's questionable social media marketing of its nicotine pouch brands ([BAT: Dubious Social Media Marketing](#)). The brand continues to promote this lifestyle marketing practice as it pictures its products alongside a healthy salad (see Exhibit 241).

With the health implications of NGPs remaining unproven, such marketing practices may not be the most responsible action to take. Moral concerns aside, these practices could attract additional regulatory scrutiny on the sector and have material financial implications for the future growth of NGPs.

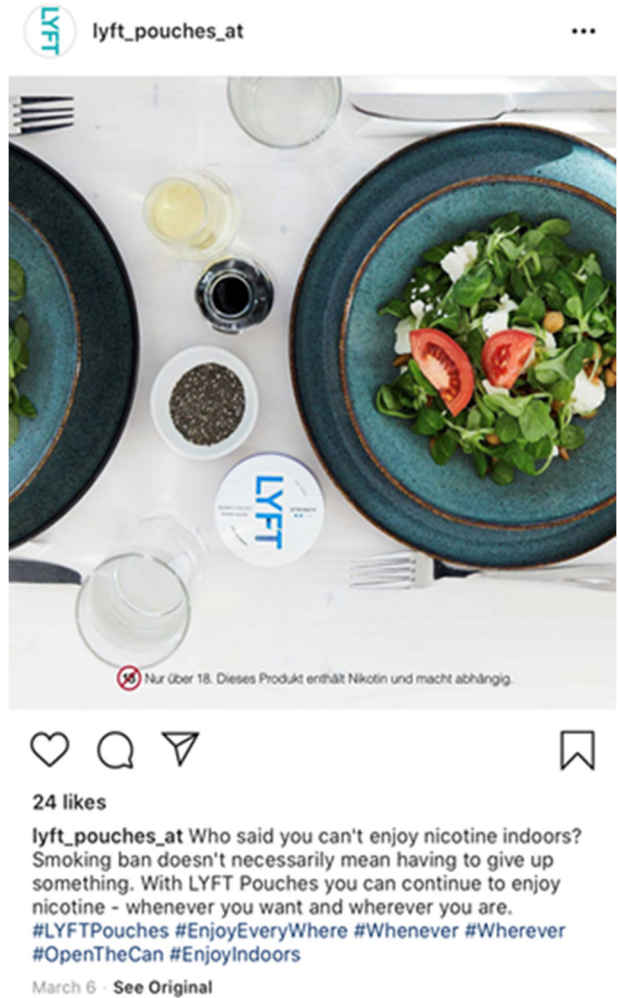
²⁹⁹ See report: [Weekend Consumer Blast: Tobacco & ESG - Incompatible or Opportunity?](#).

EXHIBIT 240: **PMI's "Mission Winnow" branding controversially appeared on Ferrari's 2019 Formula One car**



Source: Company website and Bernstein analysis

EXHIBIT 241: **Can I have the feta cheese salad and a nicotine pouch please?**



Source: Lyft Austria Instagram and Bernstein analysis

STOCK IMPLICATIONS

Global Tobacco (Callum Elliott)

How much of an ESG discount are tobacco companies trading at? Is there a way to quantify this by looking at ownership?

Zhihan isn't the first person to ask us this question. And we're fairly certain she won't be the last! We'll be the first to admit we don't think that we have a great — quantitative — answer. Nevertheless, we do our best, below. In short, we think the answer is: "it depends" what you mean by an "ESG discount."

There are myriad ways we've thought about trying to cut this question over the years:

Can we look at quantifying what proportion of AUM **can't** invest in tobacco?

- When we last looked at this question back in March 2020 ([Weekend Consumer Blast: Tobacco & ESG - Incompatible or Opportunity?](#)), we used signatories of the UN's tobacco-free-finance pledge as a proxy for investors who couldn't invest in tobacco. At the time, we quantified that those signatories had roughly US\$7tn in AUM (albeit not all in equities), which at the time translated to roughly 10% of global AUM.
- The problem we then face is: what does that teach you? What do you do with that 10% figure? How does it translate into an "ESG discount"? The total market cap of all global listed tobacco/nicotine companies is only around US\$500bn, so we don't honestly believe removing US\$7tn of AUM from your potential universe of owners *should* materially impact tobacco valuations, given the potential universe remains at US\$60tn+ of AUM.

We left the word "can't" in bold earlier, to emphasize the existence of a tangible restriction in place to prohibit investment in tobacco. However, in our experience, the universe of investor's who **don't** or **won't** invest in tobacco far outweighs those who "can't." During our years looking at tobacco stocks, we've met and spoken with (and importantly, struggled/failed to meet/speak with!) multitudinous investors, many of whom were "out" of tobacco. In those conversations, ESG pressures have often been cited as a reason for not owning tobacco stocks. In a time where ESG credentials are "table stakes" for asset managers, ownership of tobacco stocks can lead to some uncomfortable conversations with asset allocators. PMs are forced to justify ownership of tobacco. And many clients with whom we speak struggle with this justification. Anecdotally, we think this pressure to justify tobacco ownership could well have played a material part in tobacco's lackluster performance over recent years.

However, we're not sure we think this lackluster performance has been driven by the introduction of an "ESG discount."

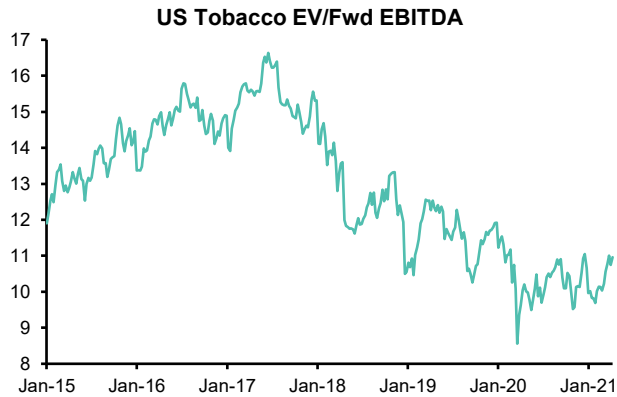
Certainly, this need to justify ownership to asset allocators is an ESG-driven trend. But for our part, we think it's really the **lack of justification** that has driven the poor performance. Over the past five years, disruption in the tobacco/cigarette industry has accelerated with cannibalization of cigarettes by NGPs. This disruption, combined with renewed regulatory pressures (especially in the US market), has led to almost unprecedented uncertainty for a previously stable, predictable industry. This uncertainty made it extremely challenging to predict with any comfort how long-term (and even medium-term) fundamentals of the tobacco industry would look. For many investors with whom we spoke through the course of 2018-19, tobacco simply sat in a "too difficult" box. With the future too challenging to forecast with any degree of accuracy, that made justifying ownership of tobacco stocks an extremely tough endeavor. Any investor — whether facing ESG pressures, or not — would have faced the same struggle to justify tobacco ownership, in our opinion.

Interestingly, as the regulatory situation has evolved and stabilized over the past 18 months — in turn impacting the path of NGP disruption — we've seen a return of interest in the tobacco space. Investors with whom we've spoken over the past 10 months seem a lot more comfortable with forecasting the development of the industry today than they did two years ago.

So, in general, we're a little skeptical as to whether (the growth of) ESG has truly been a significant contributor to weakness in the sector, and broadly think it's much more likely that increasing uncertainty has been a much bigger driver. That said, we'd also make the point that regulation (motivated largely by the social impact/harms of tobacco smoking) and NGP disruption (driven also by the social harms of tobacco smoking) are both clearly issues relevant for ESG investors. They're just issues that are so intrinsic to the evolution of tobacco sector fundamentals that every investor — whether explicitly or implicitly integrating ESG within their investment process — is cognizant of them, and has been cognizant of them since long before "ESG" became a trendy topic (see Exhibit 242 and Exhibit 243).

We have also had many conversations focusing on the impact of ESG on European tobacco companies in particular, with ESG being more rooted in Europe. While we no longer cover European tobacco names, we don't think it's clear that ESG has impacted the European tobacco names in a more pronounced way than the US names we still cover. Exhibit 244 shows EV/12-month-forward EBITDA for Altria versus BAT, showing the two companies derated broadly in line with each other between 2017 and 2020.

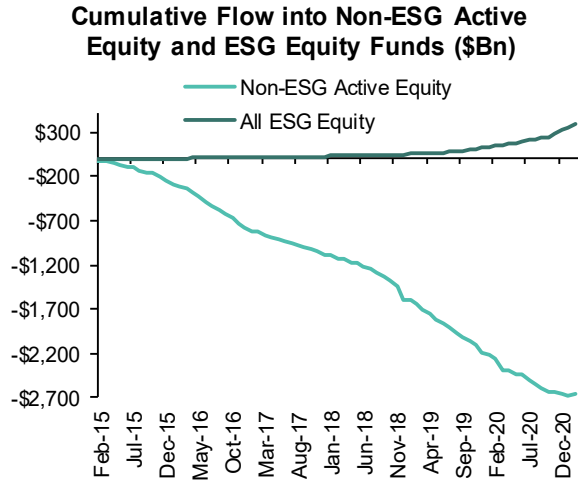
EXHIBIT 242: **Tobacco valuations**



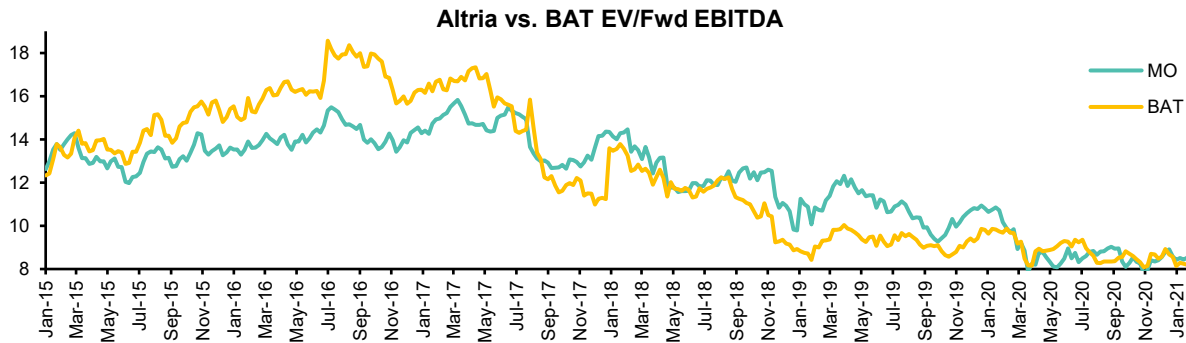
Notes: S&P500 Tobacco Industry. Blended Fwd-12-Month Consensus EBITDA.

Source: Bloomberg and Bernstein analysis

EXHIBIT 243: **ESG AUM**



Source: EPFR monthly data and Bernstein analysis

EXHIBIT 244: **Altria versus BAT valuation**

Note: BAT is uncovered. MO is the ticker for Altria.

Source: Bloomberg and Bernstein analysis

After pricing in potential regulatory risks, are tobacco companies undervalued? Is there an investment case after accounting for the potential downside?

We like to be quite careful when talking about "regulatory" risks, especially in the US market. Tobacco in the US is regulated by the FDA, and has been since the introduction in 2009 of the Family Smoking Prevention and Tobacco Control Act (Tobacco Control Act). The Tobacco Control Act is quite specific in the regulatory powers it grants to the FDA, and the process of introducing new regulatory measures is quite challenging and subject to legal scrutiny. As a result, the FDA has not been hugely successful in introducing new regulatory measures over the past 12 years. To say the least (see Exhibit 245 and Exhibit 246).

For example, in June 2011, the FDA proposed a rule (i.e., a regulation) requiring colored graphics depicting the negative health consequences of smoking on cigarette packs and in cigarette advertising (such as we see in most other developed markets around the world). As per the proposed rule, such warnings were required to cover at least 50% of the front and back of all cigarette packs and at least 20% of all cigarette advertisements. Although the rule was originally planned to be implemented by September 2012, the five biggest US tobacco companies challenged the FDA's decision in court.

EXHIBIT 245: **Health warning labels proposed by the FDA in 2011**



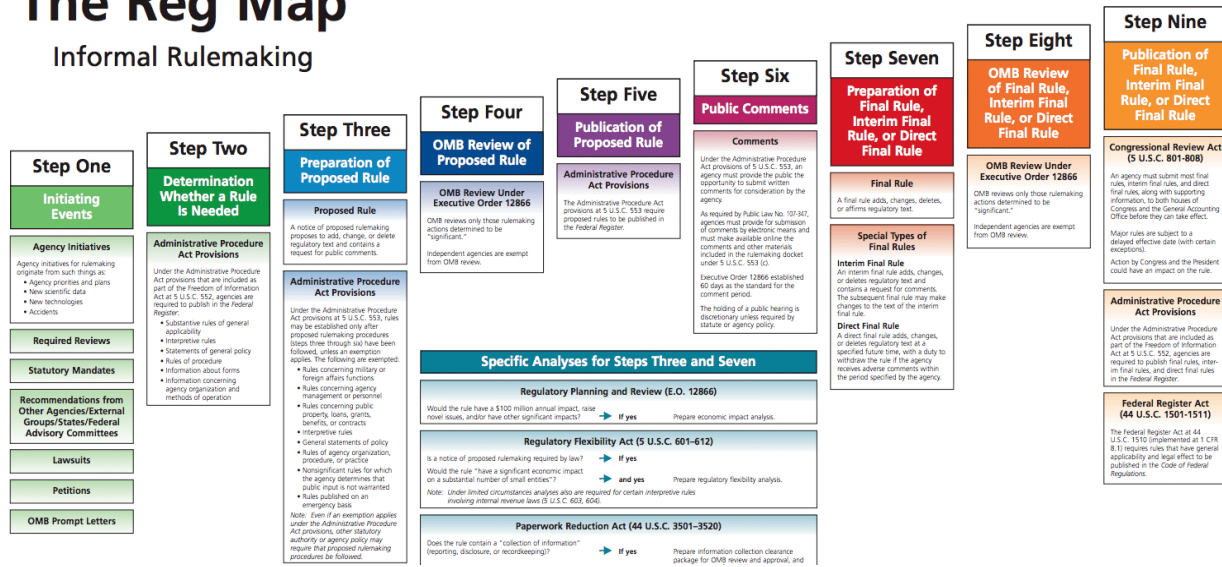
Source: FDA and Bernstein research

The law was struck down by the courts in August 2012 after finding that the proposed health warning requirements violated corporate speech rights. The FDA's petition for a rehearing was denied in December 2012, following which it has been performing research to show that graphic labels would reduce smoking. We note that as of November 2021 — almost nine years after the proposed introduction of this regulation — the process is still stalled. All this delay and legal process for a regulatory measure that has proven to be largely immaterial to tobacco consumption trends in international markets!

EXHIBIT 246: The nine-step regulatory rule-making process followed by FDA is subject to lengthy legal delays

The Reg Map

Informal Rulemaking



Source: Reginfo.gov

We don't think the risk of the FDA meaningfully impacting the tobacco industry — in a detrimental way — is that material in the medium term. We think a realistic timeframe for any such material change is likely to be around 10+ years from today. Progression toward any such material change also presupposes that the FDA chooses to focus its resources on these issues — the risk of which we believe is somewhat mitigated in the medium term, given the overwhelming focus of the agency on youth usage issues. That's not to say the FDA can't impact sector sentiment though, even if such announcements are unlikely to lead to fundamental changes for many years. We saw this, for example, in July 2017 when former FDA commissioner Scott Gottlieb set out his plan to reduce the level of nicotine in combustible cigarettes. No such change has been or is close to being made, but the whole sector derated materially as a result of the announcement.

While the risk of regulatory changes from the FDA may be fairly muted in the medium term, we think it is acutely important to be cognizant of potential changes in the political/legal landscape, which is not subject to the same stringent procedures as the FDA. Any such legal changes are much more subject to the whims of politicians and public opinion — as we saw very clearly during President Trump's time in the White House during the period of heightened public concern around youth usage of vaping products in 2018-19. Politicians and lawmakers also control the tax landscape, which is managed separately from the FDA.

Internationally, the regulatory process varies across different countries, but typically is less scrutinous and more subject to rapid change than the US. Which clearly means international markets are more challenging to predict.

This all begs the question of how one accounts for these regulatory/political/legal risks when valuing tobacco companies. We think there are two key elements to this discussion:

- First, how do you model the impact of any changes during your explicit forecast period? We model out 10 years to the end of 2030, so there are clearly a lot of potential changes that could and will occur. "Known unknowns," so to speak.
- Secondly, how do you account for the impact of the "unknown unknowns"? The left-tail events that no one sees coming — like the FDA's announcement of a plan for tobacco and nicotine regulation in July of 2017.³⁰⁰

With respect to the first issue of "**known unknowns**," we think one has to implicitly assume that we will continue to see further regulatory, legal, and tax headwinds. We don't know when or where exactly they will come. In 2020, Indonesia and South Africa were the worst hit. 2018 saw a devastating blow to the Saudi Arabian market and big headwinds in California. We don't know where the headwinds will come in 2022, let alone 2030. But we're pretty confident they *will* continue to come from somewhere, and so we don't think it would be reasonable to forecast these headwinds abate all of a sudden. We implicitly assume these headwinds continue when forecasting volume declines across the industry.

With respect to the second issue of "**unknown unknowns**," there are two methods we use to factor these risks into our tobacco company valuations. First: **we value our tobacco companies using a rate of terminal decline in cash flows**, rather than the positive terminal growth we use for our beverage/HPP companies. To some degree, we think this rate of terminal decline accounts for some of the risk of left-tail regulatory/legal developments that could cause sector profitability to decline, and also accounts for some of the (admittedly long-term) risk that, at some stage, we could see the complete elimination of cigarettes from certain markets. In a similar vein, **our second method is to add a "tobacco-specific premium" to our estimate of cost of capital for tobacco companies**. The extract from our Altria DCF (see Exhibit 247) shows these two methods, with a 3% tobacco-specific premium and a 5% rate of terminal decline. The impact of these factors on our Altria valuation is very material. If we were to remove the tobacco-specific premium and change the rate of terminal growth to 0%, our DCF valuation would change from US\$59 to US\$97. Put another way, the combined impact of the two factors is equivalent to applying a 40% discount to a multiple methodology.

³⁰⁰ <https://www.fda.gov/news-events/press-announcements/fda-announces-comprehensive-regulatory-plan-shift-trajectory-tobacco-related-disease-death>

EXHIBIT 247: Removing our tobacco-specific premium of 3% and raising terminal growth from -5% to 0% increases our DCF valuation from US\$59 to US\$97

Assumptions	
US (10-yr Bond)	1.2%
Average Risk Free Rate	1.2%
Market Premium	7.8%
Market Rate (LT SPX Est.)	9.0%
Beta	0.80
Tobacco-specific Premium	3.0%
Ke [=Rf+Beta(Rm-Rf)]	10.4%
Kd	3.0%
Tax Rate	35.4%
After Tax Kd	1.9%
Equity @ Market Value	82,171
Tgt. Debt to Capital	18%
Tgt. Equity to Capital	83%
WACC	8.9%
Terminal Growth	-5.0%

Calculation	
PV of Free Cash Flows	102,585
Terminal Value	65,247
PV of Terminal Value	12,922
Implied TEV (Tobacco Business)	115,506
ABI Stake @ Spot	13,610
Juul Stake @ \$3.8bn	1,330
Cronos Stake @ Spot	1,763
Less: Net Debt	(23,388)
Less: Minorities @ 12x P/E	96
Equity Value	108,917
Ordinary shares outstanding	1,842
Equity Value per Share	59.1

Assumptions	
US (10-yr Bond)	1.2%
Average Risk Free Rate	1.2%
Market Premium	7.8%
Market Rate (LT SPX Est.)	9.0%
Beta	0.80
Tobacco-specific Premium	0.0%
Ke [=Rf+Beta(Rm-Rf)]	7.4%
Kd	3.0%
Tax Rate	35.4%
After Tax Kd	1.9%
Equity @ Market Value	82,171
Tgt. Debt to Capital	18%
Tgt. Equity to Capital	83%
WACC	6.5%
Terminal Growth	0.0%

Calculation	
PV of Free Cash Flows	126,055
Terminal Value	195,584
PV of Terminal Value	59,839
Implied TEV (Tobacco Business)	185,894
ABI Stake @ Spot	13,610
Juul Stake @ \$3.8bn	1,330
Cronos Stake @ Spot	1,763
Less: Net Debt	(23,388)
Less: Minorities @ 12x P/E	96
Equity Value	179,305
Ordinary shares outstanding	1,842
Equity Value per Share	97.3

Note: The 1.2% risk-free rate is from July 2021.

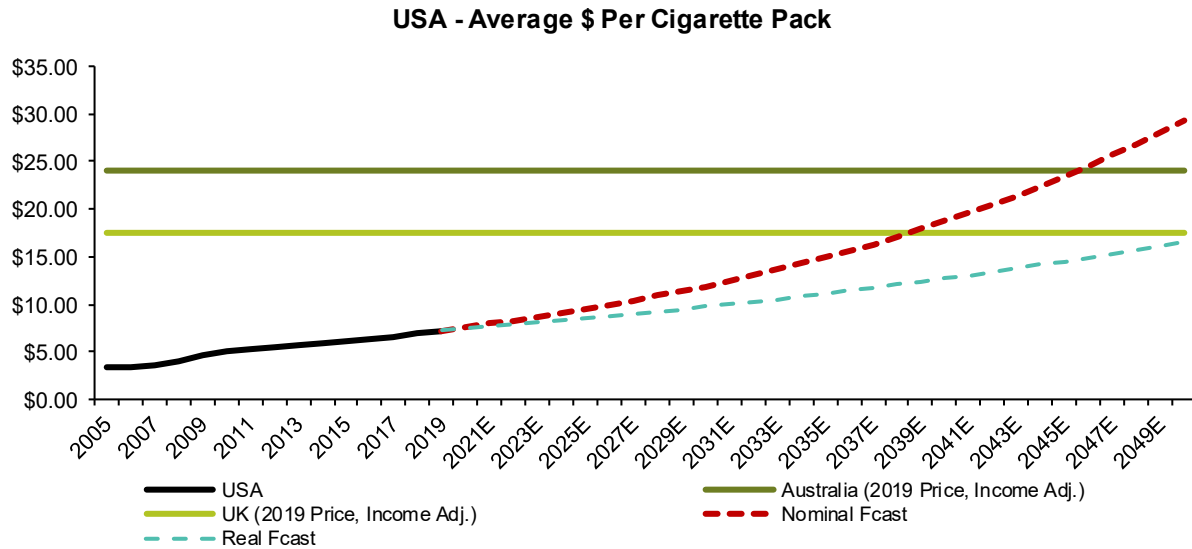
Source: Bloomberg, company reports, and Bernstein estimates and analysis

What does that mean for the investment case today?

In our view, this leaves tobacco — broadly — looking quite attractive today (see Exhibit 248). Fundamentally, we think regulation/legal changes, while presenting some threats, also create material barriers to entry that will continue to benefit incumbents, especially in the US market, where the regulatory landscape is clearly defined. While we expect the health impact of cigarettes to lead to ongoing volume declines (both from a price elasticity perspective due to rising taxes, and due to consumers quitting because of the risks of smoking), we expect this impact of volume declines to continue to be mitigated by companies' ability to push through manufacturer pricing increases. As with the regulatory environment, we also believe the US market is one of the best positioned from this pricing

perspective, as cigarettes today are extremely affordable in the US relative to other developed markets globally.

EXHIBIT 248: **We see 30+ years of pricing runway for the US cigarette market**



Note: Income adjusted, takes UK/AUS prices, converted to US\$, and grosses up by the ratio of household disposable income in the respective markets.

Source: Euromonitor, and Bernstein estimates and analysis

To put this into numbers, we estimate US cigarette volumes could shrink at ~6% per year annually over the next 30 years and industry revenues would still be flat, profits up. At a -6% CAGR, market volumes would be down -85% over this 30-year period, and the industry could still be delivering more profit.

Which companies are leaders versus laggards when it comes to responsible practices (e.g., advertising NGPs)?

In our opinion, this is quite a challenging question to answer, largely because views around what constitutes "responsible practice" are not aligned.

Even among ourselves here at Bernstein, we're not all aligned on this! For the part of our Tobacco team, we think the biggest, most important ESG issue facing tobacco companies is the huge burden of tobacco-related disease and death. Around 6 million people die every year from tobacco-related disease. Roughly double the number who have died from Covid-19 since the start of the pandemic! Just imagine if the same effort was put into eliminating the tobacco "epidemic" as has been applied to the Covid-19 pandemic.

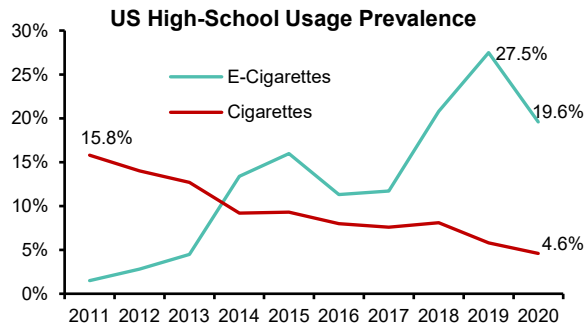
Nicotine is a hugely addictive substance, and smokers' success at quitting "cold turkey" is extremely low. Roughly 50% of smokers attempt to quit every year, but only around 3% are successful. As a result, in our view, by far the most efficient way to reduce this burden has been — and will continue to be — through tobacco "harm reduction" policies. Which is to say by encouraging consumers to switch to NGPs.

As a result, in our view, the companies engendering this switch should, simplistically, be considered the "leaders" for tobacco ESG. Clearly, however, there are also other factors at play — chief among them the marketing of these same NGPs that are engendering the switch away from cigarettes. This issue reared its head in dramatic fashion through 2018-19, as youth usage of nicotine vaping products rocketed.

It's clearly a fine balance to strike between making consumers aware of these new NGPs/engendering understanding of the products and their relative benefits versus cigarettes/making them appealing enough that smokers want to switch to using them, as against restricting the appeal of the products to nonsmokers and children in particular.

We think it's important to look at usage of these nicotine and tobacco products holistically, especially when it comes to youth. To look at the big picture — namely, nicotine usage rather than just e-cigarette usage. This big picture, in our opinion, presents a narrative in stark contrast to what we see in mainstream media. Youth use of nicotine products is actually down slightly over the past 10 years despite a sharp increase in youth e-cigarette usage. This is largely explained by a very sharp decline in youth cigarette use, down around 70% in the last nine years (see Exhibit 249 and Exhibit 250).

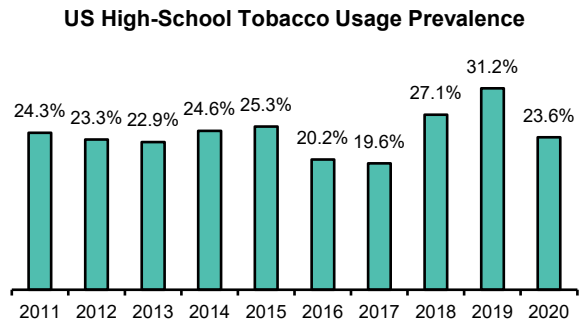
EXHIBIT 249: Youth cigarette usage has declined in tandem with the rise in youth e-cigarette usage



Note: Respondents indicate past 30-day usage as the time frame to reference when answering the survey

Source: CDC Morbidity and Mortality Weekly Report (MMWR) and Bernstein analysis

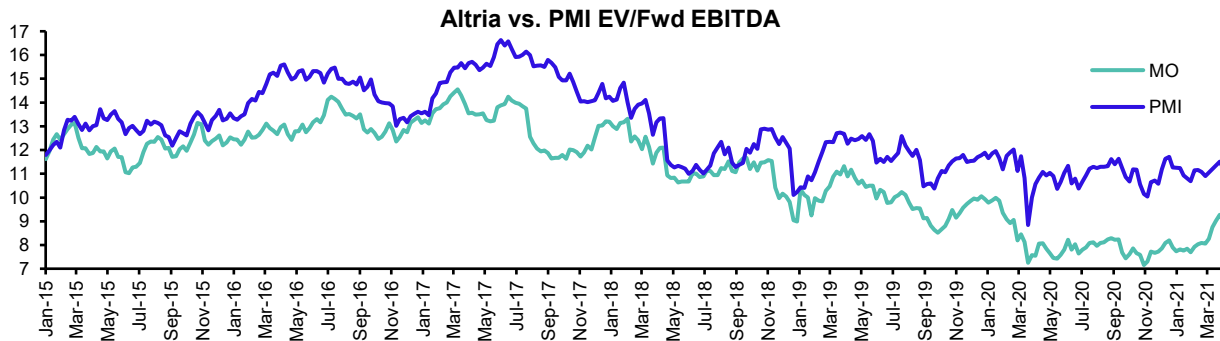
EXHIBIT 250: Youth tobacco usage is broadly flat despite some volatility



Note: Respondents indicate past 30-day usage as the time frame to reference when answering the survey

Source: CDC MMWR and Bernstein analysis

By a large margin, the company that has most driven this transformation of the tobacco industry is **PMI**. PMI generated ~25% of its revenues from NGPs in 2020. However, we believe this performance is largely baked into PMI's premium valuation relative to tobacco peers, and we rate PMI Market-Perform. On the flip side, we see scope for **Altria** to meaningfully rerate and narrow this valuation gap versus PMI as it expands distribution of NGPs in the US beyond 2021, and we rate Altria Outperform (see Exhibit 251). For more on our Altria thesis, please see our [initiation report](#) (page 83 and onward for tobacco).

EXHIBIT 251: **Altria trades at a significant discount to PMI**

Note: Altria multiple adjusted to account for ABI stake.

Source: Bloomberg and Bernstein analysis

+ GAMBLING

Gambling dates back to before written history and has been an activity engaged in by most civilizations. Historically, the industry's reputation has been tainted by criminal activity, such as the early days of Las Vegas and organized crime and Triad involvement in Macau prior to China's takeover of the city. There has been widespread legalization of gambling across many countries over the past few decades, and with greater regulation, criminal ties have largely dissipated (but not everywhere). Responsible gaming has been a key focus by regulators due to the financial and emotional toll experienced by problem gamblers and their families/communities. For most people, gambling is a harmless recreational activity. However, a small percentage of the population drifts into becoming problem gamblers, defined as individuals who suffer from the urge to gamble despite harmful consequences to themselves and others. Severe problem gambling may involve mental disorders. For example, pathological gambling, a form of psychiatric disorder, is defined as a persistent and recurrent maladaptive gambling behavior.³⁰¹ Academic studies have estimated ~2-3% of US adults are problem gamblers while another ~1% could be classified as pathological gamblers.

According to our Global Gaming team and the American Gaming Association, the US gaming industry is estimated to contribute ~US\$115bn directly to the US economy.³⁰² This figure includes ~US\$94bn of gaming and non-gaming revenue at commercial and tribal casinos, ~US\$7bn of gaming equipment manufacturers' revenue (US), and ~US\$14bn of ancillary revenue (monies spent by casino patrons, including travel and spend at non-casinos non-gaming during casino trips). The overall economic impact related to the gaming industry in the US is estimated to be nearly US\$185bn (US\$70bn more than direct impact), which includes additional supply chain effects supported by the gaming industry. The casino and gaming manufacturers industry directly employed over 560k people, with another 420k people employed to support the indirect supply chain benefits related to the

³⁰¹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3361844/>

³⁰² <https://www.americangaming.org/wp-content/uploads/2018/06/OE-AGA-Economic-Impact-US-2018-June.pdf>

gaming industry. One argument made by anti-gambling advocates is that casinos should not be treated favorably because the jobs and revenue they create are merely taking jobs and revenue out of other industries. However, this argument is spurious and can be made for many industries.

Another point to consider about legalized gambling is the benefit of having such a "sin" industry under proper government supervision and regulation. The legalization of casinos across the US (and now the legalization of sports betting) has shifted gambling activity away from underground, illegal, crime-ridden circles into the open. Government regulation allows for consumer protection (i.e., not being cheated by the casino) and responsible gambling application at gaming venues. The economic benefit of the gaming industry has supported capital flows into the industry and, therefore, many governments' decisions to legalize gambling activities.

Nevertheless, although problem gambling only accounts for a small proportion of the population and its prevalence has remained somewhat steady, problem gambling does have some negative societal impact. One of the leading voices in the social impact of gambling has been Professor Earl Grinols. His 2011 academic study estimated the average cost of each pathological gambler (the most severe type of problem gambler) to be US\$9,393 to society, in 2011 dollars, about US\$11,000 today (see Exhibit 252). Some costs included are arguable, but we have included them in our analysis. This estimate is based on earlier studies in the US looking at problem gambling costs that stem from both legal and illegal gambling, so part of the cost would be as a result of illegal activity to begin with and should not be linked to legal gambling. These studies evaluated the social cost of gambling from a number of different perspectives, including crime-related costs (e.g., police, adjudication, and incarceration expenditures), business and employment costs (e.g., lost productivity and unemployment costs), personal bankruptcy costs, illness and suicide costs, social service costs (e.g., treatment and social welfare costs), family costs (e.g., divorce, separation, child abuse, and neglect), and the cost of abused dollars (i.e., money or property stolen by a relative or friend that's not reported as a crime). While we use the US\$11,000 cost, estimates vary widely and we believe this figure is aggressive. Nevertheless, we run our analysis using this amount to show the potential impact.

Past studies have estimated that in the US less than 1% of adults (this would currently be ~1.77 million people) can be classified as pathological gamblers. The American Psychiatric Association's Diagnostic and Statistical Manual (DSM IV) defines pathological gambling as "persistent and recurrent mal-adaptive gambling behavior as indicated by five (or more) of" 10 items. Listed among the behaviors are committing illegal acts such as forgery, fraud, and theft to finance a gambling habit, repeated unsuccessful attempts to stop gambling, returning another day to win back previous losses, lying to conceal the extent of one's gambling, and damaging significant personal relationships due to gambling activity. Without delving into why some of the US\$11,000 per person estimate may be overstated, the overall social cost of gambling in the US would be ~US\$19.5bn today. This represents close to 17% of the ~US\$115bn generated by casinos, gaming equipment manufacturers, and ancillary businesses directly tied to gambling activity (see Exhibit 253). If one looks at the US\$185bn of economic activity tied to the gambling industry overall, social costs would be less than 11%.

Meanwhile, similar to the tobacco industry and most other industries (pharma, video games, entertainment, sodas, fast food, sugar, corn, etc.), the casino industry funds industry research, which can be argued leads to a compromised quality of research.³⁰³ For example, we have a lot of studies on the prevalence of problem gamblers but not nearly enough on the effectiveness of various policy measures on curbing problem gambling.

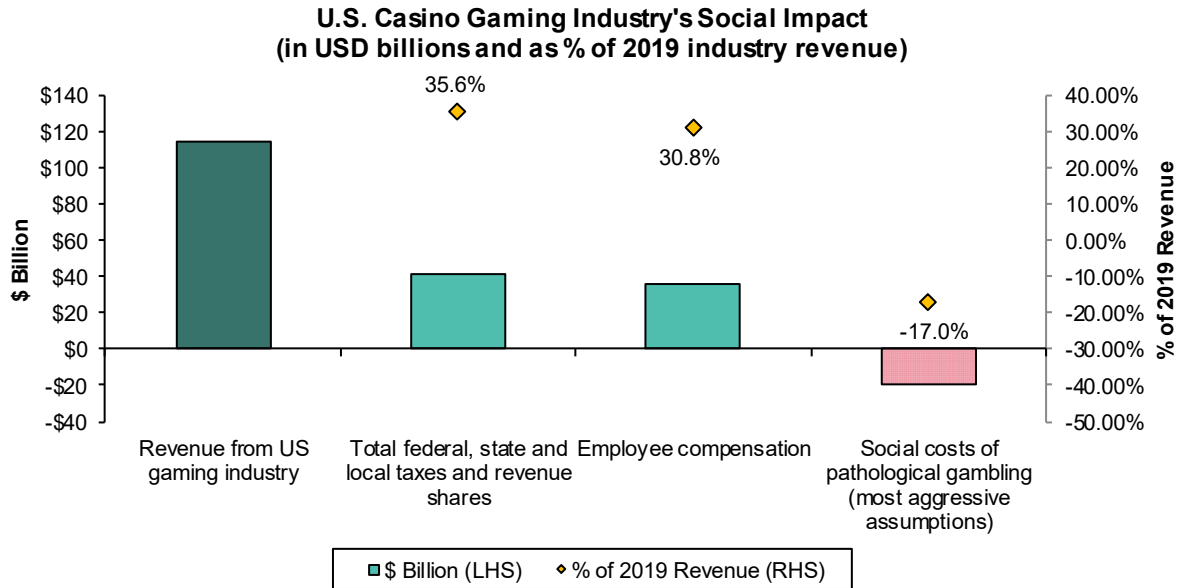
EXHIBIT 252: The average cost of each pathological gambler (the most severe type of problem gambler) is estimated to be ~US\$11,000 to society in 2019

Average Cost per Pathological Gambler (2011 dollars)	
Crime	\$1,156
Business and employment costs	\$2,882
Bankruptcy	\$307
Illness	\$945
Social Service Costs	\$507
Family Costs	\$76
Abused Dollars	\$3,520
Total (2011 Dollars)	\$9,393
Total (2019 Estimate)	\$11,005

Source: Professor Earl Grinols "The Hidden Social Costs of Gambling," and Bernstein estimates and analysis

³⁰³ <https://www.weforum.org/agenda/2014/10/problem-gambling-research/>

EXHIBIT 253: Total social cost of pathological gamblers is less than US\$20bn per year in the US (using the most aggressive assumptions) compared to nearly US\$41bn in taxes and revenue share with governments and over US\$35bn in compensation to gaming employees (the benefits do not include follow-on positive economic impact from supply chain and spend associated with velocity of money flowing through the gaming industry)



Note: Revenue includes that generated by casinos, ancillary spend by gaming patrons (e.g., travel to casinos, non-casino lodging, and F&B) and US revenue of gaming equipment manufacturers. Similarly, the tax and compensation figures include the same.

Source: American Gaming Association, Professor Earl Grinols, and Bernstein estimates (social costs) and analysis

RESPONSIBLE GAMING

Responsible gaming is a major policy lever to curb problem gambling by helping gamblers make informed and conscious decisions when it comes to gambling.³⁰⁴ We believe the industry is responsible for providing proper information to customers about potential negative consequences of gambling. A responsible gambler knows the time limit and budget that's appropriate for him/her to spend on gambling and has a good understanding of the associated risks and possibilities of winning/losing. The promotion of responsible gaming aims to prevent (more realistically, minimize) gambling addiction and other gambling-related problems, and to support individuals (and sometimes, family members) who may suffer harm from gambling-related activities.

Critics argue responsible gaming initiatives largely put the burden on gamblers to manage their own behaviors. However, blanket prohibitions could give rise to illegal gambling activities via underground gambling dens or unregulated overseas online betting sites, which could be harder to regulate. In contrast, responsible gaming initiatives, when done right, could help curb problem gambling in a more regulated environment. We review current industry practices in Macau, Singapore, and the US in the following section.

³⁰⁴ See report: [Global Gaming: Money Laundering, Responsible Gaming, and Safety & Security - the most important ESG factors to consider.](#)

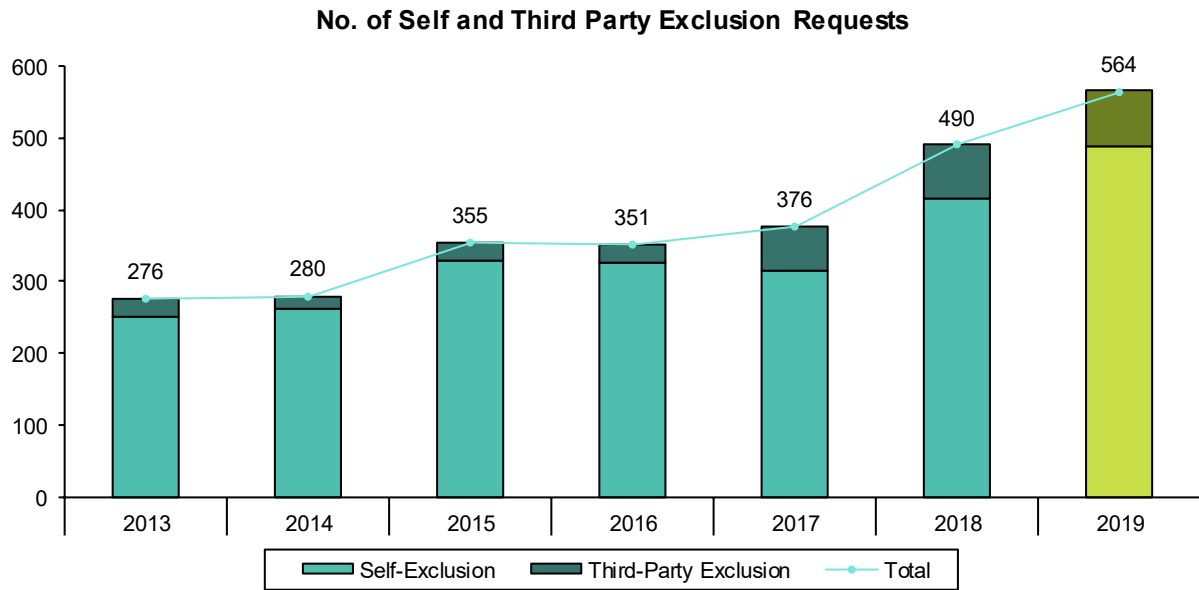
Macau

In Macau, the Gaming Inspection & Coordination Bureau ("DICJ") leads official government efforts in promoting responsible gaming. It coordinates with Macau's Social Welfare Bureau and the University of Macau to host responsible gaming activities, such as awareness weeks, and has established responsible gaming kiosks at casinos that aim to raise awareness of problem gambling behaviors. The Social Welfare Bureau also commissions NGOs in the city, such as the S.K.H. Macau Social Service Coordination Office, to offer a 24/7 Helpline and Online Gambling Counseling Service. Yat On Centre, funded mostly by donations from casinos, is another NGO that offers counseling services for problem gamblers and their families, training for gambling counselors, and outreach work.

Self-exclusion and third-party exclusion program

Macau's gaming regulator maintains a self-exclusion and third-party exclusion program for casino customers. If an individual believes they may have a gambling problem, they may apply to the DICJ to ban themselves from entering all or some casinos in Macau. Family members can also apply on behalf of such individuals. Since the program was introduced in 2012, the number of exclusion requests has gone up every year. In 2019, 564 requests (+15% y/y growth) were made in total, of which 87% applications were made by the individuals themselves (see Exhibit 254). However, these numbers remain very low relative to the number of customers as the program is purely voluntary and the number of annual Macau casino customers is in the millions.

EXHIBIT 254: In Macau, DICJ's self and third-party exclusion program for problem gamblers has been well received since inception



Source: DICJ and Bernstein analysis

Off-duty casino entry ban

In December 2018, Macau's Legislative Assembly passed a law banning gaming industry employees from entering casinos outside work hours. The law came into effect in late

December 2019 (after a 12-month grace period) and covers all staff employed by casino operators, from dealers and marketing professionals to food and beverage workers and cleaning staff, as well as employees of licensed junkets. The total number of individuals subject to the ban is estimated to be over 54,000. Macau government workers were earlier banned from casino entry. The only exception to the ban is the three-day period around Chinese New Year (the same as for government workers).

According to studies commissioned by the Macau government, the majority of problem gamblers in the city happen to be casino workers. There is limited information on how the ban is being implemented, but it is possible that facial recognition technologies could be used to keep off-duty workers (and excluded residents) off the gaming floor, after such technology passes regulatory and privacy law hurdles.

Singapore

In Singapore,³⁰⁵ the Casino Regulatory Authority (CRA) handles the regulation of casinos, which are required to have responsible gaming programs under the Casino Control Act. The National Council on Problem Gambling (NCPG) along with the Ministry of Social and Family Development works more closely on implementing responsible gaming programs.

Casino Exclusion and Visit Limit programs

Other than campaigns that aim to raise awareness of problem gambling across the country, the National Council on Problem Gambling (NCPG) also offers a helpline and help services for problem gamblers and their families, and manages the Casino Exclusion and Visit Limit programs. Casino Exclusion prohibits a certain individual from entering casinos. It can be applied by individuals themselves, by their families, or by law (applicable for those who have undischarged bankruptcy or receive financial aid from the government, etc.). As of September 30, 2019, there are 415,452 active exclusion cases in place. 90% of exclusions were applied for by the individuals themselves, 1% by family members, and 9% by law (certain individuals are prohibited from entry) (see Exhibit 255). Visit Limit restricts the number of times an individual can enter a casino in a month. Similar to Casino Exclusion, it can be applied voluntarily by the individuals themselves or by their families. The NCPG also has authority to impose Visit Limit (or complete ban) on some of the more financially vulnerable gamblers in Singapore.

Casino entry levy

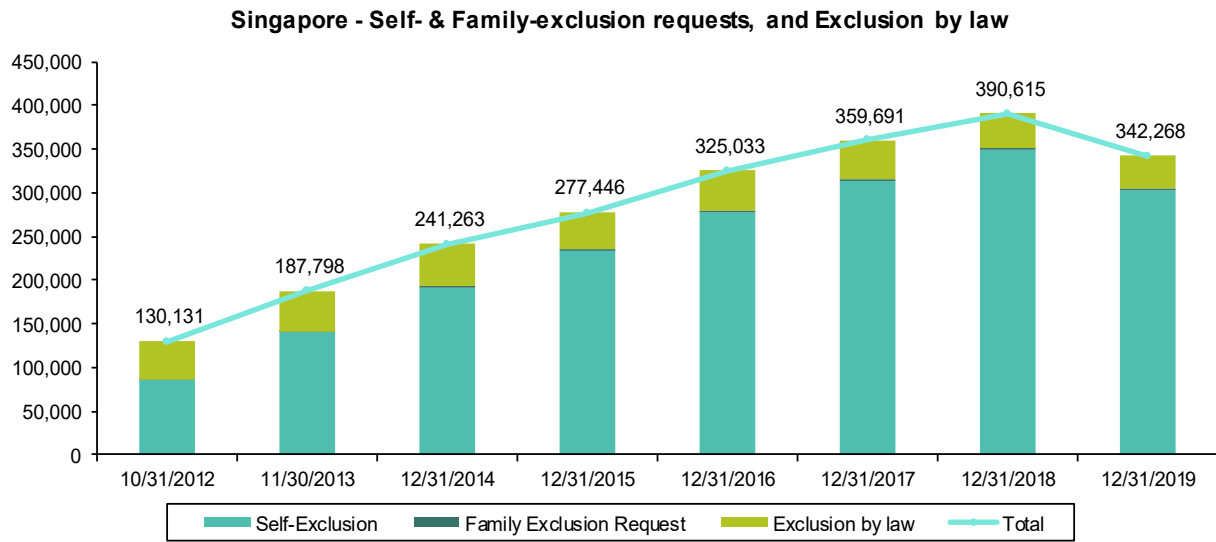
In order to limit financially vulnerable individuals from gambling, Singapore imposes entry levies on Singaporean residents. S\$150 daily entry levy or S\$3,000 for annual entry levy is also imposed on Singapore citizens and permanent residents who wish to enter one of the two Singapore casinos. This levy was increased from S\$100 to S\$150 for daily entry and from S\$2,000 to S\$3,000 for annual entry in April 2019. According to the Singapore Casino Regulatory Authority, the result of the levy increase was that visits made by Singapore citizens and permanent residents dropped from 4.0% in FY18 to 2.7% of the local adult population in FY19.

³⁰⁵ Singapore is revamping the regulatory structure on Singapore gaming. By 2021, different regulatory bodies will be consolidated under the Gambling Regulatory Authority (GRA) (to be established by the Ministry of Home Affairs), which will oversee all gambling-related matters from casinos and lotteries to illegal affairs and responsible gaming.

As another safeguard, both Singapore gaming operators also offer a voluntary pre-commitment program, which allows gaming patrons to set limits on their gaming spend before gambling.

Singapore has often been praised for having some of the most stringent responsible gaming programs in the world and has become a standard to which other jurisdictions have been looking. Japan, for example, has focused on Singapore as a benchmark regulatory environment.

EXHIBIT 255: In Singapore, in addition to self and family exclusion requests, individuals can be barred from entering into casinos by law (applicable for those who have undischarged bankruptcy, receive financial aid from the government, etc.)



Source: Singapore's National Council of Problem Gambling and Bernstein analysis

US

In the US, regulations, statutes, and policies around responsible gaming differ from state to state. For example, the legal gambling age at casinos is 18 or 21 depending on the state.³⁰⁶ Some tribal casinos have a lower minimum age requirement as they are exempt from abiding by certain state laws. In addition to state laws, the American Gaming Association (AGA) also encourages its member casino operators to implement the responsible gaming code of conduct and provide responsible gaming promotion materials, publications, and research. The National Council on Problem Gambling, a non-profit organization, provides resources for treatment and also training on the topic.

Most of the responsible gaming initiatives in the US are similar to ones in Asia (as many of the initiatives came to Asia from the US). To promote responsible gaming and prevent compulsive gaming harm, most US states require operators to bar underage individuals from the premises, have clear responsible gambling information across the casino floor,

³⁰⁶ Eleven states have the legal minimum age to enter casinos set at 18, whereas others with casinos have set the minimum age at 21.

encourage wager and time limits, offer exclusion programs, and require employee training on the topic, among other initiatives. Some states also require operators to place restrictions around the use of financial instruments (e.g., bans on electronic transfers of money or credit cards), prohibit serving alcoholic beverages, etc.

Responsible gaming initiatives by casino operators — a look at Macau

A considerable amount of work on responsible gaming has also been done by companies above and beyond what is required by law. Significant focus is placed on employee training. Beyond mandating responsible gaming as part of all casino operators' orientation program, some operators offer advanced Responsible Gaming Ambassador training (such as Sands China) and visits to local social service organizations that are focused on addressing problem gaming (such as Galaxy). Melco invested in facial recognition and biometric intelligence technology that could be used to prevent problem gamblers from entering casinos. Operators also regularly hold responsible gaming awareness activities for employees and promote responsible gaming to customers at casino floors (e.g., distributing stickers and pamphlets with responsible gaming messages and helpline information, installing kiosks at casino floors, etc.) (see Exhibit 256 to Exhibit 258).

EXHIBIT 256: **Responsible gaming kiosk in a Macau casino**



Source: University of Macau

EXHIBIT 257: **MGM China Responsible Gaming Awareness Week**



Source: MGM China

EXHIBIT 258: **Overview of selected responsible gaming initiatives across Macau casino operators**

	Galaxy	Melco Resorts	MGM China	Sands China	SJM	Wynn Macau	Notes
RG awareness promotions/ activities	●	●	●	●	●	●	• All operators hold various RG awareness initiatives e.g. forums, competitions, game booths, road shows, film screenings, etc.
RG training for all employees	●	●	●	●	●	●	• All operators provide RG training for all gaming employees, most of them also provide training to non-gaming staff
Advanced or refresher trainings for select employees	●	●	●	●	●	●	• Most operators provide refresher RG training to its staff and some (e.g. Sands China) provide advanced trainings for select group of employees • Some operators (such as Galaxy, Wynn Macau) offer RG training in the online format
Counseling service for employees	●	●	●	●	●	●	• Some operators also offer counseling service to employees' family members (e.g. Sands China, MGM China)
Collaboration with social service agencies or NGOs	●	●	●	●	●	●	• Operators partner with social service agencies on problem gambling cases • SJM funded the establishment and finance the operation and development of Yat On Center, which is a responsible gaming institution • Galaxy and Wynn Macau also organized visits to local RG-focused social service centers for its employees
Collaboration with universities and research centers on RG	●	●				●	• Melco donates and collaborates with Macao Polytechnic Institute and University of Macau • Wynn Macau also donates to University of Macau, partly for RG research • Galaxy works with the University of Macau on RG training for its employees
Invest in technology for RG purposes		●					• Melco deployed real-time facial recognition to assist self-exclusion

Note: Analysis is based on disclosure by companies in their sustainability or CSR reports, and/or their websites.

Source: Company reports and websites, and Bernstein analysis

Risks to gaming operators

If casino operators fail to comply with regulations and statutes, they risk receiving a fine or losing their gaming license in whichever gaming jurisdictions they operate in. Although the penalty is high, we believe the likelihood of license revocation is extremely low. After all, it is difficult to prove that gaming harm inflicted on a gaming patron is directly linked to a particular casino's misdoings. Casino operators generally have well-established protocols on responsible gaming in place, and some operators even go above and beyond what is required by law. Responsible gaming efforts help improve corporate image and public relations, and having responsible gaming patrons also contributes to more sustainable revenue growth.

According to a study³⁰⁷ published by the University of Macau, the gambling participation rate by Macau residents dropped to 40.9% in 2019 (from 51.5% in 2016), which is the lowest in Macau's history. Compared with previous studies, the prevalence rate of gambling disorder was also noticeably lower. "Disordered gamblers"³⁰⁸ accounted for 0.8% of the total sample, which was a significant decline from 2.5% recorded in 2016. It is reasonable to conclude these positive survey findings are a result of the concerted effort of the city's

³⁰⁷ "A Study of Macao People's Participation in Gambling Activities 2019" is a survey done by the Institute for the Study of Commercial Gaming, University of Macau, and commissioned by the Social Welfare Bureau of Macao SAR. Link here: http://www.ias.gov.mo/wp-content/uploads/2013/10/2019-10-18_104127_16.pdf.

³⁰⁸ According to DSM-5, gambling disorder refers to persistent and recurrent problematic gambling behavior leading to clinically significant impairment or distress.

gaming regulator, social service agencies, and gaming operators in promoting responsible gambling over the past decade.

For some people, gambling could lead to addiction issues and potentially result in social problems. But after all, without legalized, regulated gambling venues, customers will gravitate to underground illegal casinos, and as the trend has been growing in Asia, proxy betting or online gaming. With the rise of unregulated gaming in the virtual world, it becomes even more difficult to address gambling addiction problems. Compared to casinos, the risks associated with the lack of responsible gaming are heightened for illegal sports betting or online gaming as it is more difficult to monitor and, hence, address problem gamblers.

OTHER POLICY LEVERS – CRACKDOWN ON JUNKETS

Beyond responsible gaming initiatives, the Chinese government has been stepping up its effort to crack down on junkets in Macau, who are linked to money laundering and illegal online gambling activities. In Macau, the gaming market can be largely segmented into the VIP and mass gaming segments. Within the VIP segment, junkets play a key role by reaching out to wealthy gamblers in mainland China and bringing them to Macau by offering luxury travel and accommodation and/or other personalized services.³⁰⁹

Historically, VIP made up a significant portion of Macau's gaming revenue, at an average of 68% of gross gaming revenue (GGR) between 2004 and 2013. In the early days of modern Macau, some VIP players were tied to government officials and SOEs, who allegedly leveraged casinos in Macau to move embezzled money out of China (e.g., by exchanging embezzled money into casino chips and turning winnings in for cash to move capital out of China).

China effectively cracked down on much of the "gray market" VIP business (especially that which flowed into Macau) through its anti-corruption campaign in 2014-16. Macau's VIP market declined materially during the anti-corruption campaign, dropping from US\$30bn in GGR in 2013 to US\$13bn in 2016. VIP represented ~40% of Macau gaming revenue as of 2019, 80% of which was driven by junkets, and this ratio will likely continue to drop going forward (see Exhibit 259).

In 2020-21, China intensified its crackdown on junkets to curb illegal online gaming in China and cross-border gambling activities. For example, Suncity, a junket operator in Macau, allegedly signed up Chinese players for online gaming/proxy betting offered by overseas online casinos when they come through Macau casinos³¹⁰ (an allegation Suncity has denied). In particular, China's Ministry of Public Security targets individuals engaged in these activities, primarily junkets, agents, and funders of these operations. In 2020 alone, Chinese authorities pursued ~3,500 cases and detained ~75,000 suspects amid a sweeping crackdown on cross-border and online gambling.³¹¹

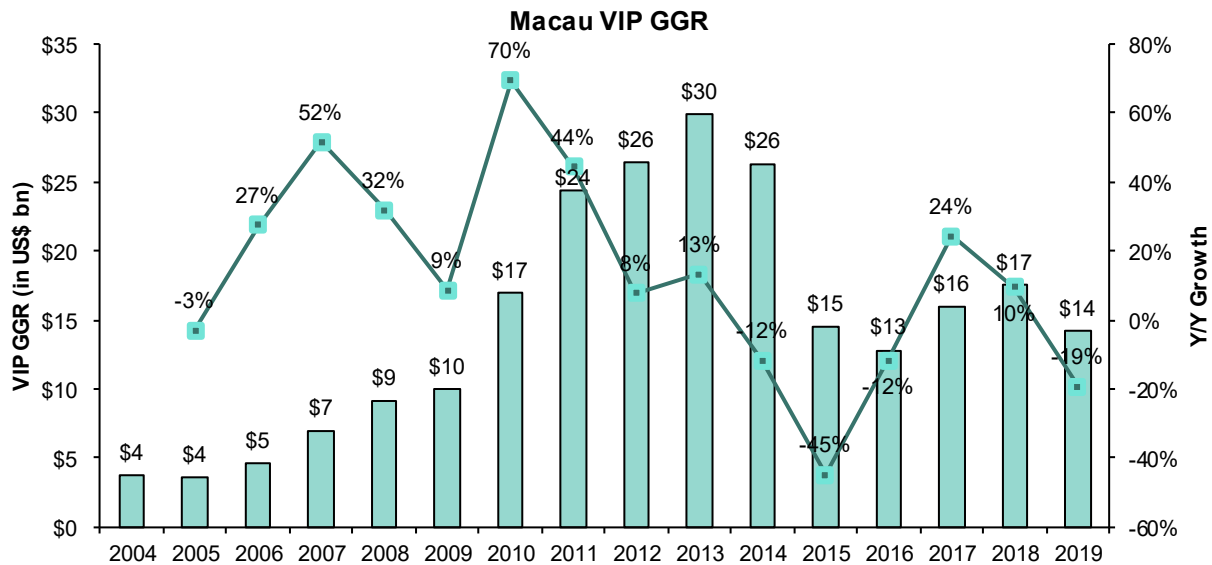
³⁰⁹ <https://www.benzinga.com/general/education/17/07/9779330/casino-stocks-101-what-is-a-junket>

³¹⁰ See report: [Quick Take: Chinese Press links Macau junket Suncity to overseas online and proxy betting.](#)

³¹¹ See report: [Quick Take: China pressure intensifies on overseas gambling and online gambling activity.](#)

These policy actions have led to a structural decline in junket activities and the VIP segment in Macau. The Macau market could eventually move closer to the Singapore model, where traditional junkets are not allowed and where there are more stringent regulations. In the near term, public scrutiny on junket gambling is likely to reduce junket traffic to Macau. Over the longer term, however, we believe the crackdown on junkets and the decline of the VIP segment could be neutral to positive for Macau's mass gaming business.

EXHIBIT 259: **Macau VIP GGR dropped from US\$30bn in 2013 to US\$14bn in 2019**



Source: DICJ and Bernstein analysis

STOCK IMPLICATIONS

Global Gaming (Vitaly Umansky)

ESG as it relates to the gaming industry does prevent some investors from investing in the sector. However, the "S" component is the only one that really impacts ESG investors in the sector. On the "E" front, many casino operators have been engaged for years on improving their impact on the environment (see: [Macau Gaming: Sustainability, beyond just paying lip service - responsible gambling and environmental initiatives](#)). As outlined, the "S" component can be debated in view of the economic benefits created by the industry and the negative externalities:

- ESG risks are largely priced into gaming stocks. However, if a big event were to occur that significantly raises risks of the enterprise, the stock can be severely impacted — look at the latest Crown Resorts (CWN.AU, not covered) money laundering allegations that have led to management and director departures and legal review of Crown's casino licenses.
- Gaming operators are strictly regulated in most jurisdictions. The US casino market is tightly regulated by state gaming regulators and the US Treasury. US operators with casinos abroad are also subject to regulatory oversight in the US. Singapore has taken a strong line on responsible gaming (even more so than the US.) Macau's regulatory

oversight, while not as strong as some other jurisdictions, continues to be enhanced. In the end, gaming remains a highly regulated industry, and a legal gaming industry replaces illegal gambling activity with greater oversight, customer protection, responsible gaming frameworks, job creation, tax proceeds, and expanded economic activity.

INVESTMENT IMPLICATIONS

European Beverages

We rate Budweiser, Anheuser-Busch InBev, Carlsberg, and Heineken Outperform; Davide Campari-Milano, Diageo, and Pernod Ricard Market-Perform; and Rémy Cointreau Underperform.

Asia-Pacific Beverages

We rate Asahi Group, Budweiser Brewing Co APAC, Jiangsu Yanghe Brewery, Kweichow Moutai, and Wuliangye Yibin Outperform; Kirin, Luzhou Laojiao, Thai Beverage, and Treasury Wine Estates Market-Perform; and Shanxi Xinghuacun Fen Wine Factory, China Resources Beer, and Tsingtao Brewery Underperform.

US Tobacco

We rate Altria Outperform and Philip Morris Market-Perform.

Global Gaming

We rate DraftKings, Galaxy Entertainment, Genting Singapore, Las Vegas Sands, Melco Resorts & Entertainment, MGM Resorts International, and Sands China, Wynn Macau, and Wynn Resorts Outperform; and SJM Market-Perform.

EXHIBIT 260: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price	Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price
BUD	O	USD	57.36	77.50	DKNG	O	USD	35.20	65.00
ABI.BB	O	EUR	50.84	67.00	27.HK (Galaxy)	O	HKD	42.65	58.25
CARLB.DC	O	DKK	1,063.00	1,310.00	GENS.SP	O	SGD	0.77	1.04
CPR.IM	M	EUR	13.09	11.35	LVS	O	USD	37.26	55.00
DEO	M	USD	205.00	194.00	MLCO	O	USD	10.12	16.50
DGE.LN	M	GBp	3,823.50	3,600.00	2282.HK (MGM China)	O	HKD	4.97	8.85
HEIO.NA	O	EUR	77.30	99.50	MGM	O	USD	41.13	58.90
HEIA.NA	O	EUR	93.44	107.00	1928.HK (Sands China)	O	HKD	17.92	29.50
RI.FP	M	EUR	206.60	200.00	880.HK (SJM)	M	HKD	5.55	5.30
RCO.FP	U	EUR	213.40	156.00	1128.HK (Wynn Macau)	O	HKD	6.95	10.15
2502.JP (Asahi)	O	JPY	4,194.00	7,300.00	WYNN	O	USD	83.00	111.00
1876.HK (Budweiser Brewing)	O	HKD	19.80	32.50	MSDLE15			1,856.96	
291.HK (CRB)	U	HKD	63.80	50.00	MXAPJ			624.39	
002304.CH (Yanghe)	O	CNY	174.30	300.00	MXJP			1,206.79	
2503.JP (Kirin)	M	JPY	1,817.00	2,150.00	SPX			4,655.27	
600519.CH (Moutai)	O	CNY	1,930.77	2,200.00					
000568.CH (Luzhou Laojiao)	M	CNY	230.05	230.00					
600809.CH (Shanxi Fenjiu)	U	CNY	310.02	210.00					
THBEV.SP	M	SGD	0.67	0.75					
TWE.AU	M	AUD	12.10	10.90					
600600.CH (Tsingtao)	U	CNY	98.77	70.00					
168.HK (Tsingtao)	O	HKD	62.85	85.00					
000858.CH (Wuliangye)	O	CNY	218.00	350.00					
MO	O	USD	43.48	58.00					
PM	M	USD	87.35	110.00					

Source: Bloomberg, and Bernstein estimates and analysis

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SUPPLY CHAIN LABOR

May the work(force) be with you

HIGHLIGHTS

Labor is the No. 1 ESG issue ranked by many of our consumer and tech analysts. Yet, it's hard to measure and often overlooked by third-party providers. In this chapter, we set up a framework for investors to quantify supply chain labor issues' P&L and multiples impact and identify leaders and laggards at the company level.

- We start by focusing on two types of labor issues that have financial implications:

(1) Poor working conditions. Outsourced labor has made it increasingly difficult for companies to ensure that workers are treated fairly while also managing labor costs. ***Could automation be the solution?*** Automation could create new jobs that we cannot think of today to support future job growth. That said, not every task can be automated today. As many companies still rely on manual labor, it is important to form long-term strategic relationships with suppliers to build trust and transparency on labor management. **(2) Labor issues in raw material sourcing.** Should companies be held liable for labor issues at the raw material sourcing stage? Some may argue it's not fully within a company's control to manage labor issues upstream. However, labor scandals could pose reputational risks to companies or result in input cost inflation. Addressing labor issues requires greater traceability, which could be facilitated by community-based programs and, potentially, blockchain technologies in the long run.
- **How financially material are labor issues?** Labor disruptions could pose top-line and cost headwinds or weigh on multiples. Following the series of suicides at Foxconn or the Boohoo modern slavery scandal, the stocks typically traded at a 10-25% discount in the 90 days after the incident. While the multiples impact tends to be short term, risks of recurrence could increase a company's earnings volatility and weigh on its long-term multiples. Further, shifting consumer buying preferences could differentiate winners from losers and have a longer-lasting financial impact.
- **Who are the leaders and laggards?** Given a lack of consistent disclosure, third-party benchmarks that score companies on labor practices have yielded different results. That said, ***Adidas, Unilever, Marks & Spencer, Inditex, and Kellogg*** in consumer and ***HPE, HP, Samsung, Intel, and Apple*** in technology are highly ranked from a labor management and disclosure perspective. Conversely, a number of Asian/emerging market companies are poorly ranked due to a lack of disclosure.

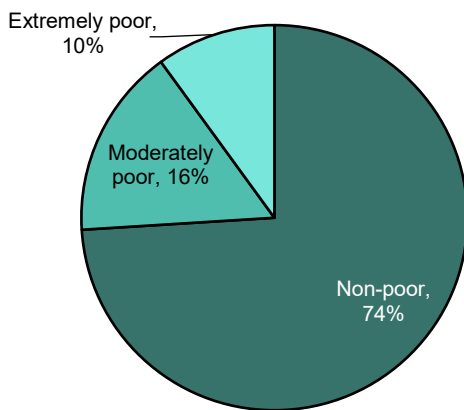
+ WHY ARE SUPPLY CHAIN LABOR ISSUES IMPORTANT?

Employment does not mean the same thing for everyone. While some may worry about workplace culture and flexible working arrangements post Covid-19, others may not have much of a choice in terms of what they do for a living, how much they get paid, and whether the job is dangerous or not. During the Covid-19 pandemic, the divide couldn't be starker. On one hand, white collar workers were able to work remotely without much disruption. On the other hand, many supply chain workers faced a tough choice between losing their income and risking their health to show up for work. At the height of the pandemic, 58% of meat packing workers in Tyson's³¹² Perry, Iowa, pork plant tested positive for Covid-19. Meanwhile, a number of Western retailers cancelled orders from apparel suppliers globally, putting livelihoods of millions of garment workers at risk.³¹³

Supply chain labor issues have existed long before the pandemic. Among the 3.3 billion working population globally, the International Labour Office (ILO) estimated close to 700 million workers in low- and middle-income countries lived in extreme or moderate poverty in 2018 (i.e., having to live on income of less than US\$3.20 per day in purchasing power parity terms, see Exhibit 261).³¹⁴ Further, 61% of the global working population, or ~2 billion workers, were in informal employment in 2018 (see Exhibit 262). Many informal workers do not enjoy any social protection.

EXHIBIT 261: **700 million workers in low- and middle-income countries lived in extreme or moderate poverty in 2018 (living on less than US\$3.20 per day)**

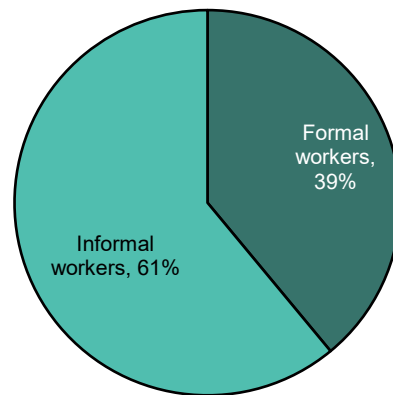
Poverty among Workers in Low- and Middle-Income Countries (2018)



Source: ILO and Bernstein analysis

EXHIBIT 262: **61% of the global working population, or ~2 billion workers, were in informal employment in 2018; many do not enjoy any social protection**

Workers in Formal vs. Informal Employment (2018)



Source: ILO and Bernstein analysis

³¹² Covered by Bernstein's U.S. Food analyst, Alexia Howard.

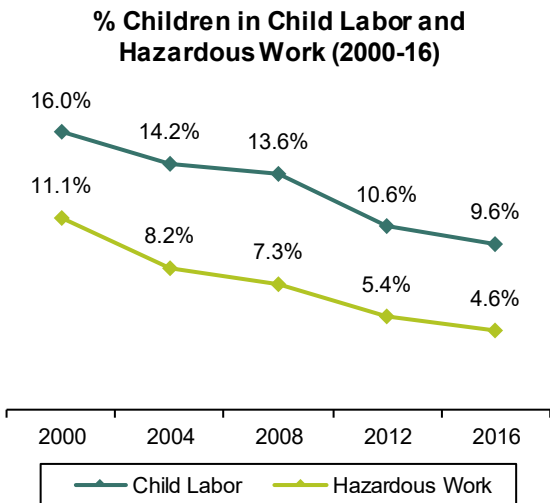
³¹³ <https://www.reutersevents.com/sustainability/millions-garment-workers-face-destitution-fashion-brands-cancel-orders>

³¹⁴ https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_670542.pdf

Meanwhile, 152 million children (aged five to 17) were subject to child labor in 2016, which accounted for almost one in 10 children globally. Not all work performed by children is considered child labor – only work "that is hazardous, demands too many hours, or is performed by children who are too young."³¹⁵ Child labor is often at odds with children's wellbeing, play time, and/or right to education. While we've made tremendous progress from 2000 to 2016 with a reduction of 94 million children in child labor (see Exhibit 263), the progress slowed during 2012-16 as some of the worst forms of child labor are taking longer to resolve.³¹⁶ At the current pace, we will fall short of the UN Sustainable Development Goal of eliminating child labor by 2025.

The agricultural supply chain is by far the biggest offender of child labor, accounting for 71% of all children in child labor (see Exhibit 264). As many child labor incidents take place upstream in the agricultural supply chain among smallholder farmers in Africa and Asia, it's challenging for downstream branded manufacturers based in the US or Europe to monitor and address these issues.

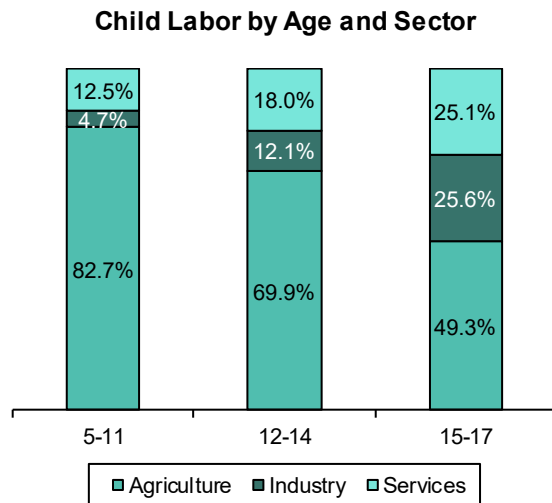
EXHIBIT 263: While we've made tremendous progress from 2000 to 2016 to reduce child labor, the pace slowed during 2012-16 as some of the worst forms of child labor take longer to resolve



Note: Children in hazardous work is a subset of children in child labor.

Source: ILO and Bernstein analysis

EXHIBIT 264: Agricultural supply chain is by far the biggest offender of child labor, accounting for 71% of all children in child labor



Source: ILO and Bernstein analysis

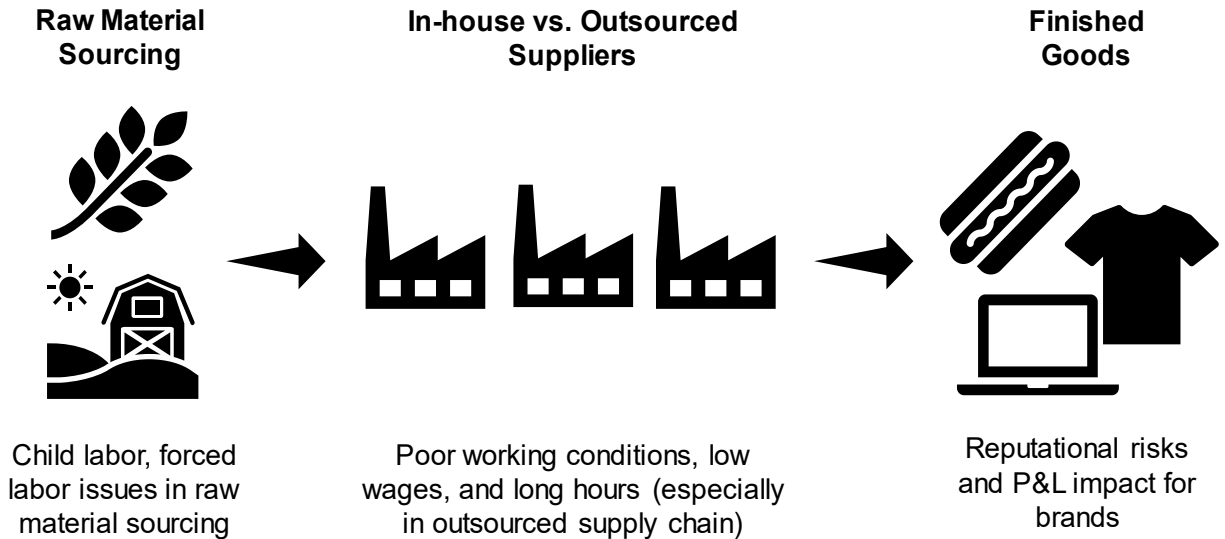
When it comes to financially material supply chain labor issues, there are, broadly speaking, two types of issues we are focused on: (1) poor working conditions, substandard wages, and excessive working hours that mostly take place in manufacturers' outsourced supply chains, and (2) child labor, forced labor, and labor abuses at the upstream raw material

³¹⁵ <https://www.alliance87.org/2017ge/childlabour.html#lsection=0>

³¹⁶ https://www.alliance87.org/global_estimates_of_child_labour-results_and_trends_2012-2016.pdf

sourcing stage (e.g., child labor in the cocoa supply chain, forced labor in cotton sourcing, and mineral sourcing from conflict zones) (see Exhibit 265).

EXHIBIT 265: **(Extremely simplified) illustration of supply chain labor issues**



Source: Bernstein analysis

POOR WORKING CONDITIONS

Apparel brands and electronics manufacturers have raced around the globe looking for the cheapest labor market to outsource their production to. While such global supply chains have created job opportunities in low-income countries, they have also raised concerns about poor working conditions. In particular, it has become increasingly difficult to monitor labor practices across the supply chain as brands outsource production to suppliers and subcontractors in foreign countries. A *Behind the Barcodes* report in 2015 reported 75% of 219 apparel brands surveyed did not know the source of all their fabrics and inputs.³¹⁷

Meanwhile, as brands push lower prices down the supply chain, there's further pressure on labor wage, which is typically a fraction of the retail price of the finished good. According to ILO estimates, the labor cost for a T-shirt from Asia is ~€0.20. By the same token, a tea picker is expected to make just £0.01 for a box of tea sold in the UK for £1.60.³¹⁸

Further, the shift to just-in-time production and fast fashion trends has resulted in shorter lead times and longer working hours in the supply chain. A study of Chinese and Thai suppliers of soccer products found 48% of workers were working more than 60 hours per week, notably above the ILO limit of 48 hours per week. And 25% of workers didn't receive the minimum one day off per week.³¹⁹

Increased cost pressure and shorter lead times also sometimes pressure suppliers into using unaudited subcontractors to meet the deadline. Social protection for such short-term

³¹⁷ See report: [U.S. Softlines & Specialty Retail: ESG - Working conditions and wages in apparel supply chains.](#)

³¹⁸ https://www.ilo.org/public/libdoc/ilo/2016/116B09_43_engl.pdf

³¹⁹ R. Smyth et al.: "Working hours in supply chain Chinese and Thai factories: Evidence from the Fair Labor Association's 'Soccer Project'", in *British Journal of Industrial Relations* (2013, Vol. 51:2, June 2013), pp. 382–408.

workers is often nonexistent. For example, banana producers were reported to have repeatedly hired workers on short-term contracts due to pressure from buyers to lower prices and to deliver just in time. As these short-term employees worked during a probationary period, they did not enjoy any social security or annual leave benefits.

How should companies balance the need to manage labor costs and the potential reputational risk in case of a major supply chain labor scandal? Major labor scandals could turn consumers away from a brand and weigh on the stock price (more on this later). According to a recent survey of 19,000 consumers across 28 countries, one-third of consumers will stop buying their preferred products if they lose trust in the brand.³²⁰ Our US Food team's proprietary survey shows 65.8% of consumers consider fair labor practices to be either somewhat important, very important, or a deal breaker in buying food products, making it the second most important consideration behind animal cruelty (see Exhibit 266).³²¹ In the apparel space, a Fashion Revolution EU Consumer Survey conducted in 2018 with 5,000 respondents shows fair/living wages and safe working conditions are key factors when purchasing clothing. 39% of consumers said fair/living wages were important, ahead of the environment (37%) and 31% mentioned safe working conditions (see Exhibit 267). A Nosto Sustainability in Fashion Retail survey conducted in 2019 with 2,000 respondents found 74% of consumers who desire more sustainability in fashion believe fashion retailers should focus on fair pay and working conditions (see Exhibit 268).

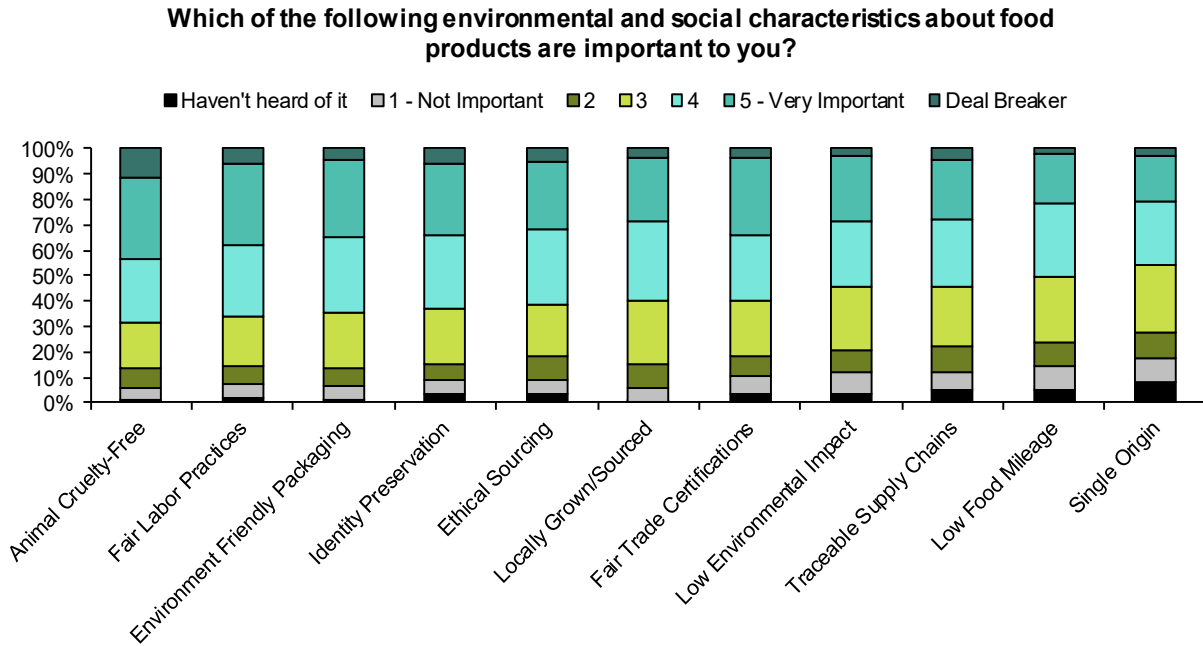
However, are consumers willing to pay a premium for fair labor practices? The answer is less clear. Only 31% in Ipsos's sustainability survey conducted in 2020 with 1,500 respondents are willing to pay a premium for sustainable and organic products.³²² While consumer preferences are shifting, we believe the majority of consumers are not willing to pay a premium significant enough to compensate for the cost of improved labor practices.

³²⁰ <https://www.prnewswire.com/news-releases/ibm-study-purpose-and-provenance-drive-bigger-profits-for-consumer-goods-in-2020-300984746.html>

³²¹ See report: [U.S. Food: Power to the people; what are consumers telling us about ESG in their food buying decisions?](#).

³²² <https://www.ipsos.com/sites/default/files/ct/publication/documents/2020-11/the-sustainability-imperative-ipsos-2020.pdf>

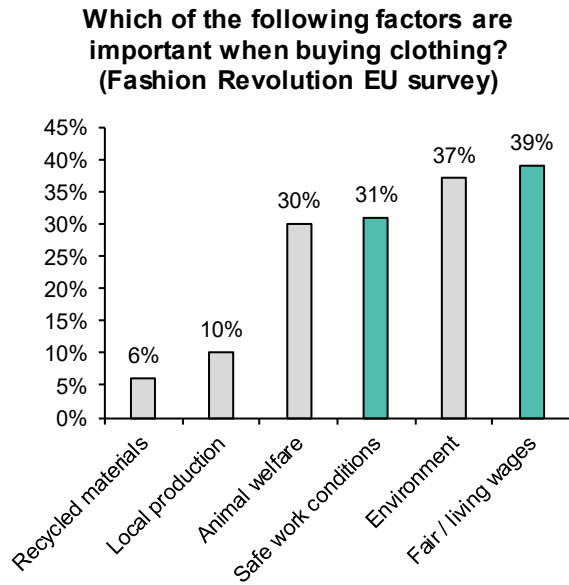
EXHIBIT 266: 65.8% of consumers consider fair labor practices to be either somewhat important, very important, or a deal breaker in buying food products, making it the second most important environmental and social consideration behind animal cruelty



Note: We provided the following definition/clarification for select environmental/social characteristics in our survey:
 Low environmental impact practices (e.g., best practices to reduce carbon footprint, water usage, and/or GHGs produced during food production)
 Low food mileage (e.g., food products undergo minimal transportation from raw goods to finished products)
 Identity preservation (e.g., food products are strictly controlled to prevent contamination with other food products)
 Traceable supply chains (e.g., food products are identifiable and traceable from raw goods to finished products)
 Ethical sourcing (e.g., food products are obtained through responsible and sustainable methods)

Source: Bernstein Consumer Survey (2019) and Bernstein analysis

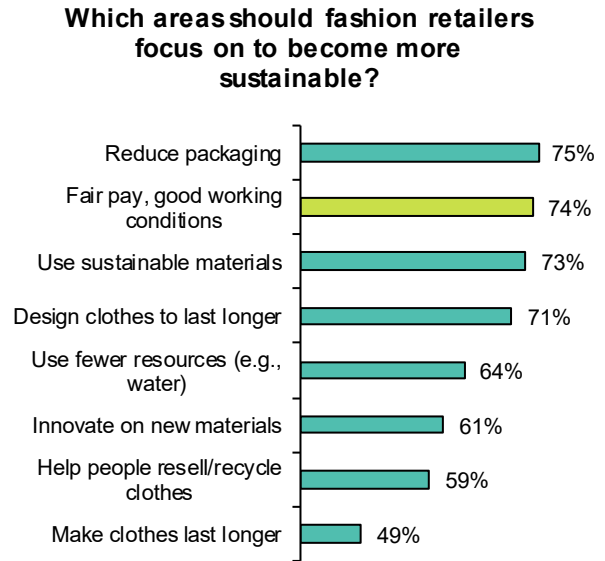
EXHIBIT 267: For consumers in the EU, fair/living wages and safe working conditions are key factors when purchasing clothing



N=5,000

Source: Fashion Revolution EU Consumer Survey Report and Bernstein analysis

EXHIBIT 268: 74% of consumers who desire more sustainability in fashion believe fashion retailers should focus on fair pay and working conditions



Note: Percentages based on subset of respondents who desire sustainability in fashion. N=2,000.

Source: Nosto Sustainability in Fashion Retail survey and Bernstein analysis

The burden then falls on brands and suppliers. What can companies do to address supply chain labor issues without squeezing their already thin margins?

Could automation be the long-term solution? As labor costs rise globally, brands will eventually run out of places to outsource their production to. Meanwhile, increasing demand for faster speed to market also leads more brands to consider bringing production closer to home (i.e., nearshoring) to reduce the lead time. Although nearshoring helps reduce freight cost and turnaround time, quality and labor productivity can be more volatile in some nearshore countries, such that nearshoring in and of itself may not be cost effective. But could automation be the solution to enable more nearshoring and solve the rising labor cost issue once and for all?

It depends. While automation appears to be the long-term direction we are moving in, not all tasks can be automated in a cost-efficient way in the near to medium term. From a technical feasibility perspective, a McKinsey study shows predictable physical work is the easiest to automate, whereas it's much more difficult to automate unpredictable physical work³²³ (see Exhibit 269). In addition to technical feasibility, the adoption of automation technologies also depends on the relative cost and benefit of automation versus manual labor. The capital outlay to set up an automated supply chain may not make economic sense at the initial stage compared to low-cost labor. However, as hardware and software costs

³²³ <https://www.mckinsey.com/~media/mckinsey/featured%20insights/digital%20disruption/harnessing%20automation%20for%20a%20future%20that%20works/a-future-that-works-executive-summary-mgi-january-2017.ashx>

come down and as automation technologies improve over time, automating certain tasks could be more economical than outsourcing to labor in offshore locations.

By sector, the top 5 users of industrial robots were **auto, electronics, metal and machinery, plastic and chemical products, and food** in 2019³²⁴ (see Exhibit 270). These sectors have more "predictable physical work" involved in the manufacturing process and are, therefore, ripe for the automated disruption. That said, in consumer electronics, for example, Apple³²⁵ still ran into issues automating the production of its 12-inch MacBook as the robot that installed the keyboard kept malfunctioning and requiring human intervention. This is likely a result of the robots not being precise enough to fasten the tiny screws Apple has on its products.³²⁶ However, Apple has successfully automated some other parts of its supply chain, including the testing of select devices and the recycling of used iPhones.

Beyond these early adopters of automated technology, the **apparel** sector has also automated parts of its supply chain. However, the sewing stage, which accounts for over half of total labor time per garment, is the most complex to automate.³²⁷ A major challenge in automating the sewing step is the complexity of dealing with the fabric, which easily deforms under very small pressure. Softwear Automation³²⁸ is a leading startup that aims to tackle the sewing automation challenge. It has created robots specifically for sewing, called Sewbots, that leverage sensors and visual enhancement software to guide fabrics through conventional sewing machines with a high degree of precision.³²⁹ While companies such as Adidas walked back from nearshoring in recent years as they couldn't make an automated nearshoring process cost competitive versus manual labor manufacturing in Asia, we believe improved automated sewing solutions could unlock major savings over time. A McKinsey study conducted in 2018 expects a 40-90% reduction in labor time by automating the sewing process, which could make nearshoring economically viable by 2025, based on its most optimistic assumptions.³³⁰

Moving down the spectrum, while the packaged food supply chain has largely been automated, the **meat supply chain** has lagged in terms of automation. As each animal is different in size and shape, the slaughtering and deboning process requires a lot of human judgment that can be difficult to replicate with a machine. However, the meat supply chain disruptions during the Covid-19 pandemic (more on this later) have raised questions about labor intensiveness in meat packing factories, which put workers in a vulnerable position with respect to contracting Covid-19, not to mention the dangerous and stressful working conditions they are already in. As a result, leading meat producers have started looking into automation more seriously to improve the resiliency of the supply chain. However, given the technological challenges, we may not see automation at a major scale in the meat supply

³²⁴ https://ifr.org/img/worldrobotics/Executive_Summary_WR_2020_Industrial_Robots_1.pdf

³²⁵ Covered by Bernstein's U.S. IT Hardware analyst Toni Sacconaghi.

³²⁶ <https://www.imore.com/apple-has-discovered-humans-are-better-assembling-products-robots>

³²⁷ https://www.mckinsey.com/~/_media/mckinsey/industries/retail/our%20insights/is%20apparel%20manufacturing%20coming%20home/is-apparel-manufacturing-coming-home_vf.ashx

³²⁸ Not covered.

³²⁹ https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_743774.pdf

³³⁰ https://www.mckinsey.com/~/_media/mckinsey/industries/retail/our%20insights/is%20apparel%20manufacturing%20coming%20home/is-apparel-manufacturing-coming-home_vf.ashx

chain in the near future. For example, Smithfield (owned by WH Group)³³¹ expects advanced robotics and connectivity on the factory floor only by 2050.³³² Automated meat processing could also affect the taste of meat as current technologies may not be able to optimize for the fat content and muscle fibers in processed meat.³³³

Speaking of time horizon, when will supply chain automation become more prevalent?

According to a recent MHI survey conducted in 2021, 39% of supply chain industry participants said robotics and automation are already in use, and another 34% expect to adopt robotics and automation in their supply chains over the next five years³³⁴ (see Exhibit 271). Of course, the pace of adoption varies by sector. We've already seen meaningful adoption across the auto, tech, metals and materials, and food industries. Elsewhere, automation technologies could make major breakthroughs in the apparel space, which have the potential to make nearshoring or even onshoring economically viable by 2025. Conversely, automation could take longer to play out in the meat supply chain, given the complexity of animal processing.

As we race toward automated solutions, what is the social cost associated with it (i.e., millions of jobs lost)? The headline numbers can be scary. At the high end, McKinsey estimates 375 million jobs globally will be displaced due to automation.³³⁵ However, it's worth remembering that this is not the first time in history that we have had to adapt to technological disruptions, and it won't be the last. While agriculture's share of total employment in the US fell from 60% in 1850 to less than 5% in 1970 on the back of technological advancement, new industries and jobs emerged to absorb jobs lost in agriculture, such that the total employment rate has continued to grow. In the latest wave of automation, jobs could be created alongside the adoption of new technologies to monitor, improve, and design new solutions.

However, the impact of technology advancements may create short-term dislocations, with millions of unskilled workers losing their jobs while leaving millions of new jobs unfilled due to a lack of skilled workers. It will require global collaboration to retrain the existing workforce, especially unskilled workers in low-income countries, which could take more than one generation's effort. Despite the potential short-term disruption, however, we believe automation is the direction we are moving in, which could create more jobs that we may not be able to think of today to offset jobs lost in traditional labor-intensive industries.

Using empirical data, the Bernstein Asian Industrial Technology team has previously analyzed the labor impact of automation in the automotive industry.³³⁶ The key finding was that at the sector level, robot adoption only reduces jobs in the initial phase when the automation level is low (e.g., India). Over a wide range of robot adoption seen across most markets (e.g., the US, Japan, and Germany, approximately 60-150 robots per 10,000 cars production; China has recently reached this level as well), increasing robot intensity does not reduce jobs until another step change occurs at a very high robot adoption level (such

³³¹ Not covered.

³³² https://just-food.nridigital.com/just-food_jun20/meat_processing_automation

³³³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6154429/>

³³⁴ <https://www.mhi.org/publications/report>

³³⁵ <https://www.mckinsey.com/featured-insights/future-of-work/what-can-history-teach-us-about-technology-and-jobs>

³³⁶ See report: [Do robots kill jobs? - A three-exhibit answer from the automotive industry.](#)

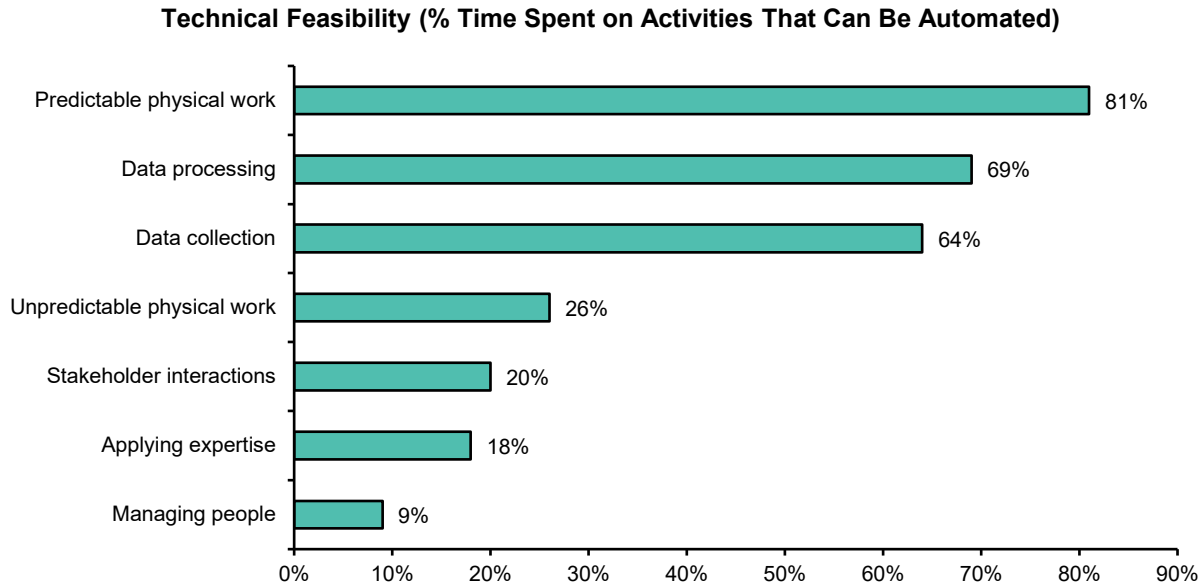
as in South Korea, see Exhibit 272). The conclusion is quite strong, although the full mechanism eludes us. We cross checked the analysis for direct manufacturing jobs (excluding, for example, dealers) and looked at cross-country data as well as same country data over time (excluding the impact from different mix of OEM versus parts or ratio of exports) — the same conclusion holds. In fact, analyzing direct manufacturing employees only, we find moderate evidence that robots created jobs (see Exhibit 273).

That said, not every step in the supply chain can be automated with current technology. As many companies continue to rely on labor-intensive supply chains, we believe it is important for brands to form **long-term strategic relationships with suppliers** to build trust and transparency around supply chain labor management. While brands can "squeeze the lemon" in the short term by moving from one supplier to another to take advantage of honeymoon pricing, the industry is moving away from that mindset to focus on building long-term strategic partnerships. These long-term relationships help incentivize brands and suppliers to co-invest in strategic initiatives to drive costs down and enable suppliers to provide more transparency and traceability in the supply chain. From time to time, subcontracting may be necessary if a supplier finds itself having overcommitted beyond its existing capacity. In such cases, long-term relationships can help facilitate more transparent conversations for suppliers to disclose any subcontracting arrangements real time, such that subcontractors can be audited properly.³³⁷

At the end of the day, no supply chain is perfect. But taking a longer-term view will help brands focus on building competitive advantages (e.g., supply chain resiliency, speed to market, scale, etc.) and mitigating potential reputational risks, which helps align their incentives to improve supply chain labor practices.

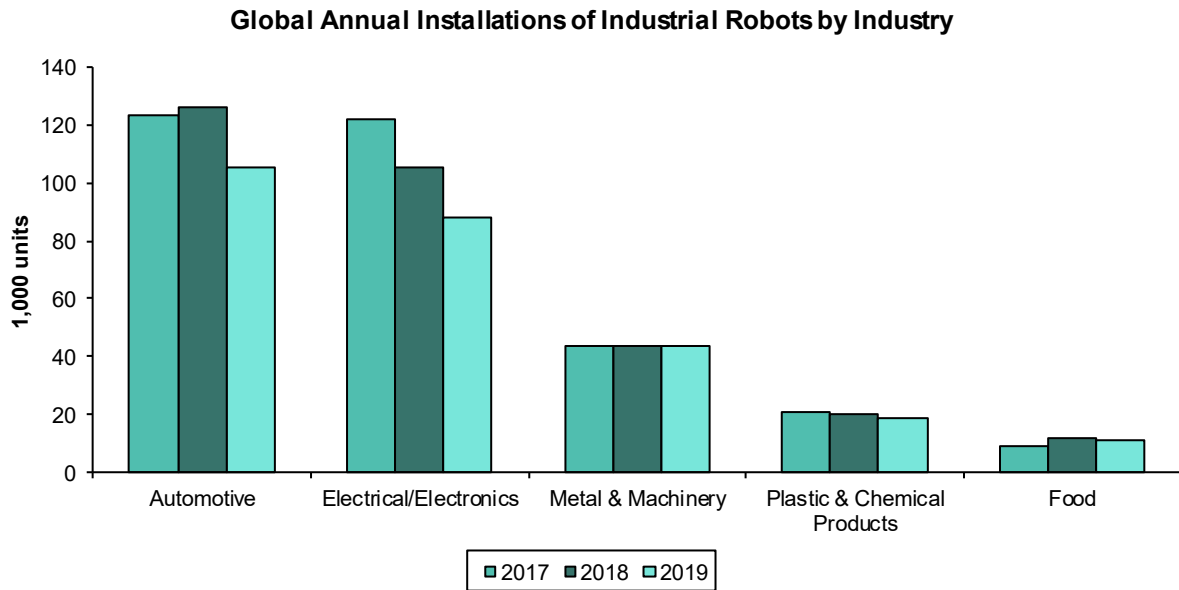
³³⁷ See reports: [Global Apparel Retail: Best Practices in Apparel supply chains - Webinar Transcript](#) and [Global Apparel Retail: The buyer perspective on supply chains - webinar transcript](#).

EXHIBIT 269: From a technical feasibility perspective, a McKinsey study shows predictable physical work is the easiest to automate (e.g., auto and consumer electronics assembly), while it's much more difficult to automate unpredictable physical work (e.g., sewing and meat packing)



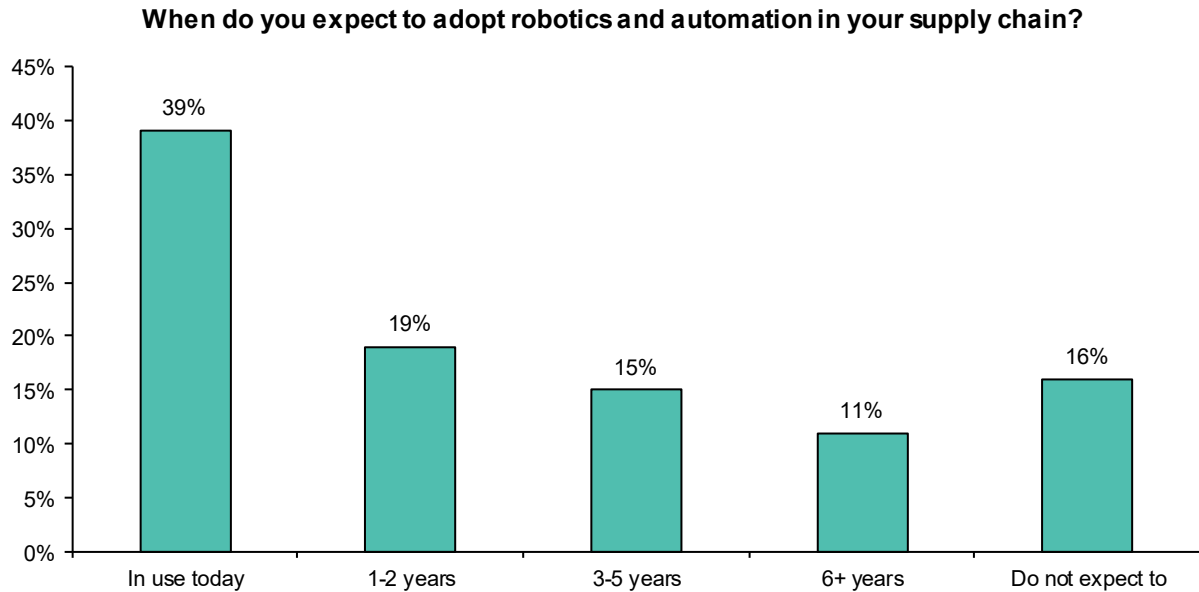
Source: McKinsey Global Institute and Bernstein analysis

EXHIBIT 270: By sector, the top 5 users of industrial robots were auto, electronics, metal and machinery, plastic and chemical products, and food in 2019



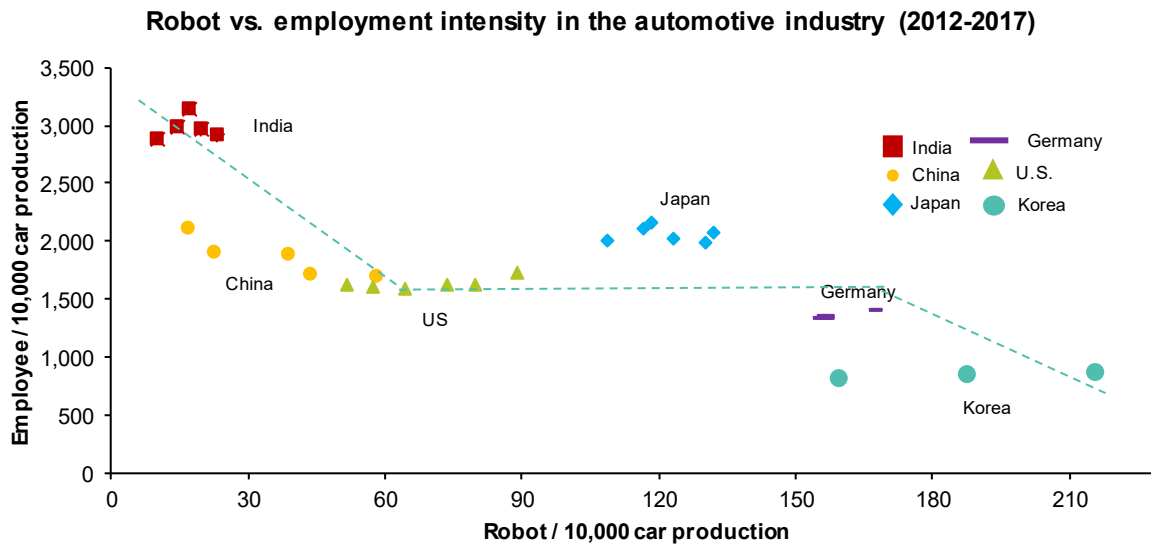
Source: International Federation of Robotics and Bernstein analysis

EXHIBIT 271: **39% of supply chain industry participants said robotics and automation are already in use, and another 34% expect to adopt robotics and automation in their supply chains over the next five years**



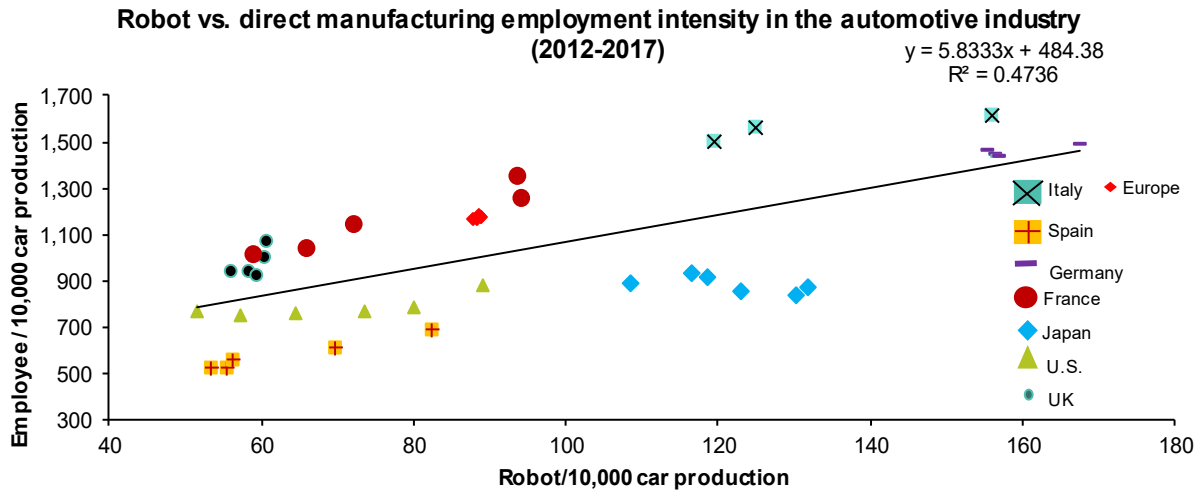
Source: MHI 2020 Survey and Bernstein analysis

EXHIBIT 272: **In the automotive industry, jobs initially reduce with robot adoption, but remain resilient over a wide "mid-range" of robot adoption across developed markets**



Source: IHS Markit, China NBS, Statista, Japan Automobile Manufacturers Association (JAMA), and Bernstein analysis

EXHIBIT 273: **Analyzing direct manufacturing jobs only in the automotive industry, we find moderate evidence that robots created jobs**



Source: IHS Markit, Statista, JAMA, and Bernstein analysis

LABOR ISSUES IN RAW MATERIAL SOURCING

Going further upstream, should companies be held liable for child labor and forced labor issues at the raw material sourcing stage? Some may argue it's not fully within a company's control to manage labor issues upstream. However, labor scandals, even upstream in the supply chain, could pose reputational risks to consumer-facing companies and damage their brand images, which requires companies to understand and manage such risks. We review child labor issues in the cocoa supply chain as an example to shed light on labor issues in the agricultural supply chain.

Child labor in the cocoa supply chain

Ever wonder what's behind the chocolate you eat? Chances are you've purchased chocolate that involves child labor in Africa.

The chocolate industry committed to combatting child labor in Ghana and the Ivory Coast – the two major cocoa-producing countries – by signing the Harkin-Engel Protocol as early as 2001. And then in 2010, the US, Ghana, the Ivory Coast, and the National Confectioners Association signed a Declaration of Joint Action to Support Implementation of the Harkin-Engel Protocol that targeted the reduction of the worst forms of child labor (e.g., slavery, trafficking, and dangerous work) by 70% in Ghana and Ivory Coast by 2020.³³⁸

Despite these decades-long efforts, the child labor situation has not improved in the cocoa supply chain. Almost 20 years from the initial signing of the Harkin-Engel Protocol, the percentage of children in child labor in agricultural households in Ghana and the Ivory Coast increased from 31% in 2008-09 to 45% in 2018-19, and the percentage of children in hazardous child labor (e.g., dangerous work and long hours) in these agricultural

³³⁸ https://www.ilo.org/washington/areas/elimination-of-the-worst-forms-of-child-labor/WCMS_159486/lang-en/index.htm

households increased from 30% to 43% over the past decade, according to a study commissioned by the US Department of Labor Bureau of International Labor Affairs³³⁹ (see Exhibit 274). Under the Declaration of Joint Action to Support Implementation of the Harkin-Engel Protocol, nationally representative child labor surveys should be conducted at least every five years to provide ongoing assessments of the prevalence of child labor in cocoa-growing areas in Ghana and the Ivory Coast. From 2008-09 to 2018-19, while a 62% increase in cocoa production contributed to the increase in child labor, the industry has clearly fallen short of its goal of reducing child labor in the cocoa supply chain.

Due to inconsistent methodologies, we are not able to compare the 2013-14 results (which only captured child labor among *cocoa-growing households*) directly with the 2008-09 results (which only captured child labor among *all agricultural households*). However, as the 2018-19 survey captured both sets of results, we are able to compare the percentage of children involved in child labor from 2013-14 to 2018-19 among *cocoa-growing households*. Across Ghana and the Ivory Coast, the percentage of children in child labor among cocoa-producing households increased from 44% in 2013-14 to 50% in 2018-19, and the percentage of children in hazardous child labor increased from 42% to 47% (see Exhibit 275). When the data is disaggregated by country, however, the increase over the past five years is not statistically significant, which suggests that companies' efforts to reduce child labor have started to yield some early results.

Despite some early signs of progress, child labor remains prevalent as a result of chocolate producers' limited ability to trace their ingredients, given the hundreds of thousands of smallholder farmers in the cocoa supply chain, broader poverty and other socioeconomic issues in West Africa that are difficult to tackle, and a lack of financial incentives for chocolate producers to drive meaningful changes. However, this could change as the Ivory Coast and Ghana started to charge a US\$400 per metric ton premium on cocoa starting in October 2020 in order to protect local farmers' livelihoods and help alleviate the child labor issue.³⁴⁰ This has led the cocoa spot price to rally to over US\$2,700 per metric ton in November 2020, 12.5% above the average price of ~US\$2,400 per metric ton (see Exhibit 276). While chocolate producers typically have long-term hedges on cocoa such that the cost impact may not be reflected immediately in their P&L statements, we do expect a cost headwind over the next 18 months to two years, which could be partially offset by price increases as chocolate producers pass on some of the cost inflation to end consumers.

What are chocolate producers doing to mitigate the risk of further cost inflation or potential reputational risks as consumers/investors become more aware of child labor issues in the cocoa supply chain? Major chocolate producers have all committed to sustainably sourcing cocoa and many rely on third-party certifications to demonstrate compliance. The certifiers (e.g., UTZ, Rainforest Alliance, and Fairtrade) pay a premium on top of the market price to farmers who participate in their programs. However, research has shown that the premium that actually reaches farmers is by no means enough to lift them out of poverty. In fact, the average income for an UTZ-certified cocoa farmer in the Ivory Coast is merely US\$1.40 a day.³⁴¹ Meanwhile, certification audits are typically done once a year on select farms, which

³³⁹ https://www.norc.org/PDFs/Cocoa%20Report/NORC%202020%20Cocoa%20Report_English.pdf

³⁴⁰ <https://www.wsj.com/articles/new-cocoa-cartel-could-overhaul-global-chocolate-industry-11578261601>

³⁴¹ <https://www.confectionerynews.com/Article/2017/12/20/Fair-trade-How-effective-is-cocoa-certification>

does little to eradicate child labor on cocoa farms. That said, getting certified is the first step. And we have started seeing more community-based programs, such as the Child Labour Monitoring and Remediation System (CLMRS), that leverage on-the-ground community facilitators to better monitor and address child labor issues.

Over time, we also envision the adoption of blockchain technologies to improve the traceability of supply chains. The blockchain technology logs a "virtual handshake" every time a transaction takes place (e.g., a farmer sells cocoa to a local buyer, who then sells the product to Barry Callebaut;³⁴² Barry Callebaut processes and sells the cocoa powder to a chocolate producer, who eventually sells the product to a retailer). By the time a consumer picks up the product, they will be able to track the full journey of the product from farm to table and be able to tell if a product is sourced organically/without child labor. That said, the economics do not support a wide adoption of blockchain technologies at the current stage. As such, we view blockchain to be a very long-term solution, although we could start to see more pilot programs in developed markets sooner rather than later.

Child labor in the cocoa supply chain is just one example of the numerous labor issues at the raw material sourcing stage. Besides cocoa, the *palm oil* supply chain has long been criticized for its environmental impact and labor abuses. The Roundtable on Sustainable Palm Oil, which was once hailed as an industry standard for third-party certification, has come under pressure for issuing sustainably sourced palm oil certifications to top palm growers despite major labor abuses identified in their supply chains.³⁴³ Elsewhere, concerns have surfaced recently about forced labor issues in *cotton* produced from Xinjiang, China, which resulted in many global apparel producers scrambling to identify the source of their cotton and/or find alternative sources.

Many developed countries also rely on *migrant workers* (sometimes undocumented foreign workers) in labor-intensive agricultural sectors such as fruits, nuts, vegetables, and melons. In Italy, for example, migrant fruit pickers can work 14-15 hours a day for as little as €3-€4 an hour, and they do not enjoy any healthcare or social benefits.³⁴⁴ These challenges have been exacerbated by the Covid-19 pandemic, with millions of migrant workers having lost their income while others are stranded in host countries without access to social protection.³⁴⁵

Beyond the agricultural supply chain, so-called *conflict minerals* (primarily tantalum, tin, tungsten, and gold, sometimes referred to as "3TG") have myriad uses, especially in the manufacture of semiconductors and electronics, and have become more in demand in the IT supply chain. There has thus been significant effort within the electronics supply chain to use so-called *conflict-free minerals*, which requires suppliers to avoid sourcing these 3TG materials from mines that are under the control of armed groups who exploit mine workers.³⁴⁶ As with issues in the agricultural supply chain, sourcing conflict-free minerals also requires greater traceability in the IT supply chain.

³⁴² Not covered.

³⁴³ <https://www.amnesty.org/en/latest/news/2016/11/palm-oil-global-brands-profitting-from-child-and-forced-labour/>

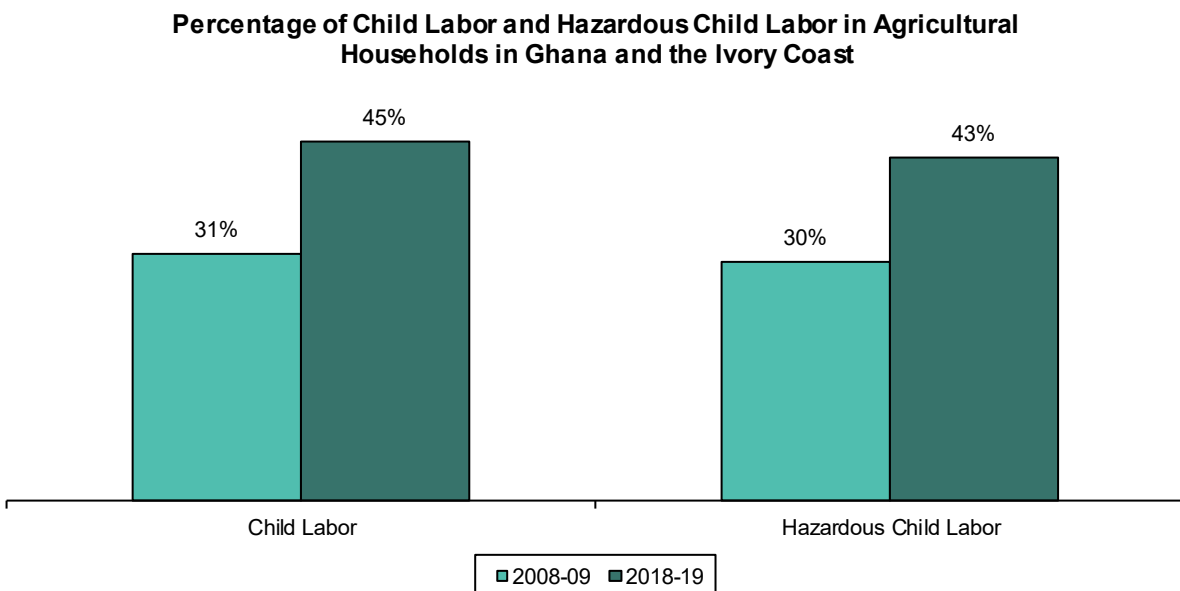
³⁴⁴ https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_748992/lang--en/index.htm

³⁴⁵ https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_748992/lang--en/index.htm

³⁴⁶ <http://www.responsiblemineralsinitiative.org/about/faq/general-questions/what-are-conflict-minerals/>

Given the complexity of these issues, which often involve socioeconomic conditions in less developed parts of the world, multi-stakeholder collaboration is needed to address them. What we want to highlight is that labor issues, even at the upstream raw material sourcing stage, can have a material financial impact on companies, either in the form of premiums charged by cocoa-producing countries or in the form of potential reputational risks, which could end up resulting in investors excluding and discounting select companies. We've already been told by some European investors that they cannot invest in chocolate producers because of child labor concerns. This should give companies concrete financial incentives to contribute their fair share to tackle labor issues in the upstream supply chain.

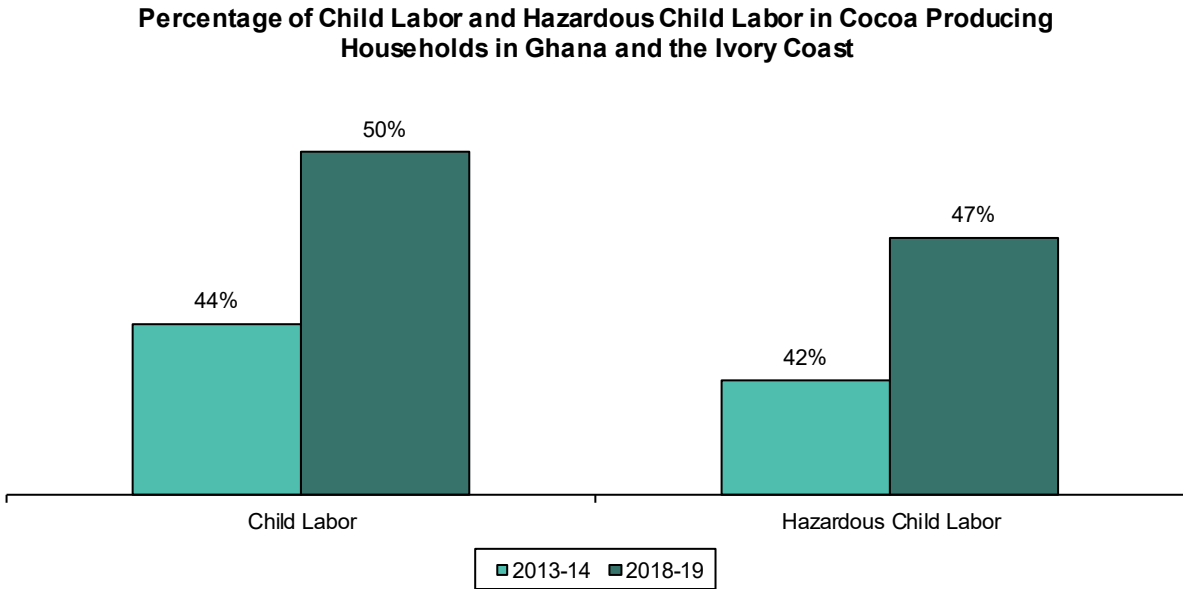
EXHIBIT 274: Close to 20 years from the initial signing of the Harkin-Engel Protocol, the percentage of children in child labor in agricultural households in Ghana and the Ivory Coast increased from 31% in 2008-09 to 45% in 2018-19, and the percentage of children in hazardous child labor increased from 30% to 43% over the past decade



Note: Child labor is defined as employment below the minimum age and beyond allowable hours of work (1+ hour/week for 5-11 years old, 14+ hours/week for 12-14 years old, and 43+ hours/week for 15-17 years old); hazardous labor is defined as activities including land clearing, carrying heavy loads, exposure to agro chemicals, using sharp tools, long working hours, and/or night work.

Source: National Opinion Research Center at the University of Chicago (NORC) and Bernstein analysis

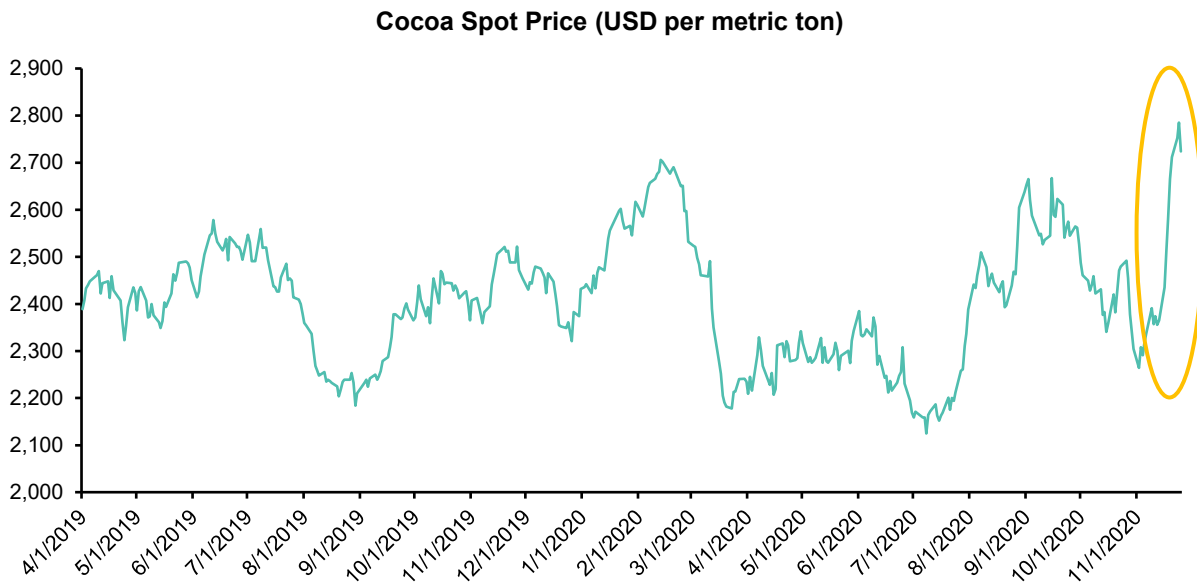
EXHIBIT 275: Among cocoa-producing households in Ghana and the Ivory Coast, % of children in child labor increased from 44% in 2013-14 to 50% in 2018-19 and % of children in hazardous child labor increased from 42% to 47%



Note: Child labor is defined as employment below the minimum age and beyond allowable hours of work (1+ hour/week for 5-11 years old, 14+ hours/week for 12-14 years old, and 43+ hours/week for 15-17 years old); hazardous labor is defined as activities including land clearing, carrying heavy loads, exposure to agro chemicals, using sharp tools, long working hours, and/or night work.

Source: NORC and Bernstein analysis

EXHIBIT 276: Cocoa spot price rallied to over \$2,700 per metric ton in November 2020 on the back of the US\$400/metric ton premium charged by cocoa-producing countries, 12.5% above the average price of ~US\$2,400/metric ton



Source: Bloomberg and Bernstein analysis

SIZING THE FINANCIAL IMPACT

For consumer-facing companies, consumer perception is reality. Supply chain labor scandals could damage brand images and move stocks. How meaningful is the financial impact? We review a few examples across the technology, apparel retail, and meat packing industries over the past decade to size the impact.

Foxconn: From March to May 2010, 10 factory workers committed suicide and two others attempted suicide at Foxconn factories in China.³⁴⁷ Foxconn³⁴⁸ is a major supplier of consumer electronics products, with Apple being its largest customer. Reports linked the cluster of suicides and attempted suicides to inhumane working conditions with excessive overtime and low wages.³⁴⁹ Although the basic salary of RMB900 per month was above the legal minimum wage, workers found it insufficient and felt compelled to work overtime. Foxconn's stock price sold off by -16% from late April to late May 2010 as the series of suicides started gaining media attention. In response, the company announced two consecutive pay rises on May 28 and June 7, 2010, which could double wages from RMB900 to RMB1,800³⁵⁰ per month. Analysts were worried about rising wages cutting into the company's razor-thin margins, which led to another -13% fall in the stock price from late May to early June 2010 (see Exhibit 277).

Over the next decade, Foxconn has moved toward automating its production lines and replacing workers with robots. Although progress has fallen short of initial expectations, automation could be the solution for some manufacturers facing supply chain labor issues over the long term.³⁵¹

³⁴⁷ <https://www.wsj.com/articles/SB10001424052748704269204575270031332376238>

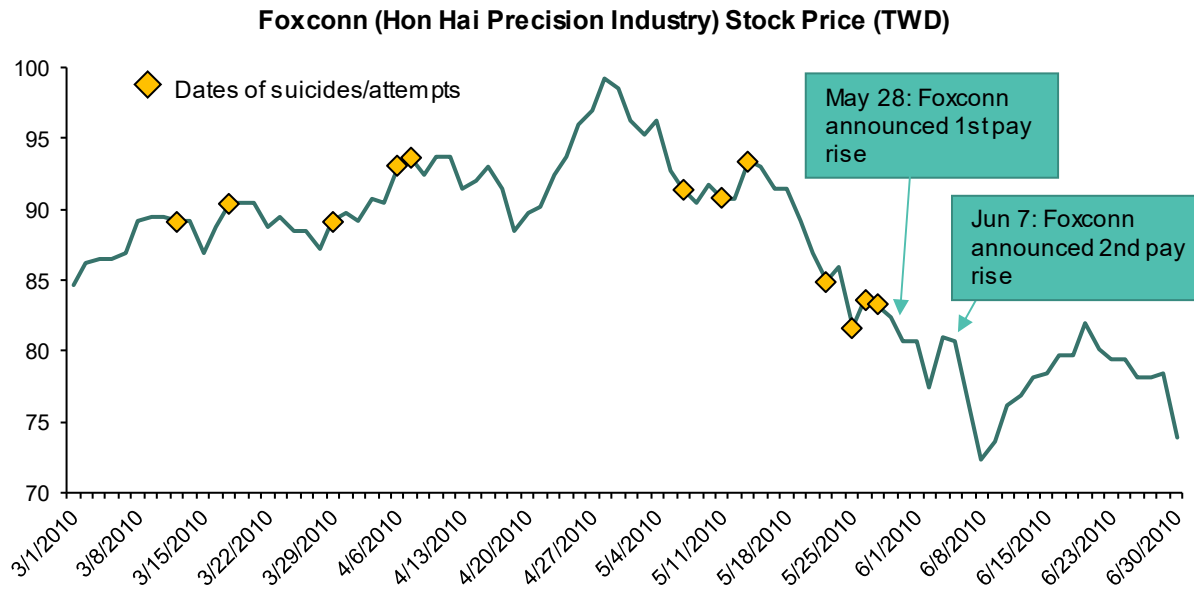
³⁴⁸ Trading as Hon Hai Precision Industry, not covered.

³⁴⁹ <https://www.theguardian.com/world/2010/may/27/foxconn-suicide-tenth-iphone-china>

³⁵⁰ <https://www.reuters.com/article/foxconn-china-shares/update-2-hon-hai-shares-tumble-on-new-china-wage-rise-idUSTOE65601920100607>

³⁵¹ <https://appleinsider.com/articles/20/06/04/how-apple-learned-automation-cant-match-human-skill>

EXHIBIT 277: Foxconn's stock price sold off by -16% on the back of a series of suicides by its factory workers; in response, the company announced two consecutive pay rises, which led to another -13% fall in the stock price as analysts worried about the margin impact



Source: Bloomberg and Bernstein analysis

Rana Plaza: On April 23, 2013, the collapse of the Rana Plaza building in Bangladesh killed 1,134 people and injured nearly 2,600.³⁵² The Rana Plaza building housed five garment factories that supplied 29 global brands including Primark (owned by AB Foods) in the UK, Benetton in Italy, Mango in Spain, and Joe Fresh in Canada.³⁵³ Cracks in the building were found the day before the collapse, but workers were ordered back in the following day; the building collapsed just before 9 AM. While AB Foods' stock price initially rose as the company reported strong earnings on the same day, protests and news headlines regarding Primark's involvement in Rana Plaza weighed on the stock in the following months. AB Foods' stock price sold off by -16% in the two months following the Rana Plaza incident (see Exhibit 278).

Following the incident, more than 200 global firms signed a legally binding agreement called the Accord on Fire and Building Safety in Bangladesh, and pledged to source from factories that met basic safety criteria.³⁵⁴ While this represented a step forward, the Bangladesh garment industry was again hit hard during the Covid-19 pandemic when global brands cancelled orders from suppliers to avoid payment for goods that were already in production.³⁵⁵ Reports show more than two million garment workers in

³⁵² <https://cleanclothes.org/campaigns/past/rana-plaza>

³⁵³ Benetton, Mango, and Joe Fresh are private and not covered.

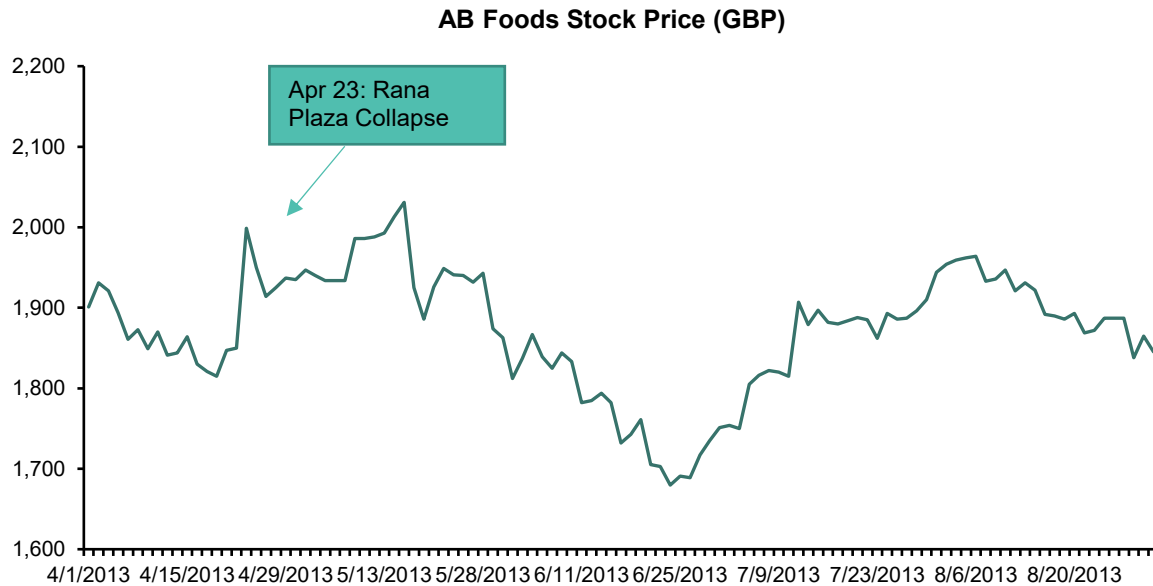
³⁵⁴ <https://www.opensocietyfoundations.org/voices/what-s-changed-and-what-hasn-t-rana-plaza-nightmare>

³⁵⁵ <https://www.reutersevents.com/sustainability/millions-garment-workers-face-destitution-fashion-brands-cancel-orders>

Bangladesh lost their jobs or were furloughed due to order cancellations amounting to US\$3bn.

Sometimes, it takes a crisis for us to move forward. Fair labor practices in Bangladesh's garment industry remain a work in progress. Without long-term solutions, labor scandals could continue to pose reputational risks to major global apparel brands and retailers that source from Bangladesh.

EXHIBIT 278: AB Foods' (parent company of Primark) stock price sold off by ~16% in the two months following the Rana Plaza incident



Source: Bloomberg and Bernstein analysis

Meat Packers: The meat packing industry has a history of labor complaints related to injuries, high stress levels, and workplace abuse. Data from the US Occupational Safety and Health Administration (OSHA) show that a worker in the meat and poultry packing industry lost a body part or was sent to the hospital about every other day between 2015 and 2018.³⁵⁶ Concerns about worker safety and wellbeing were exacerbated during the Covid-19 pandemic. Given the labor intensiveness of meat packing plants (with workers literally standing shoulder to shoulder to process animals), we saw significant Covid-19 outbreaks at a large number of meat plants in May 2020, which led to temporary plant closures and an over 30% drop in beef and pork production in the US.³⁵⁷ Tyson's stock price fell by over 10% between April 20, 2020 when its first temporary plant closure was announced, and May 7, 2020 when most plants were brought back online operating at limited capacity (see Exhibit 279).

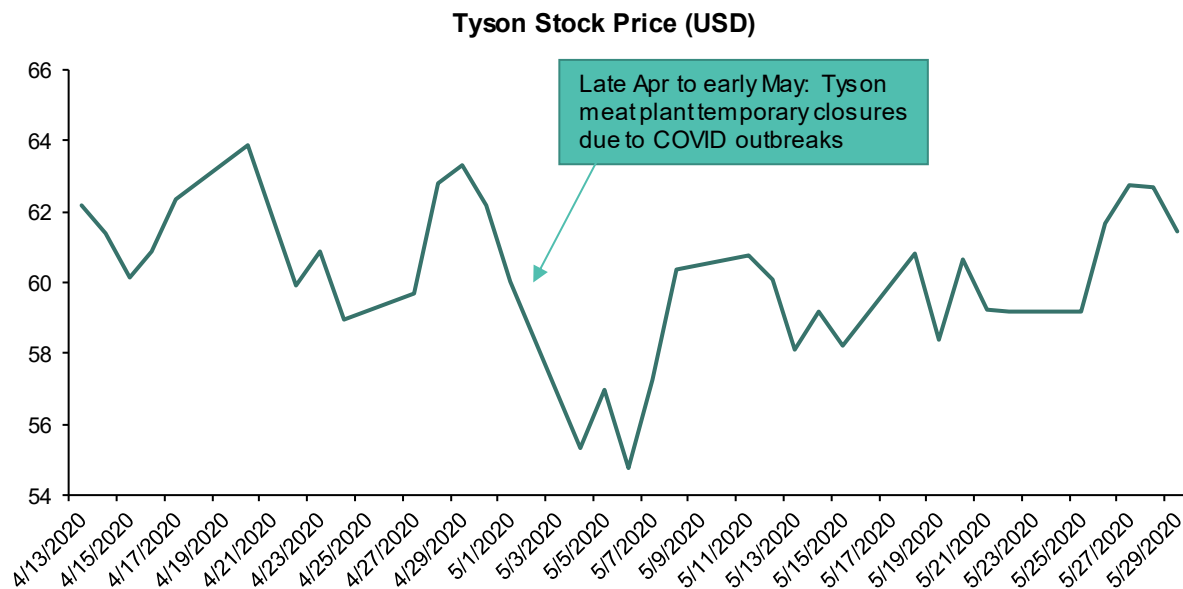
³⁵⁶ <https://www.hrw.org/report/2019/09/04/when-were-dead-and-buried-our-bones-will-keep-hurting/workers-rights-under-threat#>

³⁵⁷ See report: [Tyson: Downgrading to Market-Perform given near-term uncertainties due to meat plant closures and absenteeism.](#)

While Covid-19-related plant closures were short lived and production levels have since normalized, recurring labor issues have called into question the resilience of the meat supply chain and could weigh on the multiples of meat suppliers on the back of increased earnings volatility over the longer term.

Looking forward, Tyson is actively pursuing automated solutions to reduce the labor intensiveness of its meat packing operations. However, as each animal carcass is different, current deboning technology cannot fully replace humans and could result in a 1-1.5% loss in yield.³⁵⁸

EXHIBIT 279: Tyson's stock price fell by over 10% on the back of plant closures due to Covid-19 outbreaks among plant workers; while Covid-19-related plant closures were short lived, recurring labor issues could increase earnings volatility and weigh on the multiples of meat suppliers over the longer term



Source: Bloomberg and Bernstein analysis

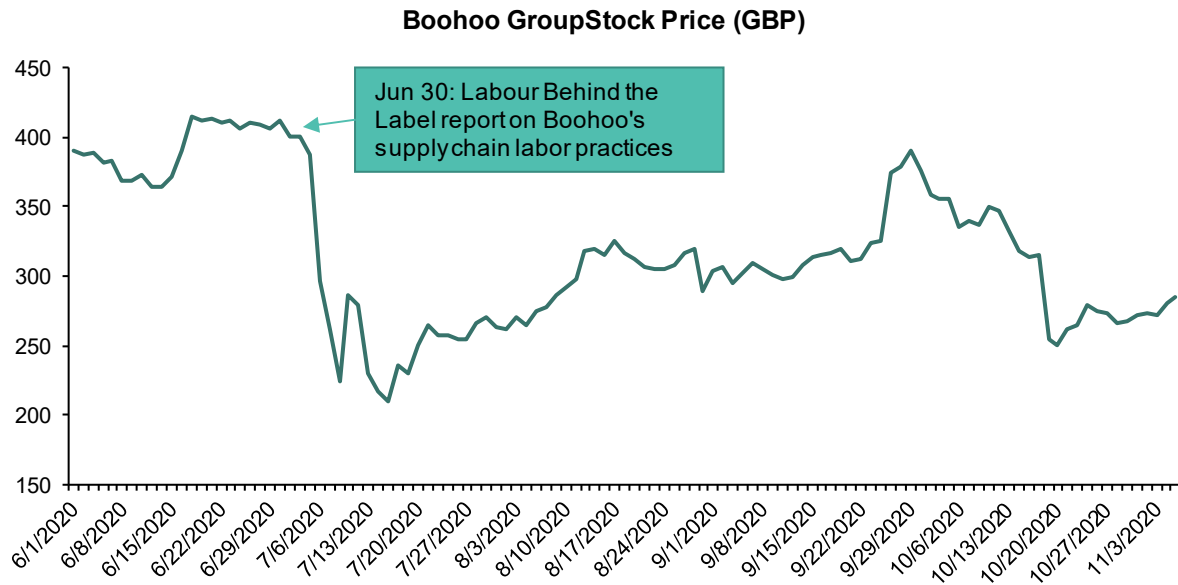
Boohoo: On June 30, 2020, a UK workers' rights organization, Labour Behind the Label, accused Boohoo's subcontractor in Leicester, UK, of remaining open during the lockdown period without proper safety measures in place. The report alleged ~80% of Leicester's garment industry are suppliers for Boohoo and that many of these suppliers had been flouting social distancing rules, asking workers to continue working while sick, and paying workers £2-£3 an hour, below the national minimum wage.³⁵⁹ The stock sold off by -35% in July 2020 (see Exhibit 280). Although we believe the direct P&L impact is small and shortlived, the ESG overhang has weighed on the stock valuation as ESG-conscious investors have been hesitant to get back into the stock.³⁶⁰

³⁵⁸ <https://www.fooddive.com/news/tyson-foods-speeds-up-plans-for-robot-butchers-during-pandemic/581450/>

³⁵⁹ <https://labourbehindthelabel.net/wp-content/uploads/2020/06/LBL-Boohoo-WEB.pdf>

³⁶⁰ See report: [Boohoo: Valuation: What's the ESG discount?](#)

EXHIBIT 280: **Boohoo's stock sold off by -35% in July 2020 after a UK workers' rights organization accused one of its subcontractors of modern slavery; although we believe the P&L impact is small and shortlived, the ESG overhang has weighed on the stock as ESG-conscious investors have been hesitant to get back into the stock**



Source: Bloomberg and Bernstein analysis

How exactly do these supply chain labor scandals move stocks? We take a closer look at the financial impact on companies' earnings as well as multiples.

EARNINGS IMPACT

For **Boohoo** (not covered) our European General Retail team estimated a -14% EPS headwind in 2021, which translates into a -8% EPS headwind in 2024, as a result of the labor scandal (see Exhibit 281 and Exhibit 282). The earnings impact is largely driven by higher labor costs, lower sales due to slower new customer acquisition, several third-party sites dropping Boohoo products pending investigation results, and increased opex as the company conducts supply chain reviews and builds additional oversight infrastructure.³⁶¹

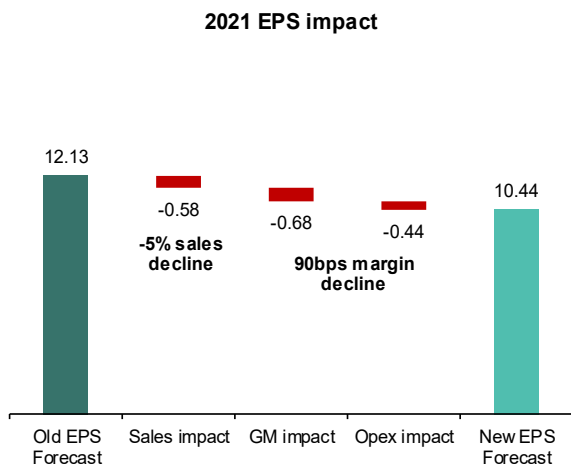
In the **Tyson** example, our US Food team reduced its FY20 EPS estimate by -16% as a result of the meat supply chain disruptions in April and May, which led the team to tactically downgrade Tyson from Outperform to Market-Perform.³⁶² The EPS headwind is primarily driven by lower sales due to temporary plant closures and increased absenteeism among plant workers. Meanwhile, we expected the cost impact to be muted as higher Covid-19-related costs (e.g., bonuses paid to front-line employees, PPE, and sanitation) were offset by lower costs of sourcing live cattle and lean hogs, given the reduced processing capacity (see Exhibit 283).

³⁶¹ See report: [Boohoo: Valuation: What's the ESG discount?](#)

³⁶² See report: [Tyson: Downgrading to Market-Perform given near-term uncertainties due to meat plant closures and absenteeism.](#)

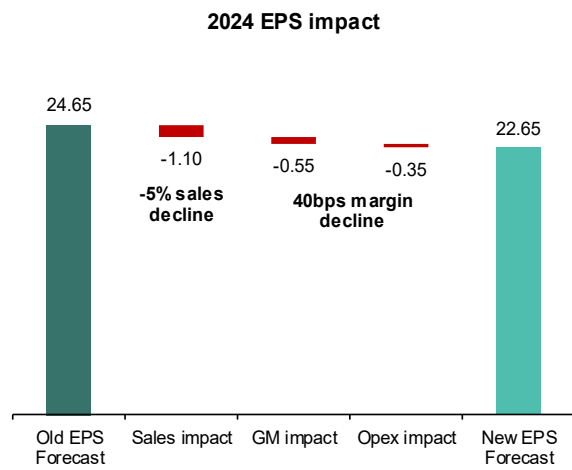
Taken together, supply chain labor issues could negatively impact many aspects of a company's P&L, posing near-term headwinds to earnings (see Exhibit 284). Consumer backlashes (in Boohoo's case) and production disruptions (in Tyson's case) could weigh on sales. Meanwhile, companies may need to incur additional costs to retain employees (think Foxconn and Boohoo) and, in some cases, higher costs to source raw materials responsibly from child-labor-free and/or conflict-free zones (e.g., we've seen this in the cocoa supply chain). Further, companies could invest more capital to implement safety protocols and/or automate parts of the supply chain, although these measures could generate savings over the longer term.

EXHIBIT 281: For Boohoo, our European General Retail team lowered its 2021 EPS estimate by 14% due to slower sales growth and higher supplier/admin costs



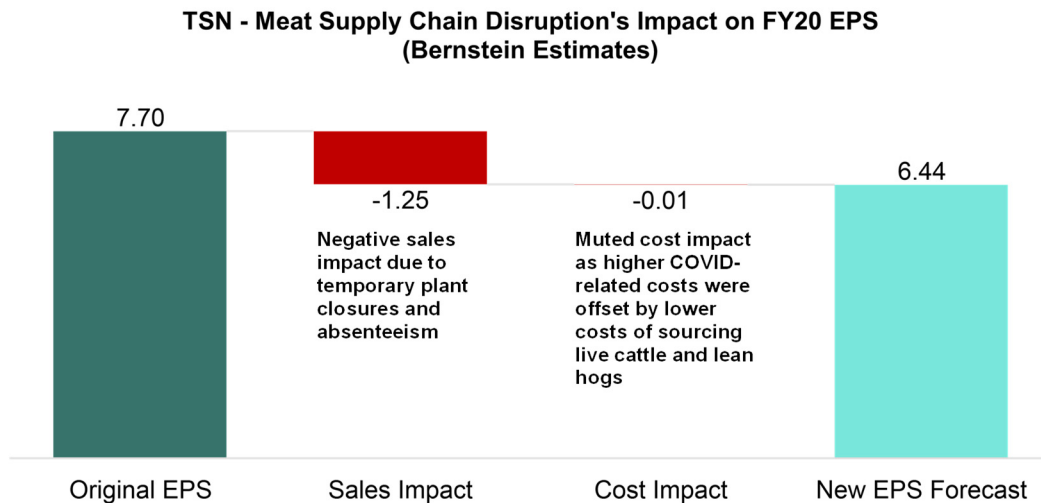
Source: Company reports, and Bernstein estimates and analysis

EXHIBIT 282: The 2020 sales deceleration should drive a small long-term headwind through 2024; EPS 8% lower



Source: Company reports, and Bernstein estimates and analysis

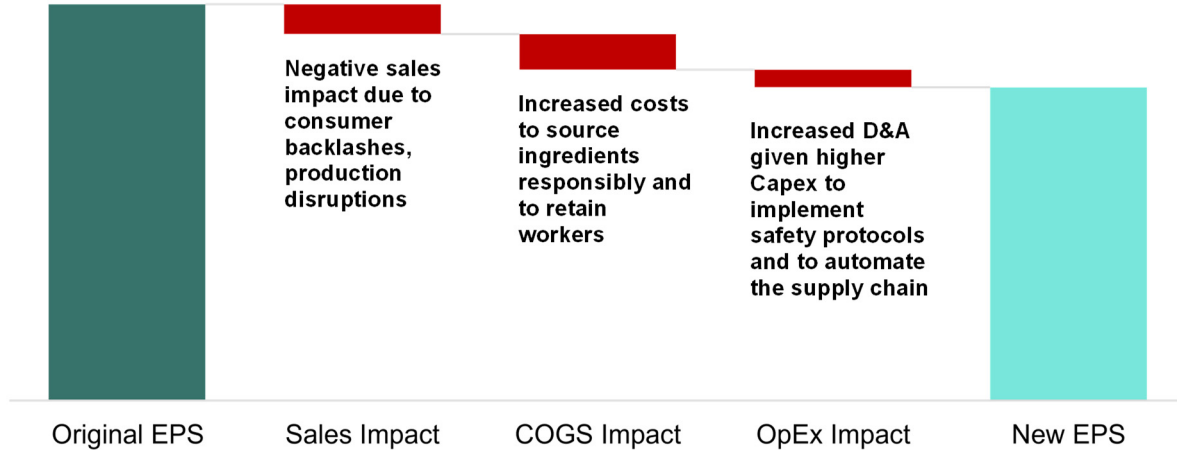
EXHIBIT 283: In the Tyson example, our US Food team lowered its FY20 EPS estimate by -16%, given lower sales due to plant closures and increased absenteeism



Source: Company filings, and Bernstein estimates and analysis

EXHIBIT 284: Taken together, supply chain labor issues could negatively impact many aspects of a company's P&L, posing near-term headwinds to earnings

Illustrative P&L Impact of Supply Chain Labor Scandals



Source: Bernstein analysis

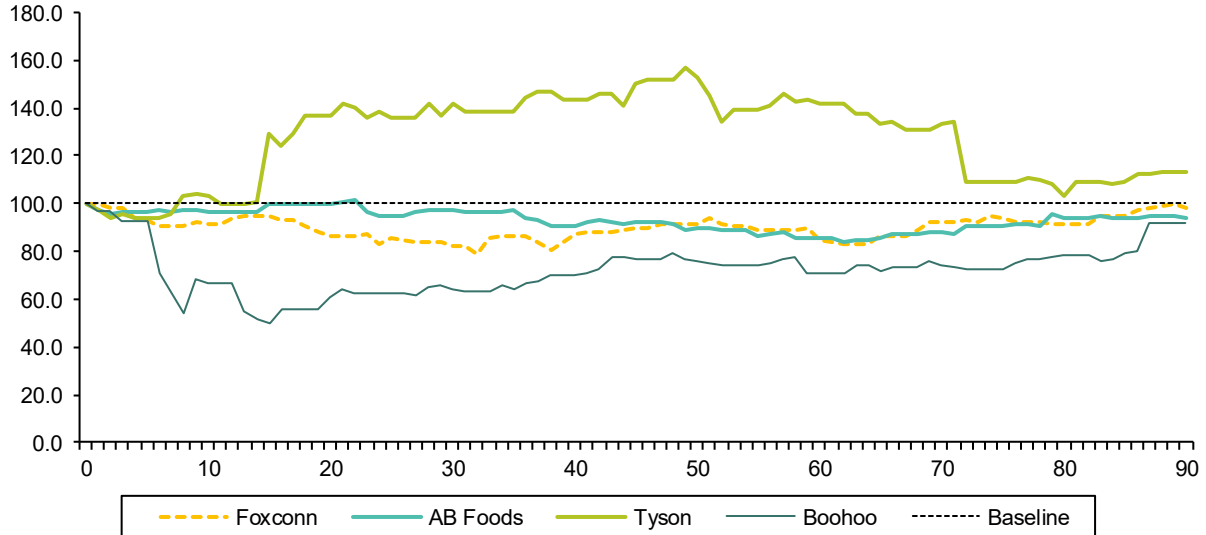
MULTIPLES IMPACT

Beyond the earnings impact, labor scandals could weigh on stock multiples as investors worry about the reputational risk of being associated with the stock. Increased earnings volatility could also lead investors to re-rate the stock. Using historical precedents as a guide, Foxconn, AB Foods, and Boohoo traded at an average P/E multiple discount of 10-25% in the 90 days following their supply chain scandals (see Exhibit 285). Conversely, after trading at a small P/E discount for the first two weeks, Tyson started trading at a significant premium as production disruptions were resolved quickly and as consensus already baked in a ~15% EPS headwind in the interim. However, given its higher earnings volatility, Tyson continues to trade at a meaningful discount to packaged food companies.

Exhibit 286 illustrates how supply chain labor scandals could impact a company's stock price by posing headwinds to both earnings estimates and multiples. As shown in Tyson's case, a company may not necessarily trade at a multiple discount if its supply chain issues are one-time in nature and can be quickly resolved. However, in most cases, we expect the stock to trade at an average ~10-25% multiple in the three months after a major scandal. While the multiples impact tends to be short term in nature, risks of recurrence could increase a company's earnings volatility and weigh on its long-term multiples. Further, as consumers start to really vote with their wallets for brands with more sustainable labor practices, that could start to differentiate winners from losers in terms of top-line growth, resulting in a longer-lasting financial impact.

EXHIBIT 285: Foxconn, AB Foods, and Boohoo traded at an average P/E multiple discount of 10-25% in the 90 days following their supply chain scandals; conversely, Tyson started trading at a meaningful premium two weeks after the initial plant closure as production disruptions were resolved quickly and as consensus already baked in a ~15% EPS headwind in the interim

Impact on P/E Multiples 3 Months After Supply Chain Labor Issues

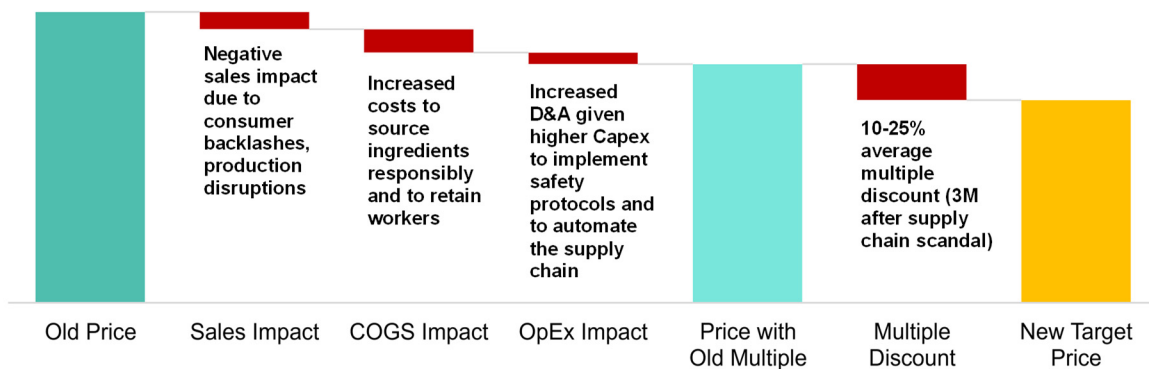


Note: The P/E ratio is based on forward earnings for all companies except for AB Foods, where we used trailing earnings as P/FE data is not available going back to 2013.

Source: Bloomberg and Bernstein analysis

EXHIBIT 286: Taken together, supply chain labor scandals could meaningfully impact a company's stock price by posing headwinds to both earnings estimates and multiples

Illustrative Stock Price of Supply Chain Labor Scandals



Source: Bernstein analysis

WHO ARE THE LEADERS AND LAGGARDS?

As supply chain labor scandals pose material reputational and financial risks for consumer-facing manufacturers, it is important to differentiate leaders from laggards. However, a major challenge to compare companies' labor practices is their inconsistent disclosure quality. In contrast to environmental metrics such as GHG emissions that are easier to quantify, labor issues tend to be more qualitative with no cross-industry disclosure standard.

While there is no perfect way to measure companies' labor practices across industries on an apples-to-apples basis, a few third-party benchmarks score companies based on their disclosures and other public data sources. It is of note that these benchmarks could yield very different results based on their different methodologies. They also tend to favor bigger companies with more resources behind labor disclosure as well as companies that have been scored for several years (while newly included companies tend to have lower scores as they are less familiar with the scoring methodology).

Given these issues, we view the benchmarks as a starting point to compare companies' labor policies and disclosures. We then provide our sector analysts' fundamental perspectives to present a more holistic picture.

The first benchmark we've come across is the **Corporate Human Rights Benchmark (CHRB)**. The CHRB evaluates companies' labor policies and practices and how they respond to serious allegations by collecting publicly available information (e.g., company reports and third-party allegations) and encouraging companies to disclose additional information. After gathering the data, the CHRB evaluates companies' labor practices from six angles: governance and policy commitments (10%), embedding respect for labor rights and measuring labor risks (25%), remedies and grievance mechanisms (15%), company labor practices and performance (20%), responses to serious allegations (20%), and transparency (10%).³⁶³

The results were quite bleak. 25% of the over 200 companies included in the analysis scored less than 10 out of 100, and close to 90% of companies scored less than 50 in 2019. By sector, Information and Communications Technology (ICT) manufacturing was included in the analysis for the first time in 2019 and scored lower — 17.8 out of 100 on average (see Exhibit 287). However, the CHRB has seen improvement in companies assessed multiple times, with the average score for these companies increasing from 18 in 2017 to 31 in 2019, and we could expect ICT manufacturing companies to play catch up in the coming years. Across the board, labor risks due diligence is a key weakness for most companies in terms of identifying, measuring, and mitigating supply chain labor risks. Disclosure quality is also low when it comes to mapping out key suppliers or disclosing living wages.³⁶⁴

³⁶³ <https://www.corporatebenchmark.org/sites/default/files/CHRB%202020%20Methodology%20AGAPEX%2028Jan2020.pdf>

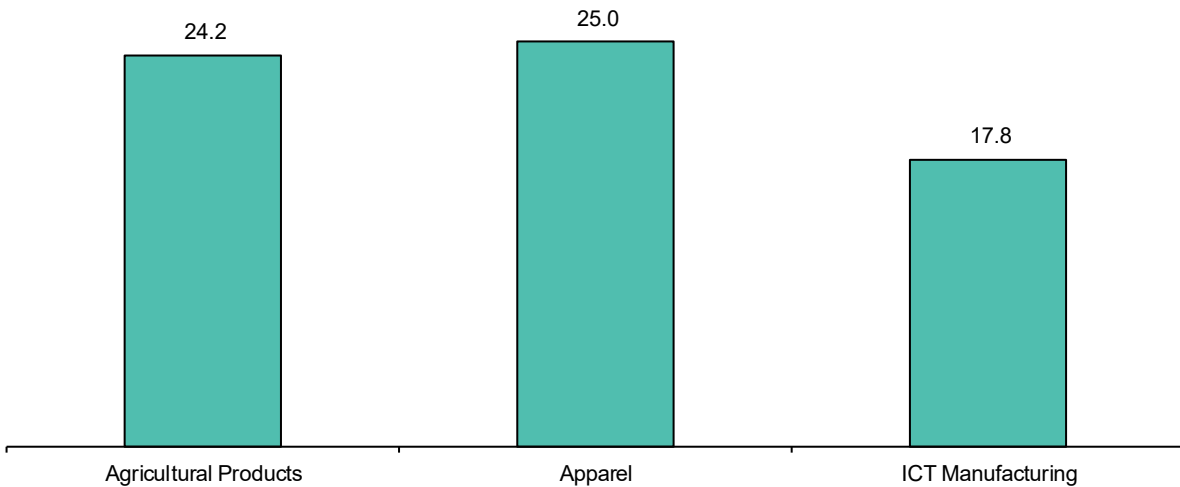
³⁶⁴ <https://www.corporatebenchmark.org/sites/default/files/2019-11/CHRB2019KeyFindingsReport.pdf>

At the company level, Adidas, Unilever, Marks & Spencer,³⁶⁵ Inditex, and Kellogg were the top 5 ranked by the CHRB in 2019 (see Exhibit 288). Most of the top-ranked companies scored highly in terms of commitments and disclosure around fair labor practices, although performance varied in terms of companies' specific labor practices and labor risk management.

On the flip side, a number of Asian companies scored 0-1 (out of 100) in 2019 due to lack of disclosure on labor practices (see Exhibit 289). In fact, many emerging market companies lack disclosures across many salient ESG topics, which suggests weaker governance beyond just on labor management. As such, our APAC Beverages team applies a higher equity risk premium to Moutai, given its weak governance versus other Baijiu stocks.³⁶⁶

EXHIBIT 287: By sector, ICT manufacturing was included in the analysis for the first time in 2019 and scored low (17.8 out of 100 on average); but overall, there's plenty of room for improvement across all sectors

Average CHRB Scores (2019) by Sector (out of 100)

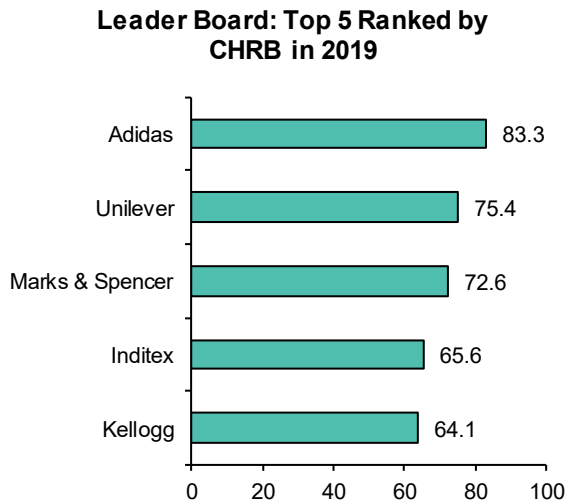


Source: CHRB and Bernstein analysis

³⁶⁵ Not covered.

³⁶⁶ See report: [China Beer & Baijiu: Key risks beyond COVID](#).

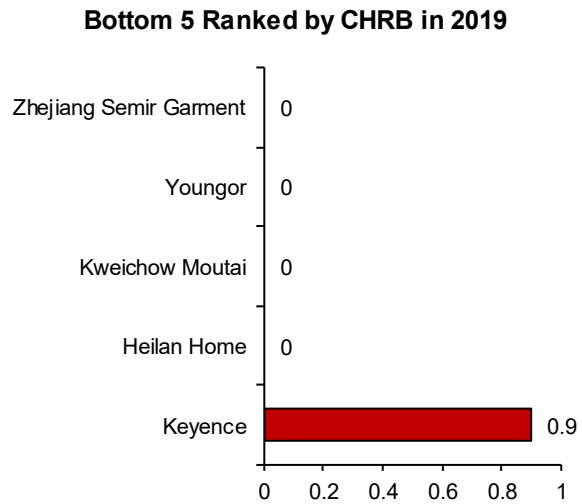
EXHIBIT 288: **Adidas, Unilever, Marks & Spencer, Inditex, and Kellogg were the top ranked by CHRB in 2019**



Note: Marks & Spencer is not covered.

Source: CHRB and Bernstein analysis

EXHIBIT 289: **On the flip side, a number of Asian companies scored 0-1 (out of 100) in 2019 due to lack of disclosure on labor practices**



Note: Semir, Youngor, and Heilan are not covered. Moutai is covered by Bernstein's Asia-Pacific Beverages analyst Euan McLeish and Keyence is covered by Bernstein's Asian Industrial Technology analyst Jay Huang.

Source: CHRB and Bernstein analysis

Another benchmark we've come across is called **KnowTheChain (KTC)**. Compared to the CHRB, KTC is mostly focused on assessing forced labor risks in the supply chain by evaluating companies' public commitments and governance, supply chain traceability and risk assessment, purchasing practices, recruitment approaches, worker voice, monitoring mechanisms, and response to allegations.³⁶⁷ KTC evaluates companies across ICT manufacturing, food & beverage, and apparel sectors every two years. As the latest apparel assessment has not been released yet, the 2020-21 benchmark only includes ICT and food & beverage companies.

Interestingly, all top 5 ranked companies were ICT manufacturers — HPE,³⁶⁸ HP,³⁶⁹ Samsung,³⁷⁰ Intel,³⁷¹ and Apple,³⁷² — in 2020 (see Exhibit 290). In contrast, no ICT manufacturers made it to the top 5 list in the CHRB benchmark in 2019 as it was the first year that ICT companies were included in that benchmark. At the bottom of the list, a number of emerging market companies, including three in the meat & dairy industry (Almarai, Yili, and WH Group), scored 0-1 (out of 100) in 2020 due to lack of disclosure (see Exhibit 291).

³⁶⁷ <https://knowthechain.org/benchmark-methodology/>

³⁶⁸ Covered by Bernstein's US IT Hardware & Electric Vehicles analyst Toni Sacconaghi.

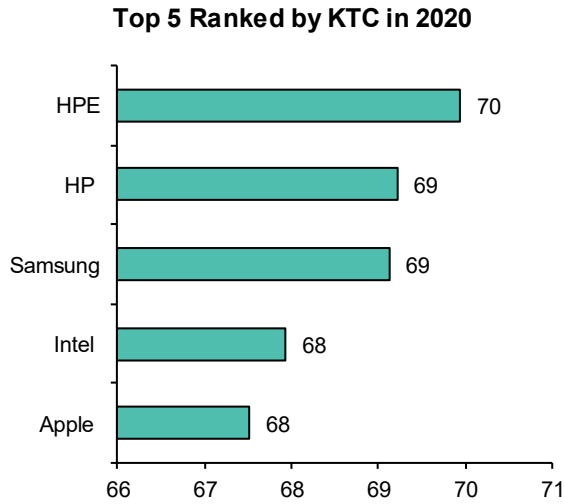
³⁶⁹ Covered by Bernstein's US IT Hardware & Electric Vehicles analyst Toni Sacconaghi.

³⁷⁰ Covered by Bernstein's Global Memory analyst Mark Li.

³⁷¹ Covered by Bernstein's US Semiconductors analyst Stacy Rasgon.

³⁷² Covered by Bernstein's US IT Hardware & Electric Vehicles analyst Toni Sacconaghi.

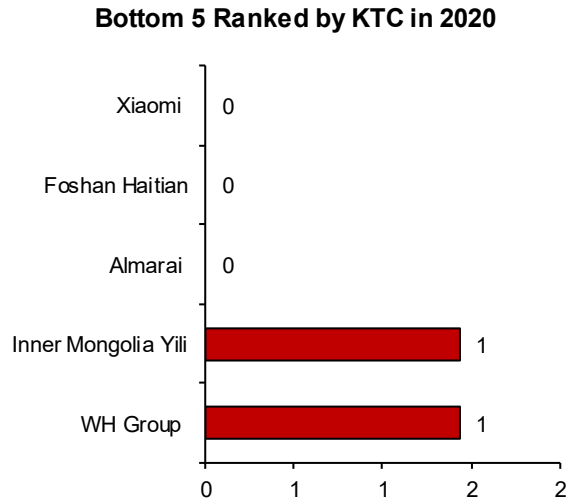
EXHIBIT 290: All top 5 ranked companies by KTC in 2020 were ICT manufacturers



Note: HPE, HP, and Apple are covered by Toni Sacconaghi, Samsung is covered by Mark Li, and Intel is covered by Stacy Rasgon.

Source: KTC and Bernstein analysis

EXHIBIT 291: In contrast, a number of emerging market companies, including three in the meat & dairy industry, scored 0-1 (out of 100) in 2020



Note: Xiaomi, Haitian, Almarai, Yili, and WH Group are not covered.

Source: KTC and Bernstein analysis

+ SECTOR PERSPECTIVES

US FOOD (ALEXIA HOWARD)

Within the US Food space, it's probably important to put labor management practices into a longer-term context. Historically, these companies enjoyed leading positions in a very safe and secure industry where barriers to entry were very high. And white-collar workers were typically recruited from good schools in a competitive labor market (for the employers) into higher-paying jobs, while front-line workers were typically less educated and skilled and lower paid at standard industry rates, which were then supported by unionization. Nonetheless, the high barriers to entry in the industry likely enabled these companies to develop fairly good pay rates and labor practices over time. In recent years, the industry has become more competitive and barriers to entry have reduced, with many companies focusing more on cost-cutting efforts (especially since the entry of 3G with its acquisition of Heinz in 2013 and the subsequent merger with Kraft in 2015). As such, we suspect workforce reductions may have put more overall strain on the remaining employees. Although the failure of the 3G model in packaged food may have alleviated this pressure over the past couple of years, it's also worth considering recent employee strike actions that have occurred during a period of supply chain disruption and labor shortages, which suggest relationships remain strained for some companies.

As such, while we are encouraged that the CHRB ranked *Kellogg* #5 in 2019, we suspect this may have inadvertently missed the strain on employee relations that emerged back in the 2015 union negotiation as the company introduced a new transitional workforce at a lower hourly rate than legacy workers. This controversy resurfaced in October 2021 as the

deadline for renegotiating these contracts expired. And in a tight labor market hot off the arduous demands of the pandemic and with workers who have saved up their money after contract negotiations failed in 2020, this could be a drawn-out battle with implications for short-term and longer-term labor costs and company image.

Many companies are now complaining they have been deluged with requests from many ratings systems to invest additional time and resources into completing submissions. We encourage the companies themselves to collectively embrace a common set of metrics that we as analysts can use to compare one company against another in the most transparent way possible.

The pandemic has clearly also raised questions of worker safety in the meat processing industry, which may result in increased worker compensation as well as investments in automation over the coming years.

As for the question of child labor issues in the cocoa supply chain, we can't help but notice the wide gulf between the data shown in the NORC study from 2018-19 and the progress that companies such as *Hershey*³⁷³ and *Mondelez*³⁷⁴ have made in their percentage of sustainably sourced cocoa. We suspect these leading companies have indeed made decent progress, and it is cocoa going to other manufacturers that is the real problem, but ongoing improvements in monitoring child labor and deforestation problems are needed. Clearly, there is still work to be done to improve the overall situation in the Ivory Coast and Ghana, and the recent moves by governments to impose a US\$400 per metric ton living income supplement may help to address this.

In terms of how easy it might be to quantify the financial impact of supply chain labor issues, frankly it's hard. When major issues occur that weigh on a company's reputation (leading to reduced sales as consumers switch to alternative brands or leading to investors choosing not to invest based on these criteria) or that lead to incremental costs over time (which may or may not be able to be passed on in the form of higher pricing), we certainly see a short-term impact, as in the case of *Tyson* in the summer of 2020. But building such factors into earnings forecast models is a new source of uncertainty. Perhaps the best place to start will be to pick out the major areas where pain points have already been identified (e.g., cocoa and meat processing) and think about how the incremental costs to address these issues may evolve over time and how much pricing power these companies have in terms of passing along these costs. In the case of chocolate companies, we suspect their pricing power is fairly high due to the lack of private-label competition in chocolate. In the case of meat processors, it will likely depend upon the industry adopting new processing technologies and labor practices over time and slowly passing these incremental costs on to consumers.

In terms of underappreciated ESG stories, the main one that jumps out is *Beyond Meat*. Since the plant-based meat industry is so embryonic, Beyond Meat often surfaces as lower rated on many ESG-based ranking systems, but this is likely because the company's rapid rate of growth has prevented management from having much bandwidth to be transparent

³⁷³ Covered by Bernstein's US Food analyst Alexia Howard.

³⁷⁴ Covered by Bernstein's US Food analyst Alexia Howard.

in its disclosures in this area, and not because there is an inherent problem with the business model. Certainly from an environmental standpoint, the relatively low environmental impact of its products relative to the animal meat production industry should stand it in good stead.

EUROPEAN FOOD (BRUNO MONTEYNE)

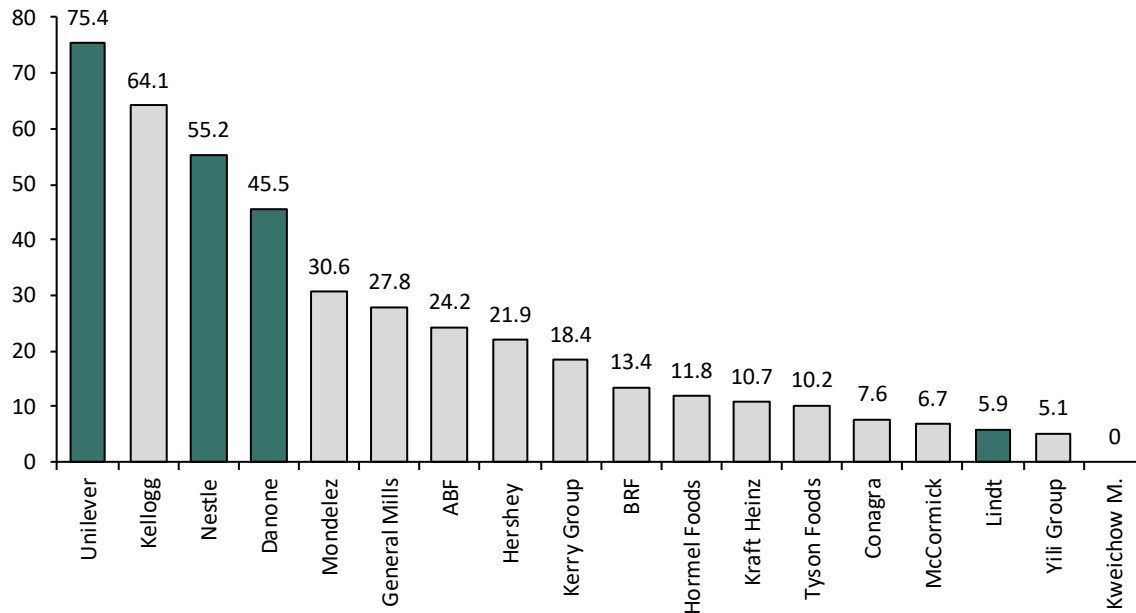
How do European Food companies perform?

European companies score vastly better than their global peers. On the CHRB human rights ranking, our coverage takes three out of the top 4 slots, but Lindt comes far behind (see Exhibit 292). On the KTC rankings (related to forced labor), they all score relatively well and all four companies (Unilever, Nestle, Danone, and Lindt) are in the top 7 (see Exhibit 293).

European companies keep accelerating ahead. Not only are Unilever, Nestle, and Danone ahead, their year-on-year improvements in the CHRB rankings are also the three highest improvement scores across the entire sector. The lead is extending further.

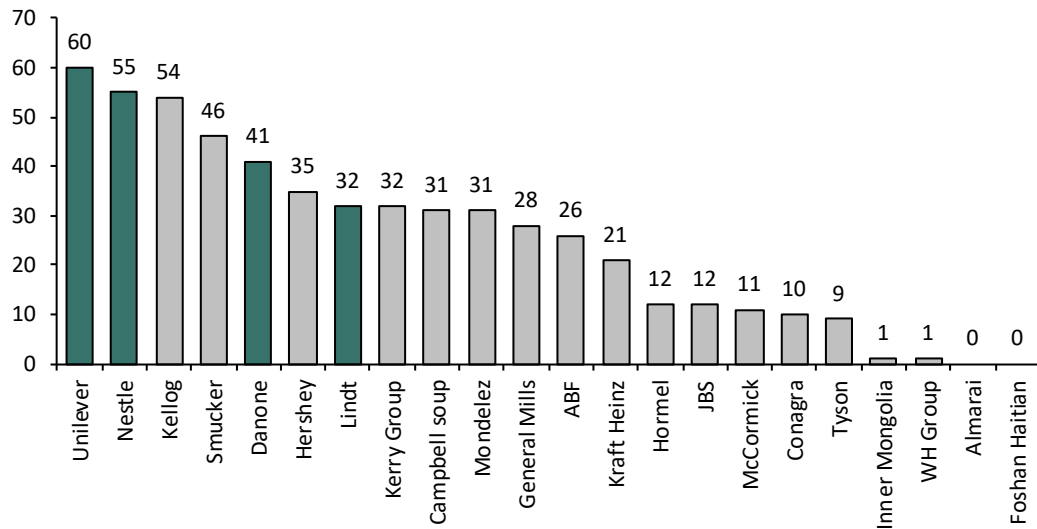
EXHIBIT 292: **CHRB Rankings (Human Rights) – Packaged Food 2019 Rankings**

CHRB - Packaged Food 2019 Rankings



Note: Kerry Group, BRF, and Hormel are not covered.

Source: Bernstein analysis

EXHIBIT 293: **KTC (Forced Labor) – Packaged Food 2020 Ranking****Know The Chain - Packaged Food Score**

Note: Kerry Group, Hormel, JBS, Inner Mongolia Yili, WH Group, Almarai, and Foshan Haitian are not covered.

Source: Bernstein analysis

That doesn't mean there isn't a problem or a risk. Agricultural sourcing in emerging markets is one of the main places where labor issues occur. Certain key commodities (cocoa, tea, and coffee) are sourced in very low-income countries, where the probability of child labor is high. There is a risk of forced labor, especially in regions where war causes large amounts of migrants. Both Unilever and Nestle, with very strong scores in the CHRB framework, have had serious allegations documented by the CHRB. No such issues were reported for Danone and Lindt. Currently, a case is going through American courts against Nestle, Cargill,³⁷⁵ and other confectionary companies related to forced labor issues in the cocoa supply chain.

What's the main type of labor risk? As this chapter describes, there are multiple problems that relate to labor relationships, but only one seems particularly relevant for our coverage. We classify the labor issues of this chapter into three different types of labor problems:

- **(1) Treating your employees badly.** Ranging from the extreme case of benefiting from forced labor up to weaker forms such as companies preventing labor from organizing themselves.
- **(2) Finding somebody else to treat your employees badly.** Often in complex outsourcing supply chains, companies knowingly let the production go through multiple layers of outsourcing in search of lower product costs. This can lead to shifting of work to the weakest members in society in countries with weak labor laws and/or with weak

³⁷⁵ Not covered.

enforcement of labor laws. Thanks to the multiple layers, the companies have plausible deniability and can say "we didn't know," "somebody breached our contracts."

- **(3) *Struggling to find anybody that can do the work in good conditions.*** This is the case of sourcing agricultural commodities in poor countries where there are large pools of unemployed labor and relatively low barriers to entry.
- Our sector's problems (i.e., European Food) are largely the third. Our companies tend to be those that employees want to work for with knowledge-based jobs in marketing, sales, or finance. Manufacturing is usually highly automated and attracts skilled workers to run automated plants. Labor issue 1 (treating employees badly) is, therefore, not a major concern. The second labor issue (finding somebody else to treat your employees badly) is structurally quite hard as there is: (1) relatively little cheap labor that can be offshored, and (2) the distribution costs associated with finding cheap offshore manufacturing would be prohibitively high for most product categories. But the sector is a major buyer of agricultural commodities that are mainly found in very poor countries (cocoa, tea, and coffee).
- Companies in our sector pay market rates for those commodities, often pay premiums over market rates, and do not knowingly transgress any local trading laws. But the fact is that the availability of cheap labor and agricultural land, combined with a market mechanism that matches supply and labor, leads to very low agricultural prices. At the prevailing commodity prices, many (if not most) of the farmers producing those commodities will live in poverty. Poverty on farms leads to increased likelihood of child labor on those farms. Eradication of child labor in the supply chain is one of the high-priority goals for improving labor standards. While there may not be a direct mechanism by which our companies cause child labor, they clearly source their commodities from places where child labor is prevalent today. It is a moral issue foremost and also a brand risk for those companies. This problem of child labor is not straightforward to solve. One cannot say: "bring production in-house, use higher standards, problem solved." We can't take cocoa production out of those poor countries, and our companies can't single-handedly lift those countries out of poverty.

Child Labor is just one of the many challenges in the Human Rights for "decent standard of living." The problem is further compounded by the UN Universal Declaration of Human Rights, article 25, stating: "*Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.*" Child labor is a symptom of poverty. Poverty itself is an infringement of human rights as per this statement. Therefore, even if child labor could be materially reduced in the short term, the problem would simply shift toward the next challenge of "decent standard of living."

The solution the industry is working toward. The decent standard of living challenge also points in the direction of how to solve the child labor problem: pay farmers a "decent" wage, or a "living income" (the farmer equivalent of living wage, a wage that is typically above minimum wage and allows for "decent" standard of living). How do you get farmers to make

a living income? The industry is working on a combination of improvements to achieve a living income:

- **Certification.** Certification doesn't mean there is no child labor problem. It simply means that you know where your commodities come from. That is very important in countries with limited formal infrastructure where there are often a large number of middlemen between the farmer and the final buyer. This requires investment in embedding oneself within the local communities where the commodities are sourced from.
- **Productivity improvements.** Companies such as Nestle, Unilever, and Lindt work closely with those certified areas to improve productivity: from providing better seeds/trees to improving the ecological resilience of the area, diversifying production into other crops, farmer training, etc. They all lead to the same farmer producing more of the commodity.
- **Social engagements.** These companies play the role of the state in those certified areas: building schools, buying books, sourcing birth certificates so the children can attend school, strengthening the roles and support for women, educating families about what constitutes child labor, etc.
- **Quality and environmental improvements.** Certification programs also focus on improving the quality of the crops and the environmental sustainability of those products. While that is an ESG goal in and of itself, it also helps with earning a potential price premium for the final product.
- **Paying a premium above the market rates.** There are several mechanisms out there (e.g., Fair Trade and Living Income Differential) that boost the payments for farmers. But none of those truly get to a "living income" for the farmer yet.
- **Time.** While none of the above really achieves "living income" and, therefore, is unlikely to eradicate child labor today, the intent clearly is to keep improving productivity and quality so that production can go up and prices can go up, to the point that the farmer earns a living wage.

But it is taking too long... Why not simply pay more? While the current plans of our European players are genuine, make a material difference, and seem to be doing materially better than their global peers, progress is too slow. This is increasingly raising the focus on "simply pay more to the farmers." Who cares what the market price is? If you know where your beans come from, why not simply pay more? One particular brand, Tony's Chocolate (not covered), is doing exactly that. It pays materially more for its cocoa beans to ensure its farmers are earning a living income.

Unilever is leading the way. Unilever recently announced it will pay the Living Wage and Living Income to anybody directly employed by it and one level deeper in the supply chain. This will cover small farmers in the most-at-risk food commodities. This is a major step forward. In our reading, that means if productivity gains are insufficient by 2030, Unilever will have to find ways to pay its farmers more. That provides a target date for a decent

standard of living and, therefore, child labor. Where Unilever goes, others will have to follow. We would expect Nestle to follow in due course.

Shift to premium chocolate. As an example, prices for cocoa beans that ensure a living income to the farmer are at least 50% higher than what is currently being paid at market prices. If it was only the raw material that cost a bit more, the final product to the consumer would only have to cost a single-digit percentage more to afford that extra cost. However, the more likely outcome is that the entire supply in between farmer and consumer will keep its margins intact, and the end product will be materially more expensive to the consumer. That will make living wage chocolate likely an ingredient for premium chocolate in the near future. We would expect our companies to keep moving increasingly into premium versions of this category. This seems to be the way Nestle is going already, with the exit out of US confectionary and its focus on the more premium KitKat (and the recent launch of a vegan version of KitKat).

How much should investors worry? Labor conditions should remain front of mind as they meet with companies — the focus can't just be on climate change. There is still a major problem out there. Fortunately for our coverage, these companies tend to be leading the change, are far ahead of their peers, and keep accelerating ahead of their peers. Therefore, these concerns are not at a level where it would make us walk away from any of those stocks. On the contrary: our companies tend to drive local change and will make these changes happen. It would, however, reinforce our preference for more premium-oriented manufacturers. At first sight, that would favor *Lindt*, but its scores on human rights issues are clearly weaker; that, therefore, would lead to a marginal benefit for *Nestle* as it is moving into more premium versions of the products using those at-risk food commodities. But *Unilever* is such a standard bearer for doing the right thing that we conclude this also favors Unilever over other food manufacturers.

US SEMICONDUCTORS (STACY RASGON)

The semiconductor industry requires a highly skilled, often globally based collection of talent, with fierce competition for the best personnel, and maintaining high levels of employee satisfaction is critical, especially in key areas (such as California) where non-compete agreements are unenforceable. Semiconductor manufacturing already benefits from high automation levels, though workers can be at risk of exposure to potential toxic chemicals and other risks; hence, maintaining worker safety is a significant focus for all companies in the space.

The manufacturing of semiconductors does, however, require the use of so-called conflict minerals (3TG), which historically were sourced from areas such as the eastern Congo, funding militias and rebel groups. Hence, conflict-free mineral programs are typically pursued by almost all players to some extent.

Intel in our coverage is probably the farthest ahead in its conflict minerals efforts. It was the first to publish goals related to manufacturing using "conflict-free" sources and conducted its first supply chain survey on the issue back in 2009. It met goals to manufacture products free of conflict-tantalum in 2012, with tin, tungsten, and gold sourced conflict-free by 2013; in 2018, it began expanding to other minerals such as cobalt, as well as avoiding sourcing from other conflict-afflicted and high-risk areas beyond the Congo. Hence, we are

not surprised to see it score relatively high in the KTC metrics around use of forced labor (see Exhibit 290).

Supply chain labor issues are not an enormous direct contributor to earnings (the percentage of cost from these materials is not high). However, supply chain disruption from these materials could conceivably be devastating as the semiconductors in question cannot be made without them. Therefore, seeking stable supply chains for critical materials, where they cannot be disrupted by conflict or flare-ups, is significant from a risk-avoidance perspective.

ASIAN INDUSTRIAL TECH (JAY HUANG)

The fact that Keyence ranks at the bottom of the CHRB rating due to the lack of information (see Exhibit 289) raises questions about ESG ratings' effectiveness more than about Keyence's labor ESG practices. Keyence is often known for disclosing only the minimum. However, it has systematic ESG disclosures with a focus on the social and environmental impact of its technology and operations.³⁷⁶ The lack of details on the labor issue indicates neither weak governance nor elevated risks from an ESG point of view. In fact, the biggest risk, we believe, is for investors (or their algorithms) to take the quantitative ratings at face value, screen out Keyence automatically, and miss a great investment opportunity.

A few facts about Keyence could help mitigate the labor concerns people may have:

- Keyence consistently ranks among the best Japanese employers, known especially for: (1) best salary, (2) meritocracy, and (3) on-the-job training and learning.
- Keyence is fabless, and practically all suppliers are Japanese companies.³⁷⁷ This is not a profile giving rise to elevated labor ESG risks.
- Keyence has maintained a gross margin of 80%+. Bill of direct material is only 10-15% of sales. Given this low ratio, supply chain labor issues have very modest financial impact, and Keyence has little economic incentive to squeeze the supply chain against ESG values.

³⁷⁶ See <https://www.keyence.com/about-us/sustainability/>.

³⁷⁷ It is possible certain Japanese suppliers may produce a portion of products outside Japan and supply to Keyence.

 **INVESTMENT IMPLICATIONS****European Food**

We rate Danone, Unilever, Lindt & Sprüngli, Orkla, Henkel, Beiersdorf, and Reckitt Benckiser Group Market-Perform; and Nestle and L'Oréal Outperform.

For European Food & HPC: Fortunately for our coverage, our companies tend to be leading the change, are far ahead of their peers, and keep accelerating ahead of their peers. Therefore, these concerns are not at a level where it would make us walk away from any of those stocks. On the contrary, our companies tend to drive local change and will make these changes happen. It would, however, reinforce our preference for more premium-oriented manufacturers. At first sight that would favor *Lindt*, but its scores on human rights issues are clearly weaker; that, therefore, would lead to a marginal benefit for *Nestle* as it is moving into more premium versions of the products using those at-risk food commodities. But *Unilever* is such a standard bearer for doing the right thing that we conclude this also favors Unilever over other food manufacturers.

US Semiconductors

We rate Intel Underperform.

Intel's long-term structural issues have finally come to the forefront, with competitive pressures increasing amid an outlook that remains uncertain.

Asian Industrial Tech

We rate Keyence Outperform.

US Food

We rate Kellogg Underperform, Hershey and Beyond Meat Market-Perform, and Mondelez and Tyson Outperform.

EXHIBIT 294: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price
INTC	U	USD	50.00	40.00
K	U	USD	63.87	54.00
MDLZ	O	USD	60.64	75.00
HSY	M	USD	179.16	191.00
TSN	O	USD	81.88	95.00
BYND	M	USD	74.60	100.00
LISP.SW	M	CHF	11,330.00	9,700.00
LISN.SW	M	CHF	112,300.00	102,500.00
NESN.SW	O	CHF	120.10	130.00
UNA.NA	M	EUR	46.61	40.50
ULVR.LN	M	GBP	3,921.00	3,500.00
BN.FP	M	EUR	54.33	54.00
ORK.NO	M	NOK	84.10	90.00
HEN3.GR	M	EUR	71.32	89.00
HEN.GR	M	EUR	67.05	82.00
BEI.GR	M	EUR	89.52	93.00
OR.FP	O	EUR	401.80	435.00
RKT.LN	M	GBP	6,164.00	5,500.00
6861.JP (Keyence)	O	JPY	70,330.00	75,000.00
MSDLE15			1,856.96	
MXJP			1,206.79	
SPX			4,655.27	

Source: Bloomberg, and Bernstein estimates and analysis

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DATA PRIVACY

Swipe right for personalization and left for online data privacy

HIGHLIGHTS

- Could we be living in a Black Mirror episode before we know it? Over 80% of US internet users feel they have little or no control over their personal information online. However, 91% of consumers say they are more likely to shop with brands that send them personalized offers and recommendations. How can companies strike the right balance between data privacy and personalization? How does regulation affect the equation? And how should we quantify the financial implications?
- According to the Ranking Digital Rights (RDR) 2019 index, **Microsoft, Google, and Apple** stood out with their privacy commitments and disclosures, while international companies including **Mail.Ru, Samsung, and Baidu** lagged due to limited disclosures. Overall, big tech companies with access to first-party data are better positioned, although their scale advantages could be limited by anti-trust regulations. There are also real downside risks if companies fail to protect their customer data. A mega data breach involving more than 1 million customer records could cost a company ~US\$50-US\$392mn on average. In mega data breaches like the Equifax or Marriott incident or privacy breaches like the Facebook-Cambridge Analytica scandal, the stock could be hit hard (-15% to -35%). While the share price typically recovers within months, repeated breaches could erode consumers' trust in a brand and weigh on its brand equity over time.
- Going across the value chain, cloud-based platforms and digital marketing/data analytics solution providers could see increased demand to process first-party data from consumer-facing brands, although this also comes with the added responsibility of ensuring data security. Conversely, data brokers and ad agencies will likely face more regulatory pressure. The requirement for consumers to consent to their data being shared with third parties could reduce the amount of third-party data and increase the cost of data acquisition.

CONSUMER PERSPECTIVE: TRADEOFF BETWEEN PRIVACY AND PERSONALIZATION

In the digital world, we are no strangers to agreeing to privacy agreements in order to get access to a website or an app. But, do we really know how our data is shared? When we send our DNA sample to 23andme,³⁷⁸ we are knowingly sharing our personal data with the company. But the 80% of users who have opted in to share their data for research purposes

³⁷⁸ Private, not covered.

may not realize their DNA data can be resold to pharmaceutical companies.³⁷⁹ We may also not realize that beyond tracking our online searches and purchases, companies are also tracking how we touch, hold, and tap our phones to gather behavioral datapoints to establish our identities.³⁸⁰

When we visit a typical commercial website in the US or the UK, we set off a dozen or more JavaScript tracking tags, which set a cookie (a piece of tracking code) on our device, take our browser's fingerprint, measure our activity on the site, or load other tags that do the same. With tags passing along information to each other, a single website can give tens of companies access to data about the user (see Exhibit 295).³⁸¹

As such, over 80% of US internet users feel they have little or no control over who can access their personal information online (see Exhibit 296). Soon enough, we could be living in a Black Mirror episode where hackers use people's secrets to blackmail them, parents monitor their children 24/7, and devices can be implanted in our bodies to capture our entire personal history.³⁸²

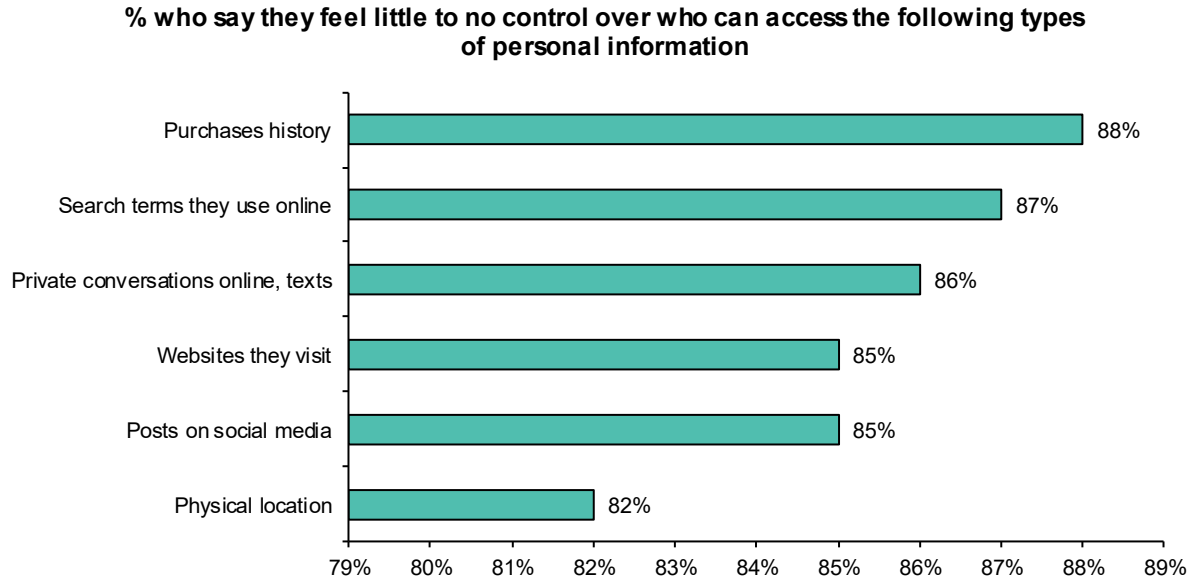
³⁷⁹ <https://www.cnn.com/2018/06/16/5-biggest-risks-of-sharing-dna-with-consumer-genetic-testing-companies.html>

³⁸⁰ <https://www.nytimes.com/2018/08/13/business/behavioral-biometrics-banks-security.html>

³⁸¹ See report: [European Media & US Internet: Every Breath You Take - A consumer personal data primer](#).

³⁸² <https://medium.com/digiprivacy/black-mirror-illustrates-the-importance-of-digital-privacy-756068e8a3db>

EXHIBIT 296: Over 80% of US internet users feel they have little to no control over who can access their personal information online



Source: PEW Research Center ("Americans and Privacy: Concerned, Confused and Feeling Lack of Control Over Their Personal Information"), and Bernstein analysis

Yet, it's not all doom and gloom. The collection of personal data has made personalized recommendations and services easier and cheaper than ever before by filtering out irrelevant ads and making the consumer experience more seamless. 91% of consumers are more likely to shop with brands that send them relevant offers and recommendations.³⁸³ Further, 80% are willing to share their personal information to get rewards or cash back from a company (see Exhibit 297). Unsurprisingly, younger generations are more willing to share their personal information in exchange for benefits or offers (see Exhibit 298).

However, there is a fine line between personalization and invasion of privacy. It becomes creepy when the same ads follow us wherever we browse, and hypertargeting can lead to consumer backlashes. 73% of consumers in the US have increasing concerns over personal data privacy,³⁸⁴ while 53% think brands should respect their online anonymity more.³⁸⁵

Consumers' views on the trade-off between privacy and personalization also vary across countries and cultures. A survey shows 54% of German respondents prefer privacy over personalization, whereas 70% of Chinese respondents prefer some degree of personalization at the expense of sharing their personal information (see Exhibit 299). We can try to explain the difference by pointing to different cultural values and historical roots. But it's also worth remembering that no culture is homogeneous. Businesses operating in

³⁸³ <https://www.marketingdive.com/news/will-personalizations-role-in-marketing-shrink-as-challenges-grow/568607/>

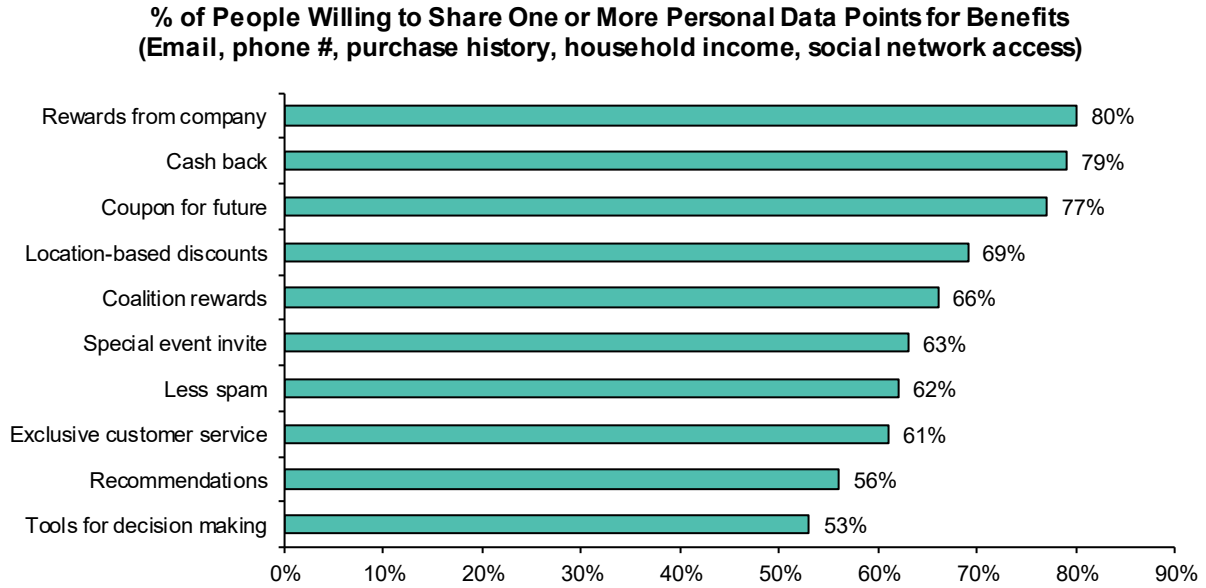
³⁸⁴ <https://www.chiefmarketer.com/data-privacy-concerns-on-rise-report/>

³⁸⁵ <https://www.retaildive.com/news/companies-face-a-paradox-between-digital-personalization-and-data-privacy/572909/>

any market need to account for individual differences to best accommodate a variety of consumer preferences.

Given the range of views out there, what can brands, digital marketers, and technology, media, and telecommunications (TMT) companies do to strike the right balance between privacy and personalization? How does regulation affect the equation? We start by comparing the regulatory landscape across key global markets.

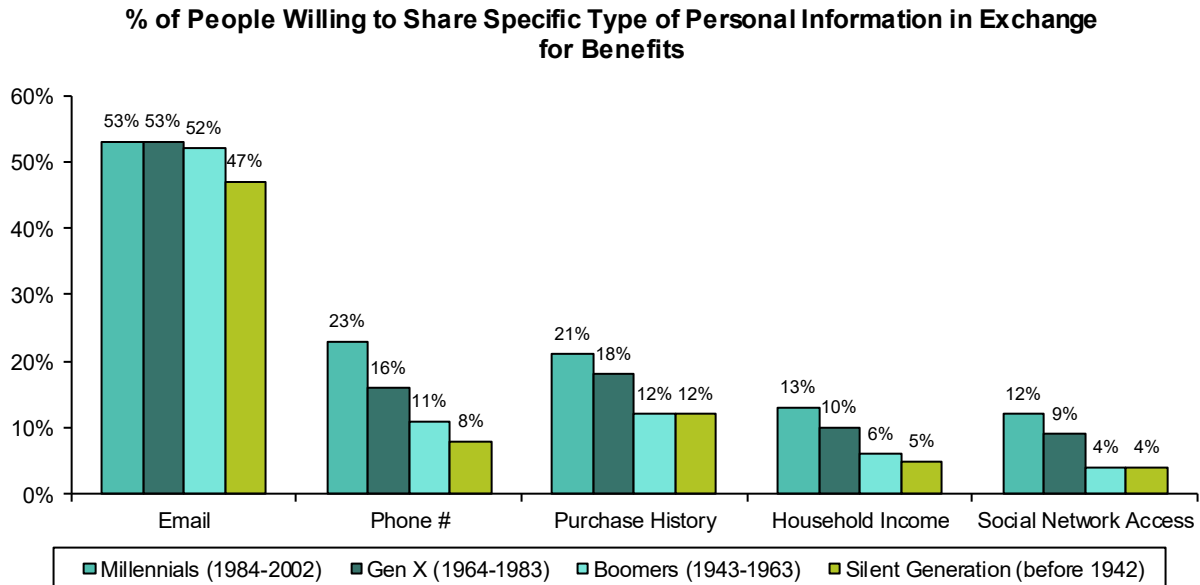
EXHIBIT 297: While people are concerned about privacy issues, 80% are willing to share personal information to get rewards or cash back from a company



Note: Survey of 8,000+ respondents across five countries (US, Canada, UK, France, and India)

Source: Columbia Business School, AIMIA Inc, and Bernstein analysis

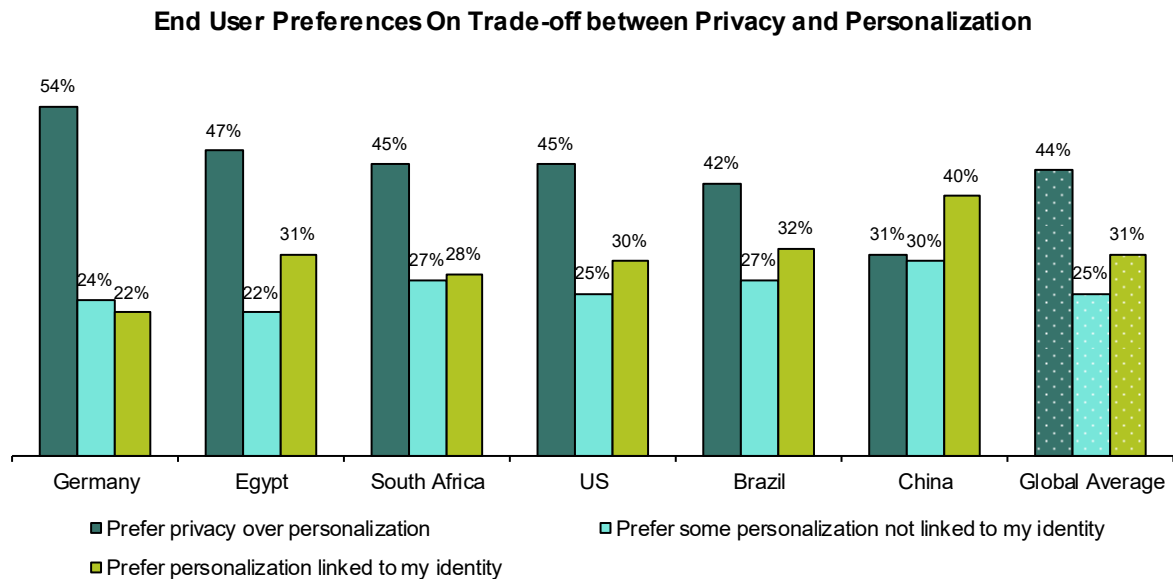
EXHIBIT 298: Unsurprisingly, younger generations are more willing to share their personal information in exchange for benefits or offers



Note: Survey of 8,000+ respondents across five countries (US, Canada, UK, France, and India)

Source: Columbia Business School, AIMIA, and Bernstein analysis

EXHIBIT 299: 54% of German respondents prefer privacy over personalization, whereas 70% of Chinese respondents prefer some degree of personalization at the expense of sharing their personal information



Note: The full text for the three options is: (1) Prefer to have none of my information collected, analyzed, and stored; therefore, I would not have a personalized user experience. (2) Prefer that my information is collected, analyzed, and stored, but not linked to my identity; therefore, there would still be some personalization of my user experience, including what ads and marketed products/services I see. (3) Prefer that my information is collected, analyzed, stored, and linked to my identify, for the personalization of my user experience, including what ads and marketed products/services I see.

Source: World Economic Forum 2017 (The End User Perspectives on Digital Media Survey of 6,347 users across 6 countries), and Bernstein analysis

REGULATORY LANDSCAPE: FIRST-PARTY DATA IS KEY

Data privacy regulations vary significantly across the world. However, more regulation is not always better. In the early days of automobile development, Pennsylvania proposed a law in 1896 that would require all drivers, upon encountering livestock, to immediately stop, "as rapidly as possible disassemble the automobile," and "conceal the various components out of sight, behind nearby bushes until equestrian or livestock is sufficiently pacified."³⁸⁶ Thankfully, the proposal was vetoed by the governor. Conversely, regulation that fails to catch up with technology could put consumers at risk, as we've seen with data leaks and breaches in recent years.

In the following section, we review the privacy protection regulatory landscape across Europe, the US, and China. While each country/region has adopted a different approach toward data protection, companies that rely on third-party data will likely face more stringent regulations globally. Conversely, access to first-party data can differentiate winners and losers, which favors major brands and big tech companies with scale and loyal user bases.

EUROPE – GENERAL DATA
PROTECTION REGULATION
(GDPR)

Setting the global high-water mark

The EU's General Data Protection Regulation (GDPR) is seen as the global high-water mark in data protection law. It was signed into law in 2016 and came into effect in 2018. The EU uses it not only to harmonize data protection across its member states but also to set higher standards globally — data sharing between the EU and other countries is restricted unless they are deemed to have an adequate level of legislation and enforcement comparable to the GDPR regime. Moreover, GDPR protections apply to any EU resident using online services, meaning that in practice, most global online services are exposed to the GDPR and have to either localize their data practices in Europe or implement changes in all regions.³⁸⁷

What personal data does the GDPR protect? Essentially, any data that can be used to directly or indirectly identify a person is considered personal data. This includes not only basic personal information like name, email address, and ID number, but also IP addresses and cookie identifiers that can be used to identify a user.³⁸⁸ Further, some personal information is deemed particularly sensitive and requires special protection, including racial or ethnic origin, political opinions, religious beliefs, trade union memberships, genetic and biometric data, health information, and data around a person's sex life and sexual orientation.³⁸⁹

³⁸⁶ <https://www2.deloitte.com/us/en/insights/industry/public-sector/future-of-regulation/regulating-emerging-technology.html>

³⁸⁷ See report: [European Media and US Internet: Privacy and data protection primer](#).

³⁸⁸ <https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/key-definitions/what-is-personal-data/>

³⁸⁹ <https://www.wired.co.uk/article/what-is-gdpr-uk-eu-legislation-compliance-summary-fines-2018>

Compared to earlier privacy laws that were too specific in their definitions and quickly became obsolete, the GDPR is based on general principles that can be applied to any industry that processes personal data and can adapt to the rise of new technologies. The GDPR outlines seven principles:

- **Lawfulness, fairness and transparency** — Companies must have a valid basis for collecting personal data, use the data in a fair way, and be transparent with consumers on how their personal data is used. To establish a valid legal ground to collect data, **consent is key**. There are six possible lawful grounds for companies to collect and process data, of which three are valid for for-profit companies (including consent, legitimate interest, and necessity for executing a contract). Of all the legal grounds, consent applies to more use cases while others have specific conditions on which they can be used. Getting consent from the user is by far the most straightforward way for companies operating in the EU to legally collect personal data.
- **Purpose limitation** — Data can only be collected for specified and legitimate purposes. Companies can only use the data for a new purpose if this is compatible with its original purpose or if the company gets consent.
- **Data minimization** — Companies need to ensure that the personal data they collect is limited to what is necessary.
- **Accuracy** — Companies need to ensure the accuracy of any personal data they collect and take steps to correct or delete any incorrect data.
- **Storage limitation** — Companies should not keep any personal data for longer than is necessary.
- **Integrity and confidentiality** — Companies need to have security measures in place to protect the personal data they hold.
- **Accountability** — Companies are required to take steps to ensure compliance with GDPR principles.

Legal jargons aside, what does the GDPR mean for businesses? On the one hand, **third-party data will face much greater scrutiny**. Under the GDPR, consumers in many cases will need to opt in to provide consent for their data to be shared with third parties, such as advertising technology firms or data brokers, for any specific purpose — whether sending unsolicited offers or tracking their online behavior.³⁹⁰ This opt-in requirement could significantly reduce the amount of third-party data that can be legally collected and processed.

Conversely, owning direct client relationships and having first-party data have become ever more important. We acknowledge that companies with access to first-party data will still need to rethink the way they collect data under the GDPR or similar regulations elsewhere (i.e., they can no longer collect as much as possible and hold the data

³⁹⁰ <https://econsultancy.com/gdpr-what-future-for-first-second-and-third-party-data/>

indefinitely). However, studies have found that people tend to be more willing to share personal data with brands they trust (see Exhibit 300).

- What are these trusted brands? The survey shows **Facebook and Google** are the top two most trusted web service brands across the US, Canada, the UK, France, and India, while **Amazon** is the #1 most trusted eCommerce brand in all markets except India, where Amazon is #2 behind Flipkart.³⁹¹
- These trusted platforms are by no means free of privacy issues. The Facebook-Cambridge Analytica scandal — where 50 million Facebook users' personal data was acquired without consent by Cambridge Analytica for targeted political advertising during the 2016 election cycle³⁹² — still haunts the company. Big tech companies are also no strangers to testifying in front of Congress for a whole host of issues from privacy protection to content moderation to anti-trust considerations.
- Consumer trust is a key asset as first-party data increasingly becomes a competitive advantage. And it's up to big tech companies to prove that such trust is not misplaced. On the positive side, these companies have the scale and resources to improve their privacy protection practices to comply with global regulations. However, regulatory scrutiny will make it harder for companies to generate revenue from personalized advertising as they are now required to give customers more control over how their data is used and shared.

What's at stake? The maximum fine under the GDPR for a severe violation (such as a major data breach due to negligence) is 4% of global revenue or €20mn, whichever is greater. Note that such fine is per incident, and some breaches count as multiple incidents. The regulation also gives supervisory authorities sweeping powers to impose a temporary ban on data processing, enough to entirely disable the operation of a data-intensive business line, which could have much more significant financial implications than the 4% fine.

So far, GDPR fines have been limited. The biggest was a €50mn fine on Google by France's Commission nationale de l'informatique et des libertés (CNIL) in 2019 for using forced consent (a take it or leave it policy) to process users' personal data. This is followed by the German regulator's €35mn fine on H&M (not covered) in 2020 for violating employees' privacy.³⁹³ Both fines represented a fraction of these companies' revenues (less than 0.1%). That said, the cost of compliance has increased, especially for smaller organizations that don't have the resources to ensure compliance.

Meanwhile, the potential ban on data processing could have a greater financial impact. An example can be found in the UK, which has the most developed data broker infrastructure in Europe. After recently concluding its GDPR audit of the industry, the Information Commissioner's Office (ICO) issued an enforcement notice to Experian (not covered) to

³⁹¹ https://www8.gsb.columbia.edu/globalbrands/sites/globalbrands/files/images/The_Future_of_Data_Sharing_Columbia-Aimia_October_2015.pdf

³⁹² <https://www.businessinsider.com/cambridge-analytica-whistleblower-christopher-wylie-facebook-data-2019-10>

³⁹³ <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/h-m-faces-8364-35m-fine-for-violating-staff-privacy-60601242>

cease the supply of non-compliant marketing data products and services.³⁹⁴ A warning was enough to make Equifax and TransUnion (not covered) do the same.

Implementation of the GDPR remains a challenge. The downside of the GDPR being a principles-based regulation is that principles have to be interpreted for each industry by national privacy regulators, which has resulted in different interpretations even in similar cases. Although the EU has proposed the Digital Services Act to help clarify GDPR requirements, in many cases, it could take years of investigation and court cases before any Europe-wide rules become clear.

Taking a long-term view, however, with more stringent regulations around personal data being shared with third-party vendors, **access to first-party data is key to differentiate winners from losers.** While big tech companies clearly have more work to do, they are better positioned to leverage their high-quality, first-party data to provide a more personalized user experience. That being said, increasing scrutiny around anti-competitive behaviors globally could offset some of the scale advantages of big tech companies, which is a whole other conversation (see our report on the regulator's dilemma for details).³⁹⁵

Consent fatigue — a case of the regulator's dilemma

A problem with the GDPR in online advertising has been that it never specifically defined when and what kind of consent is needed, or whether users can be prevented from using a website or app if consent is not given. As a result, consumers have been bombarded with vastly different consent requests across websites, except on the largest platforms that only need to ask once for each logged-in user. This risks "consent fatigue" — how many of those boxes do we have the energy to read? — and further moving audiences from smaller websites to social media and other logged-in environments. Ironically, if you are not able to track users, your website can't remember they didn't give consent, and has to ask again next time they visit.

There's finally going to be some clarity, as the European Council agreed on the final text of the ePrivacy Regulation, originally meant to arrive at the same time as the GDPR to bring sector-specific rules. The final compromise³⁹⁶ is that commercial websites will always need consent for any data collection and processing for the purposes of personalized advertising. However, they can deny access as long as there are alternatives for consumers to go to (such as competing websites or, say, a paywalled tier with no tracking). This leaves them vulnerable to joint privacy/anti-trust action against platforms that are seen to have a dominant market position.³⁹⁷ To combat "consent fatigue," a user can give or refuse consent to several services through their browser or end device settings, with the preferences saved locally. This should help reduce the number of annoying consent pop-ups, but we think there will likely be technical hiccups ahead.

³⁹⁴ <https://ico.org.uk/media/action-weve-taken/2618470/investigation-into-data-protection-compliance-in-the-direct-marketing-data-broking-sector.pdf>

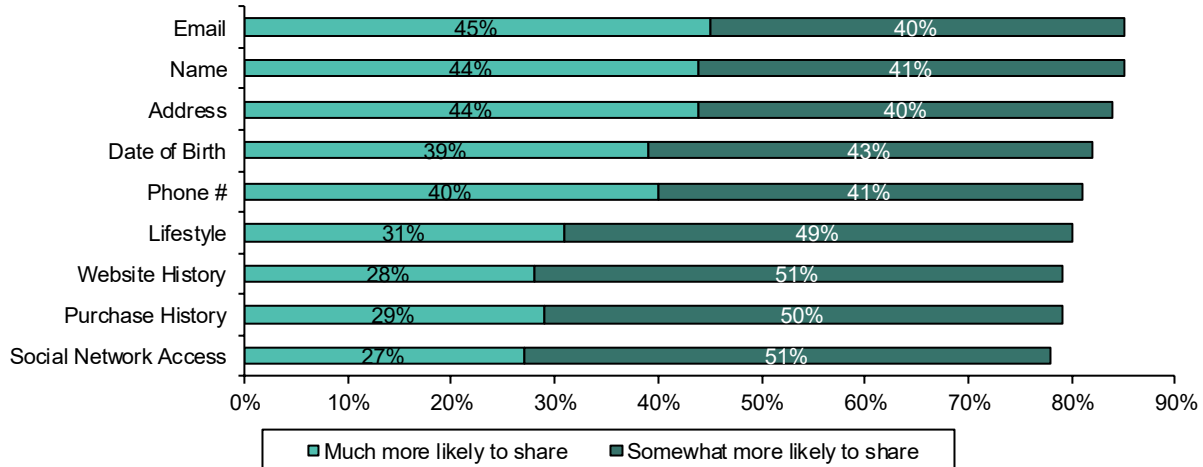
³⁹⁵ See report: [US and EU Internet regulation: The regulator's dilemma](#).

³⁹⁶ <https://data.consilium.europa.eu/doc/document/ST-6087-2021-INIT/en/pdf>

³⁹⁷ This two-tiered approach is also reflected in the draft EU Digital Markets Act (DMA), which would prevent gatekeeper platforms from asking for consent to market data between services as a condition of use, while other online properties could use the "take it or leave it" approach. However, we think the DMA is still years away from enforcement.

EXHIBIT 300: Studies have found people tend to be more willing to share personal information with brands they trust

How does your relationship with your trusted company influence the likelihood that you would share the following pieces of data that you identified as being willing to share?



Note: Survey of 8,000+ respondents across five countries (US, Canada, UK, France, and India)

Source: Columbia Business School, AIMIA, and Bernstein analysis

US – CALIFORNIA CONSUMER PRIVACY ACT (CCPA)

Less (regulation) is more?

In contrast to the EU that strives to set the global high-water mark in privacy regulations, the US does not have a federal-level privacy law at the cross-sector level, while state laws have been patchy and limited in scope. That said, we could see a federal level privacy law under the Biden administration, although between the Covid-19 vaccine distribution and climate change initiatives, privacy policies may be on the back burner for now. Some experts also argue overly stringent regulations could be costly and reduce the innovative power of the industry. Meanwhile, lawmakers in the US are not known to be the most tech savvy, as we've learned from recent big tech hearings.³⁹⁸

Enter the California Consumer Privacy Act (CCPA), which came into effect in January 2020. The law has been widely compared to the GDPR and taken as a sign that US privacy protection was finally catching up with Europe. However, after years of being watered down in the Californian legislative process, the CCPA hardly changes the status quo in US data protection.³⁹⁹

The most powerful right the CCPA gives consumers is to opt out of their data being sold. But online advertising companies have been quick to argue that they don't, strictly speaking, sell data, but rather provide data activation services. Businesses that *do* sell consumer data – data brokers – are also mostly unaffected because the California law does not apply to data covered by the existing sectoral laws, which means most of the core

³⁹⁸ <https://www.npr.org/2019/06/05/730057484/are-lawmakers-tech-savvy-enough-to-conduct-their-antitrust-investigation>

³⁹⁹ See report: [European Media and US Internet: Privacy and data protection primer.](#)

personal data they harvest will be unaffected. This is in stark contrast to the GDPR, which covers all personal data, and not only allows customers to object to any data processing but, in many cases, requires them to opt in.

To close the loopholes, activist group Californians for Consumer Privacy entered a ballot measure (Proposition 24) on the November ballot in 2020. This successfully passed with 56% in favor. It broadens the scope to protect any personal data being *shared* (not just *sold* to third parties under the CCPA) and offers special protection for sensitive personal information such as race, sexual orientation, and location. However, this measure was watered down to not make opting out of data collection the default.⁴⁰⁰ Meanwhile, as was the case with the CCPA, we expect a messy lobbying effort before it comes into effect in 2023.

Despite state-level progress, the US continues to lag Europe in terms of privacy regulation, which likely means data brokers and companies that rely on third-party data can largely maintain the status quo for now. While the US may not take the European approach, selective privacy regulations at the state level or targeting specific sectors could still make third-party data more costly to obtain. We expect companies with access to first-party data to lead with a sustainable edge, although big tech companies' scale advantage could be limited by anti-trust regulations.

CHINA – CYBERSECURITY LAW
AND DRAFT OF PERSONAL
INFORMATION PROTECTION
LAW (PIPL)

Privacy protection with Chinese characteristics

While China has been slow in building out its data privacy regulations, rapid digitization of the country has made privacy regulation an imperative. China's Cybersecurity Law, effective as of June 2017, was its first major step toward setting up a framework for cross-sector data protection, in addition to addressing other cybersecurity issues. In October 2020, China unveiled a draft of its Personal Information Protection Law (PIPL), which will be China's first comprehensive law that focuses exclusively on personal privacy protection when it comes into force.⁴⁰¹ In particular, the draft requires opt-in consent for sharing sensitive personal data such as race, ethnicity, religious beliefs, biometric and health data, financial account information, and location data, although it doesn't require opt-in consent for other types of personal data collection.

Serious violations of the PIPL can be fined up to RMB50mn (US\$7.7mn) or up to 5% of the company's previous year sales. This compares to the GDPR's maximum fine of 4% of sales or €20mn, whichever is greater. Both regulations also allow regulatory bodies to impose temporary bans and, in China's case, to revoke the business license in severe violations, which could result in much greater financial losses than the maximum fine.

Further, the PIPL builds on the Cybersecurity Law's requirement for data localization and requires all personal data processors over a certain size to store all personal information collected in China within the country.⁴⁰² Localization of data is becoming increasingly common across countries. The PIPL also requires security assessments for any cross-

⁴⁰⁰ <https://www.nytimes.com/2020/10/28/opinion/california-prop-24-privacy.html>

⁴⁰¹ <https://iapp.org/news/a/a-look-at-chinas-draft-of-personal-data-protection-law/>

⁴⁰² <https://www.lexology.com/library/detail.aspx?q=40faa069-c4d0-48f3-b742-cbc52f560f73>

border data transfers. Such regulation has supported the growth of the Chinese cloud industry while putting limitations on how non-Chinese companies can compete (e.g., they have to provide their services through joint ventures with local Chinese partners).⁴⁰³

On paper, China's privacy regulation is catching up with the GDPR in many aspects. That said, regulation with Chinese characteristics remains the flavor of the day, with the government raising the hurdle for companies to collect personal data while the government itself is becoming the ultimate data aggregator.

- With the rise of facial recognition technologies, for example, China is increasingly leveraging AI systems to collect information. Such technology is by no means 100% accurate. In fact, a famous businesswoman in China was accused of jaywalking in Ningbo, China, in 2018. It turned out she wasn't even in that city when the alleged jaywalking took place; the facial recognition system captured a picture of her painted on the side of a bus crossing the intersection.⁴⁰⁴ As the technology matures over time, however, we can only expect the government to be more effective at collecting and processing data.

Another aspect of data regulation with Chinese characteristics is that the government has been working with big tech companies to pilot a credit scoring system based on people's online purchases, social media presence, etc. This then evolved into a nationwide effort to assign residents social credit scores, which are linked to penalties and rewards based on an individual's social credit. Those who end up on the blacklist, typically for not complying with court rulings or not paying fines, may be prevented from purchasing high-speed train or plane tickets.⁴⁰⁵

Meanwhile, the Chinese government has partnered with Tencent⁴⁰⁶ and others to collect health records across the country to build an AI system for disease diagnosis, which has shown some early promise in alleviating the pressure the aging population is putting on the healthcare system.⁴⁰⁷ However, collecting nationwide health records is not allowed in most developed countries due to privacy concerns.

While the Chinese government has primarily partnered with big tech companies to build a nationwide data system, the relationship soured in recent months as the government called off the Ant IPO in late 2020 and started targeting anti-competitive behavior. While the last-minute cancellation of the Ant IPO was initially prompted by some critical comments by Alibaba's founder, Jack Ma, the broader anti-trust campaign likely also reflects concerns of big tech companies growing outside the government's control.

Long story short, understanding the Chinese regulatory landscape is not as simple as interpreting the laws. Given the government's increasing role in both regulating private data collection and becoming a data aggregator itself, big tech companies that partner with the

⁴⁰³ <https://www.geekwire.com/2019/building-wall-around-cloud-china-will-soon-important-cloud-computing-market/>

⁴⁰⁴ <https://www.bbc.com/news/technology-46357004>

⁴⁰⁵ <https://www.wired.com/story/china-social-credit-score-system/>

⁴⁰⁶ Covered by Bernstein's China Internet analyst Robin Zhu.

⁴⁰⁷ <https://www.chinabusinessreview.com/the-hidden-challenges-of-chinas-booming-medical-ai-market-2/>

government will likely be the long-term winners, while smaller local competitors and foreign companies may find it difficult to compete.

WHICH COMPANIES ARE BETTER POSITIONED IN TODAY'S REGULATORY ENVIRONMENT?

The RDR Corporate Accountability Index evaluates some of the largest global TMT companies on their commitments and disclosures of privacy policies.⁴⁰⁸ Specifically, the index evaluates a company's privacy policies and practices based on 18 metrics, including access to privacy policies, disclosure around the collection and sharing of user information and the purpose of collecting such information, retention policies of user information, users' control over how their data is collected and retained, and disclosure of security vulnerabilities and data breaches.

As with all ESG scores and rankings, the RDR Index is more a reflection of disclosure quality than companies' actual privacy practices (i.e., we cannot give a company credit for protecting user data if it is not disclosing it). The overall privacy scores, which range from 24% to 59%, suggest most companies are not disclosing enough about their privacy policies and practices.

That said, **Microsoft**,⁴⁰⁹ **Google**, and **Apple**⁴¹⁰ stood out in the 2019 index (see Exhibit 301). Microsoft had stronger disclosure of its handling of government requests for user information, made improvements to its disclosure of data breach policies, and rolled out an end-to-end encryption option for both Outlook and Skype. Microsoft is also less reliant on advertising as a revenue stream — it only relies on advertising in the Bing and LinkedIn business segments — which reduces its focus on monetizing through its customer data. Apple and Google tied for second place, with Apple having the best disclosure quality around its security and encryption policies, and Google scoring relatively high for disclosing how it handles user information.

Facebook and Twitter tied for fifth place. Twitter scored the highest in terms of disclosures around how it handles user information but received one of the lowest scores on disclosing security policies, especially in response to data breaches. Facebook made notable improvements around disclosing how it handles user information, likely in response to the Cambridge Analytica scandal, but still didn't give users a clear idea of how their data is used.

At the bottom of the list, **Mail.Ru (Russia)**,⁴¹¹ **Samsung (South Korea)**,⁴¹² and **Baidu (China)**⁴¹³ have lagged due to limited disclosure and transparency around their privacy practices. However, Baidu, along with Tencent, has improved its disclosure quality on the back of stricter regulations by the Chinese government (see Exhibit 301).

While the RDR Index is a helpful starting point to compare companies on an apples-to-apples basis in terms of their privacy commitments and disclosures, it's worth remembering that privacy is only one side of the equation. To meet consumers' demand for more

⁴⁰⁸ <https://rankingdigitalrights.org/index2019/report/privacy/>

⁴⁰⁹ Covered by Bernstein's Global Software analyst Mark Moerdler.

⁴¹⁰ Covered by Bernstein's U.S. IT Hardware analyst Toni Sacconaghi.

⁴¹¹ Not covered.

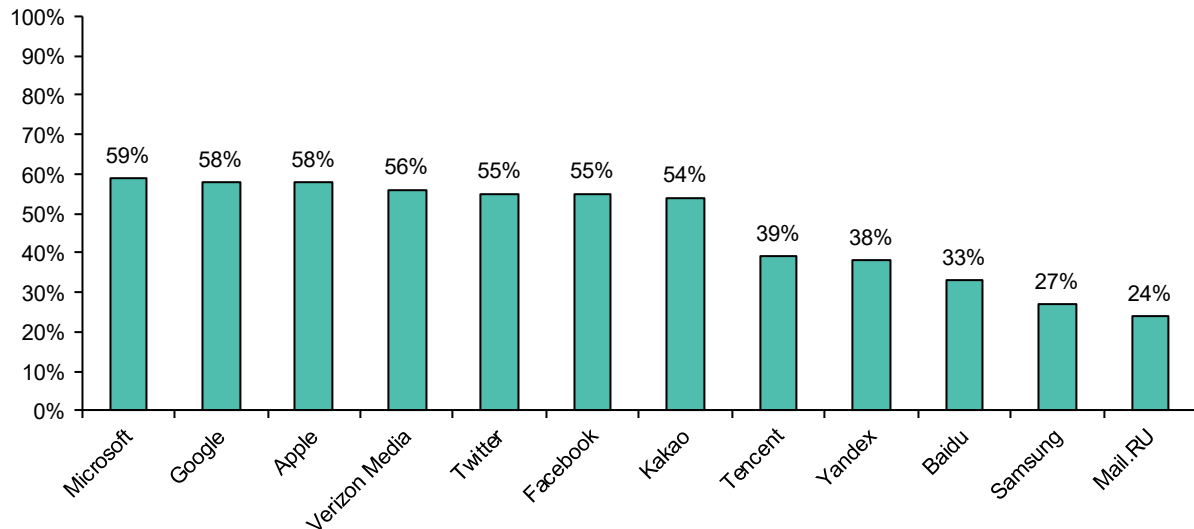
⁴¹² Not covered.

⁴¹³ Baidu is not covered. Tencent is covered by Bernstein's China Internet analyst Robin Zhu.

personalized services and to navigate the more stringent regulatory environment globally, players that own first-party data will be have a competitive advantage both to provide more value-added services to consumers and to better comply with regulatory requirements.

EXHIBIT 301: According to the RDR 2019 Index, Microsoft, Google, and Apple stood out with their privacy commitments and disclosures, while international companies including Mail.Ru, Samsung, and Baidu lagged due to limited disclosures around their privacy practices

Ranking Digital Rights - 2019 Scores for Internet and Mobile Companies



Note: Kakao, Baidu, Samsung, Yandex, and Mail.Ru are not covered. Verizon is covered by Bernstein's US Telecom, Cable & Satellite analyst Peter Supino.

Source: RDR and Bernstein analysis

+ THE CONSUMER-FACING BUSINESS PERSPECTIVE

How are consumer-facing businesses navigating the regulatory landscape? There are, broadly speaking, two types of consumer-facing businesses that leverage data: (1) businesses that rely on data to run their day-to-day operations (e.g., healthcare providers, although due to significant privacy concerns, creating a nationwide health database has not been made possible in most countries);⁴¹⁴ and (2) brands that capture data to personalize their digital marketing and to enhance the consumer experience. We primarily focus on the latter in the following section to understand how brands leverage customer data to provide personalized services and recommendations.

PERSONALIZATION COULD
SEPARATE WINNERS FROM
LOSERS

Many of us have browsed Amazon's "people who bought this item also bought..." section for inspiration, which leverages the company's wealth of first-party data and deep learning technology to create a personalized experience. The company estimates 35% of its sales

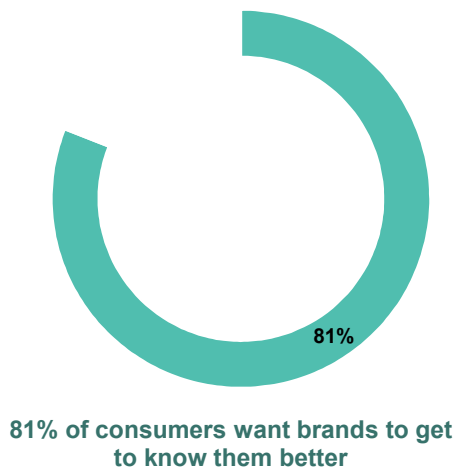
⁴¹⁴ We discuss the technological solutions for healthcare in the chapter "The Price of Medical Innovation," focusing on healthcare pricing and affordability.

are generated by the recommendation engine. In fact, the Association of National Advertisers (ANA) named *"personalization"* the marketing word of the year in 2019, based on a survey of 341 industry participants.⁴¹⁵ Meanwhile, 81% of consumers want brands to get to know them better and to understand when to approach them and when not to (see Exhibit 302).⁴¹⁶

However, not every brand has access to first-party data at scale and analytical capabilities to offer personalized services to users. 83% of marketers believe creating personalized content is their biggest challenge as a result of insufficient internal resources and capabilities, the difficulty of leveraging data from different third-party sources, and customer privacy concerns around the handling of their personal data (see Exhibit 303).

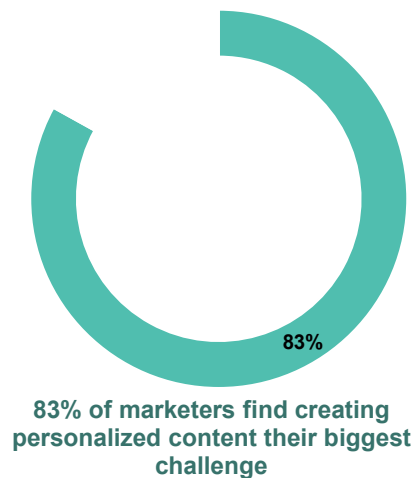
While 68% of marketers believe their companies are increasingly competing on the basis of customer experience, personalization is a luxury that's not for everyone. Gartner made a bold forecast that 80% of marketers will abandon their personalization efforts by 2025.⁴¹⁷ 27% of marketers believe data is a key obstacle, as they have limited access to first-party data and limited capabilities to integrate and protect such personal data. Further, mismanaging data can have real consequences — Gartner expects one-third of all brand PR disasters will be a result of data ethic failures in 2023.

EXHIBIT 302: Consumers want brands to know their needs and when to approach them...



Source: Salesforce survey and Bernstein analysis

EXHIBIT 303: ...yet 83% of marketers find creating personalized content their biggest challenge, given a lack of access to data and analytical capabilities



Source: Salesforce survey and Bernstein analysis

QUANTIFYING THE GOOD, THE BAD, AND THE UNKNOWN

What do businesses get out of having access to data?

On the upside, brands have the opportunity to meaningfully improve the ROI on their marketing investments by personalizing customer experience. A BCG study shows that

⁴¹⁵ <https://www.ana.net/miccontent/show?id=ii-2019-ana-word-of-year>

⁴¹⁶ <https://www.salesforce.com/ca/blog/2017/12/personalized-marketing.html>

⁴¹⁷ <https://www.gartner.com/en/newsroom/press-releases/2019-12-02-gartner-predicts-80--of-marketers-will-abandon-person>

companies that do this right (i.e., delivering the right message to the right person at the right time in the right place) have reported cost savings on marketing spend of up to 30% and revenue increases of up to 20%.⁴¹⁸ However, only a select few companies BCG surveyed have such capabilities today to leverage integrated data across channels to enhance the customer experience throughout the entire customer journey.

- For example, *Amazon, Netflix, and Starbucks* are some of the highly sophisticated digital marketers that have built a relationship with consumers, who have learned to expect outreach, interaction, and personalized offers from the brands or platforms.
- What do they have in common? First and foremost, access to a wealth of first-party data through customers' online accounts or loyalty programs. They also have the technical capabilities to integrate omni-channel data to build a complete customer profile. They have also developed in-depth understanding of the entire customer journey to know when and how to engage.

However, brands don't automatically improve their marketing ROI and reduce costs by shifting their media mix to digital. Instead, consumers' increasing demand for a personalized experience will separate winners from losers. Brands that own first-party customer relationships and have the analytical capabilities will generate higher returns by providing a better customer experience. Conversely, brands that simply shift their marketing spend to digital without fully understanding what their customers need may not see the returns they had hoped for. Some brands that historically relied on third-party data have also started exploring alternative approaches, including using contextual ad targeting (i.e., advertising based on the content of the page rather than the user profile), which has shown some early promising results.

At the same time, there could be significant downside if companies fail to protect their customer data. And this is not limited to companies that leverage data to personalize the customer experience. Businesses that rely on data for their day-to-day operations, such as healthcare providers, could also be exposed to significant privacy risks as they gather more data over time.

According to a study by IBM, a mega data breach involving more than 1 million customer records could cost a company ~US\$50-US\$392mn on average (see Exhibit 304). The estimated cost has increased in recent years on the back of an increasingly complex regulatory landscape.

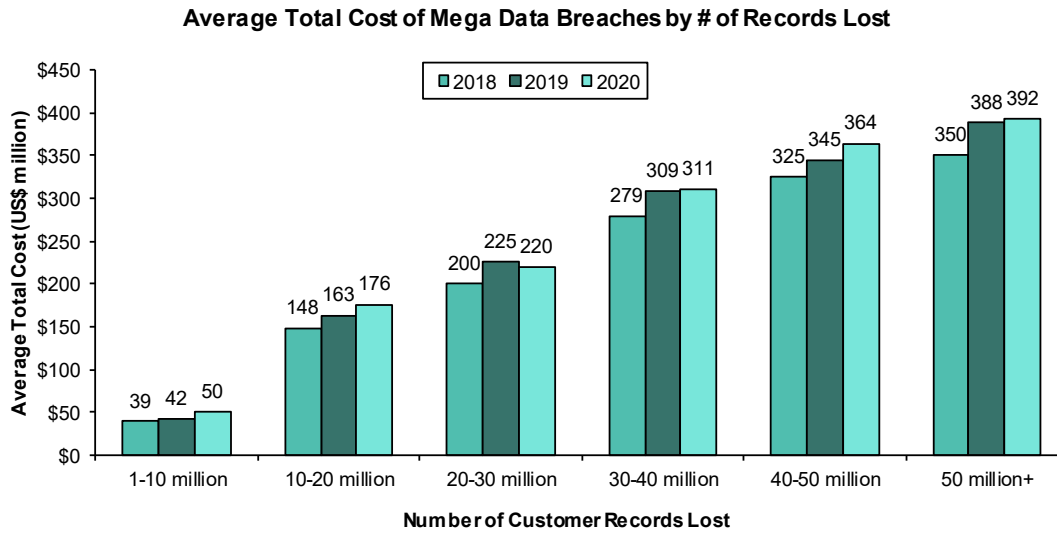
- The cost of lost business is by far the biggest component — a company could face increased customer turnover and lost revenue due to system downtime. Other one-time costs associated with a data breach include potential legal fees, regulatory fines, and costs of investigation and crisis management.⁴¹⁹ Fines from the GDPR or similar regulations could represent an increasingly large proportion of the total cost of a data breach.

⁴¹⁸ <https://www.bcg.com/publications/2019/dividends-digital-marketing-maturity>

⁴¹⁹ <https://www.ibm.com/security/digital-assets/cost-data-breach-report/#/pdf>

- Data breaches can have a multi-year financial impact on companies. The IBM study estimates on average 61% of costs of a data breach are incurred in the first year, while 92% of costs are incurred in the first two years after a data breach. The timeline is more stretched out for highly regulated industries, including energy, healthcare/pharma, consumer, financial, technology, communication, public sector, and education, with 53% of the costs expected to be incurred in year two and beyond (see Exhibit 305). This is likely a result of lawsuits and regulatory fines taking multiple years to settle.

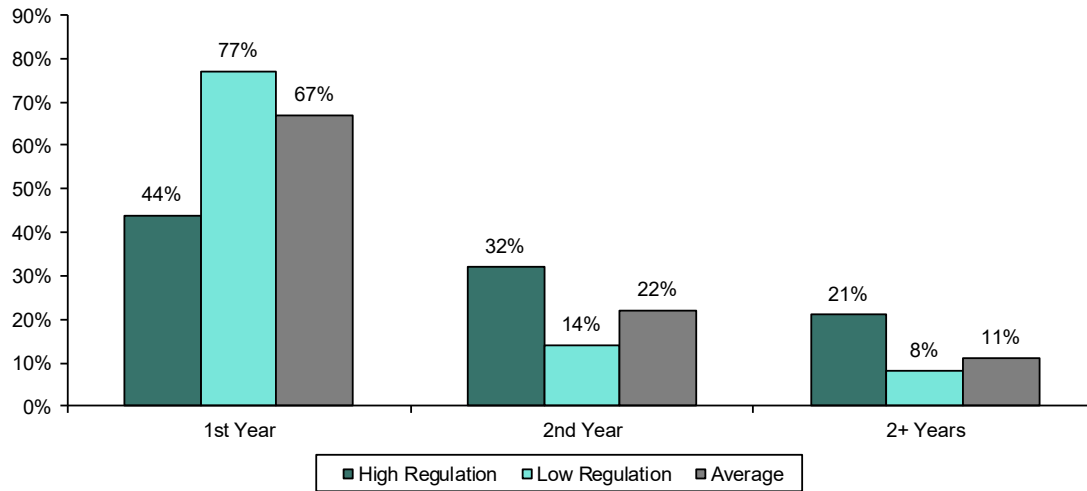
EXHIBIT 304: A mega data breach involving more than 1 million customer records could cost a company ~US\$50- US\$392 million on average



Source: IBM and Bernstein analysis

EXHIBIT 305: Data breaches can also have a multi-year financial impact on companies, especially those in highly regulated industries

Average Distribution of Data Breach Costs Over Time



Source: IBM and Bernstein analysis

A study of 113 publicly traded companies that experienced a data breach (of any size) shows they experienced an average stock price decline of **-5%** immediately after the disclosure of the breach.⁴²⁰ Companies with strong self-reported data security systems were able to recover their share prices after seven days on average, while companies with weaker data security didn't recover their share prices until more than 90 days later.

The stock price impact could be much greater for mega data breaches. For example, in September 2017, **Equifax**⁴²¹ disclosed a data breach that involved the personal information of 145 million US consumers (~45% of the US population). The stock plunged -14% on the following day and sold off by -35% in the first week (see Exhibit 306). It took the stock almost two years to recover to the pre-data-breach level. In 2019, Equifax settled with the Federal Trade Commission (FTC) and agreed to pay up to US\$700mn in fines, which represents ~20% of Equifax's 2019 revenue.⁴²²

In November 2018, **Marriott**⁴²³ reported a data breach involving the personal data (i.e., passport and credit card information) of 500 million guests (or ~330 million unique customers) who stayed at Starwood properties since 2014. The stock sold off by -17% from November 30 to December 24 in 2018 before starting to bounce back (see Exhibit 307). The company has since incurred ~US\$28mn in expenses⁴²⁴ and ~US\$24mn in fines,⁴²⁵ which are relatively insignificant compared to Marriott's 2019 revenue of

⁴²⁰ https://www.centrify.com/media/4737054/ponemon_data_breach_impact_study.pdf

⁴²¹ Not covered.

⁴²² <https://www.wired.com/story/equifax-fine-not-enough/>

⁴²³ Covered by Bernstein's Global Hotels & Leisure analyst Richard Clarke.

⁴²⁴ <https://www.csoonline.com/article/3441220/marriott-data-breach-faq-how-did-it-happen-and-what-was-the-impact.html>

⁴²⁵ <https://techcrunch.com/2020/10/30/uk-watchdog-reduces-marriott-data-breach-fine-to-23-8m-down-from-123m/>

~US\$21bn. Interestingly, that breach did not lead to customers leaving the brand. On the contrary, Marriott has now become the largest hotel loyalty program in the world at over 100 million members. However, if such data breaches become recurring, it will be interesting to see if there's any impact on the company's brand equity over time.

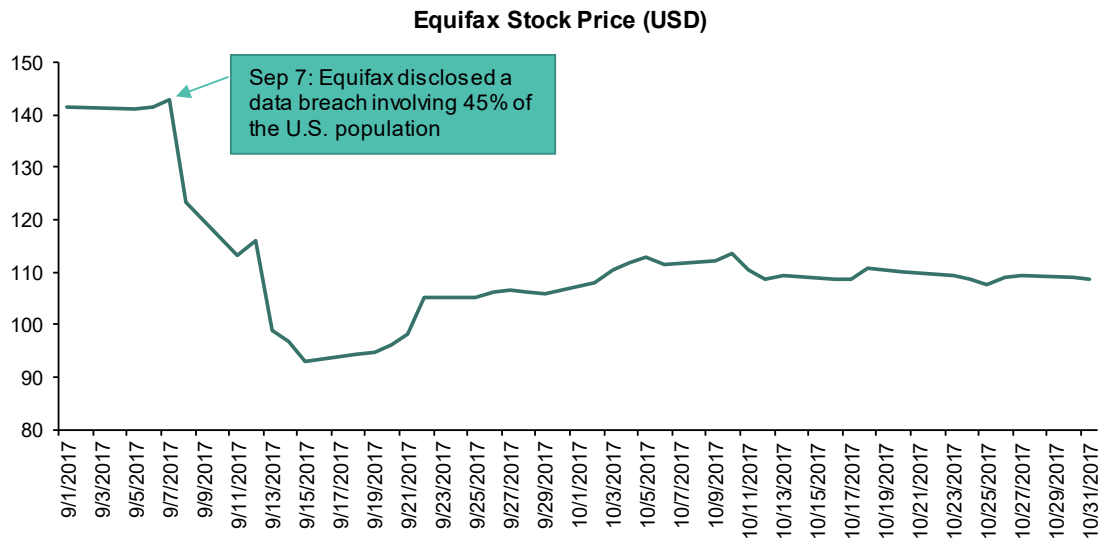
We cannot discuss data scandals without talking about the Facebook-Cambridge Analytica incident, which is not strictly speaking a data breach, but a mega-scale privacy breach involving 50 million people's personal data. **Facebook's** stock price sold off by -18% in the first week after the initial report of the Cambridge Analytica scandal in March 2018 (see Exhibit 308). Beyond the near-term stock price impact, Facebook settled a series of fines with regulatory bodies globally in the following years, including a record US\$5bn fine (~7% of Facebook's 2019 revenue) with the FTC in the US, which highlights how much regulatory scrutiny big tech companies have come under.

In these cases of mega data breaches or scandals, the stock price impact has ranged between **15%** and **35%** in the weeks following the initial reporting of the incident. While the stock price usually recovers within months, in severe cases like the Equifax data breach, the impact could linger for multiple years. In terms of the direct financial impact on a company's PnL too, we've seen a range from Facebook's record US\$5bn fine to Marriott's fairly small US\$24mn fine.

Beyond the near-term financial impact, what's more difficult to quantify is the damage to brand equity over the long term if consumers lose trust in a business. A survey of US and UK consumers shows 65% of respondents have lost trust in businesses that experienced data breaches.⁴²⁶ 31% of respondents in the US and 27% of respondents in the UK have taken it to the next level and terminated their relationships with these businesses. While studies have shown limited customer turnover immediately following a data breach (~2.6% on average), repeated scandals could erode customers' trust in a brand and weigh on its brand equity over the long term.

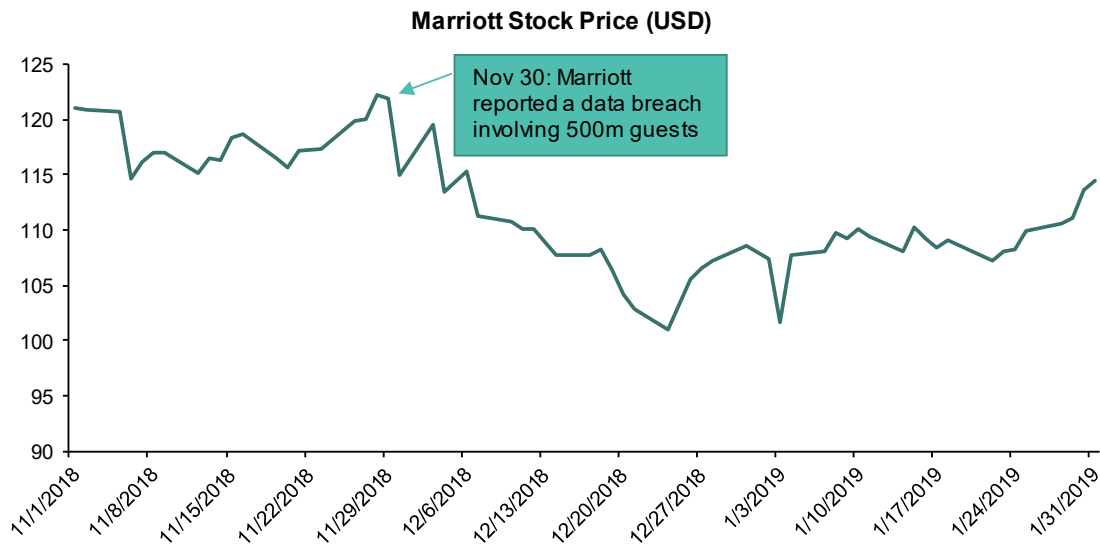
⁴²⁶ https://www.centrify.com/media/4772757/ponemon_data_breach_impact_study_uk.pdf;
https://www.centrify.com/media/4737054/ponemon_data_breach_impact_study.pdf

EXHIBIT 306: Equifax's stock price plunged -14% the day after it disclosed a data breach affecting 145 million consumers or 45% of the US population, and sold off by -35% in the first week



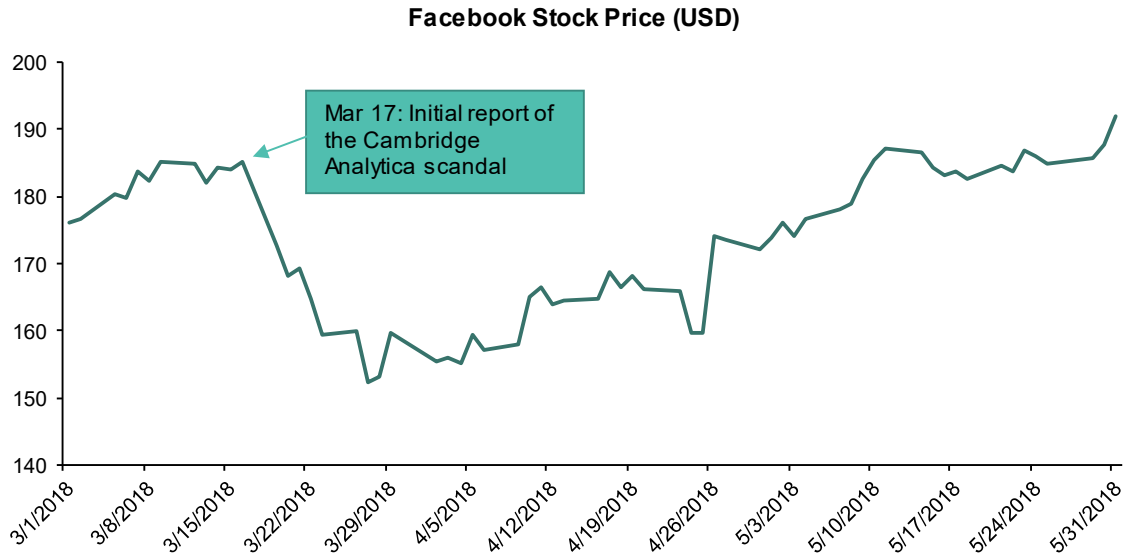
Source: Bloomberg and Bernstein analysis

EXHIBIT 307: Marriott's stock price sold off by -17% in the first few weeks after the company reported a data breach involving the personal data of 500 million guests who stayed at Starwood properties since 2014



Source: Bloomberg and Bernstein analysis

EXHIBIT 308: **Facebook's stock price sold off by -18% in the first week after the initial report of the Cambridge Analytica scandal in March 2018**



Source: Bloomberg and Bernstein analysis

+ HOW ARE OTHER KEY PLAYERS POSITIONED IN THE DATA VALUE CHAIN?

Beyond consumer-facing brands, who are the other key players in the data value chain? Broadly speaking, they compete in one of the four stages in the data value chain, with winners and losers across the value chain as we face more regulatory scrutiny and greater demand for personalization (see Exhibit 309):⁴²⁷

- **Data generation.** This is where consumer-facing businesses, retailers, social media platforms, and big tech companies acquire first-party customer data. While regulations have raised the bar for acquiring customer data by requiring consent in most cases, **companies that own direct customer relationships and first-party data are structurally advantaged** as they are able to provide more personalized services while still complying with regulatory requirements.
- **Data collection.** At this stage, data is transmitted through telecommunication networks to data centers or cloud-based storage platforms. The data is then pooled with other associated data from other sources/time periods and validated for accuracy. **Cloud-based data storage and processing facilities**, such as Amazon Web Services (AWS), are key enablers and could see increased demand to store and process first-party data from B2C companies, although this also comes with the added responsibility of ensuring data security.

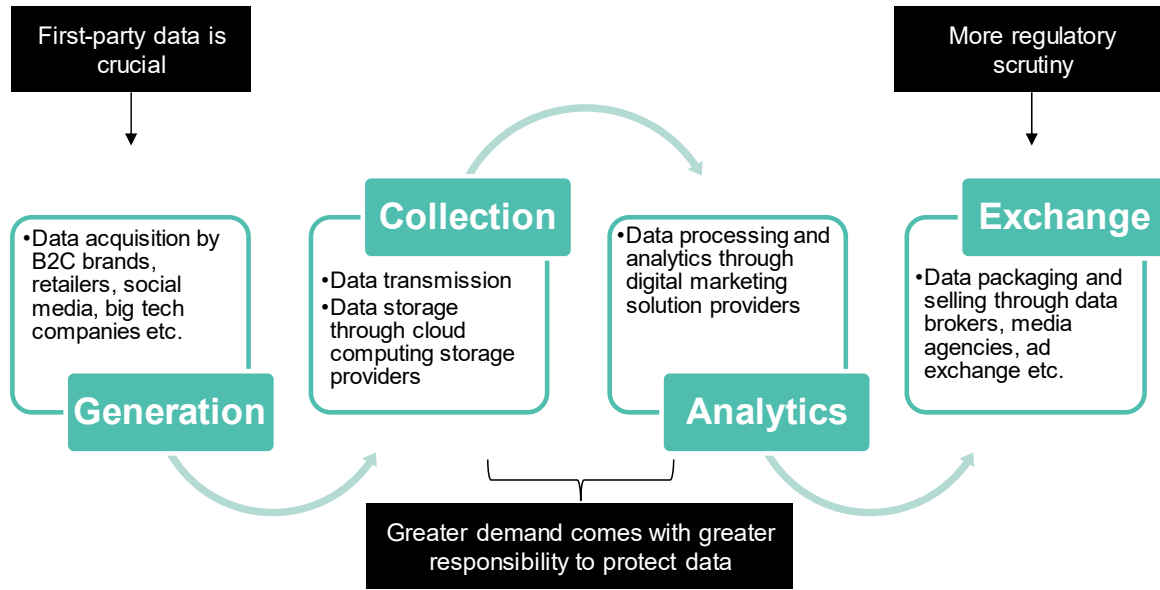
⁴²⁷ https://www.gsma.com/publicpolicy/wp-content/uploads/2018/06/GSMA_Data_Value_Chain_June_2018.pdf

- **Data analytics.** This is where software/analytical service providers process and analyze data to generate useful insights. *Digital marketing solution providers* (e.g., Adobe Experience Cloud) are key enablers in this process, which provide analytical solutions (e.g., data mining to uncover patterns, predict likely outcomes, and provide actionable recommendations for targeted advertising). In many cases, cloud-based platforms provide both data storage and Software-as-a-Service (SaaS) data analytics solutions.
- Although **data security** is not a big issue for traditional on-premise software companies as the end users bear the responsibility of collecting and using the data, cloud-based platforms have come under regulatory scrutiny for privacy and data security issues as they are responsible for managing and securing their customers' data. The move from on-premise software to the cloud could help enhance data security management as the cloud has a simpler tech stack and more up-to-date patching, refreshes servers more frequently than an enterprise, and is more automated, which removes the human error component from the equation.⁴²⁸ However, cloud-based platforms are by no means immune to cyberattacks, as evidenced by the recent SolarWinds data breach.⁴²⁹ As hackers become much more sophisticated in targeting cloud-based systems, the burden is on cloud providers to ensure data security.
- **Data exchange.** At the last stage, data brokers and media agencies package and sell data and insights to end users who do not have access to first-party data or data analytical capabilities themselves. Players involved in the data exchange stage will likely face the most amount of regulatory pressure. In particular, the requirement for consumers to explicitly consent to their data being shared with third-party vendors could significantly reduce the amount of third-party data available and increase the cost of data acquisition. For example, Oracle's Data Cloud business has declined as consumer internet companies moved away from their data broker service due to regulatory pressure and privacy concerns around third-party data.
- Meanwhile, **advertising agencies** are increasingly finding themselves between a rock and a hard place. Note that ad agencies have invested in their own data capabilities/solutions, some with major acquisitions. Agencies in big holding companies are now typically closely integrated with digital agencies and data specialist teams. However, competition from consultancies and independent specialist agencies is fierce. The agencies risk getting stuck on the service layer, while Google, Facebook, Amazon, and the marketing clouds capture the spoils.

A more stringent regulatory environment and the move to personalized advertising will continue to separate winners from losers in the digital data value chain. In the next section, we take a closer look at the stock-level implications, with perspectives from our sector analysts.

⁴²⁸ See report: [Cybersecurity: While we are under attack - Who wins in Cybersecurity?](#).

⁴²⁹ <https://www.geekwire.com/2020/solarwinds-hackers-targeting-cloud-services-unprecedented-cyberattack/>

EXHIBIT 309: **Four stages in the data value chain**

Source: Global System for Mobile Communications Association (GSMA) and Bernstein analysis

+ SECTOR PERSPECTIVES

US INTERNET

How should investors think about quantifying the financial impact of the trade-off between privacy and personalization?

All the companies we cover (except Lyft) earn revenues from advertising, and for five of those companies (Google, Facebook, Snapchat, Twitter, and Pinterest), advertising is the majority or entirety of their revenues. Advertising can generally be segmented by objectives: (1) brand for reach and (2) direct response for action. In both cases, personal data is essential for the ad units to hold value. Even for brand, the value of digital platforms over their TV and out-of-home alternatives is the ability of advertisers to target more specific audiences based on demographics, interests, and even behaviors.

Misuse of data is an ever-present risk across the social landscape, less so from DoS-style hacks and more from unintentional backdoor access, as discussed earlier with the Facebook-Cambridge Analytica incident, which led to Facebook tightening and restricting access across the board.

The trade-off between privacy and personalization is perhaps most evident in the internet realm, where regulators and the platforms themselves (e.g., Apple and Google) are continuously pushing the envelope on new privacy paradigms. Much of the value of these same platforms to advertisers and developers has been the ability to spend their growth/ad budgets more effectively by offering better targeting and measurement than the black box of traditional ad channels. The trade-off between privacy and personalization is due to the following:

- Digital advertising has democratized the ad world, which was historically gated by large agencies and enterprises. Most businesses couldn't afford a TV ad spot, and even if they could, it would be hard to justify whether that was a good use of dollars. Digital ad platforms can not only help you find your target audience, but also measure the engagement the user has with your brand even off a platform.
- There's an argument that the "right" level of personalization enhances the platform user experience. It's nice to see relevant ads so long as they aren't too creepy.
- Yet, stitching together a user's behavior across the internet opened the door to bad actors who package and sell user data for less pure purposes. As such, we've seen a wave of new privacy policies emerging from both government regulatory bodies (such as the EC) and the platforms themselves (e.g., Apple ID for Advertisers (IDFA) and Facebook Off-network opt out).
- Europe's GDPR and California's CCPA are examples of regulatory policies that create guardrails around data and personal privacy.
- Private entities, such as Apple, Google, and Mozilla are also making changes. This has been building for a while now. Firefox and Safari already moved to block third-party cookies and Google Chrome will likely follow suit by 2022. Elsewhere, Apple is effectively killing off the IDFA — the mobile app equivalent of cookies — and we expect to see Google make similar changes to GAID in the near to medium term (its version of Apple's IDFA).
- While consumers may like these changes, it's concerning for ad buyers that rely on personalization and targeting. For example, Apple's recent changes prompting users on whether they want specific apps to track off-app data (IDFA) has made it incrementally more difficult for Facebook and other digital ads businesses to measure ad effectiveness for mobile app downloads and website conversions. Since many advertisers optimize their spend/bidding threshold based on the ad's effectiveness, we see companies such as Facebook build closed ecosystems relying more heavily on first-party data (privacy-centric) and driving conversions on platform to be more resistant to future IDFA-like changes.
- Whenever the signal is lost and measurement is more difficult, ad buyers will typically see return on advertising spend (ROAS) drop. This in turn reduces demand for ad units and leads to price drops. Typically, as evidenced by the GDPR and the CCPA, the industry eventually resets to the new normal, pricing recovers, and ad dollars return. We expect the same to happen with IDFA, though we have seen and will likely continue to see material negative impacts in 2H21 as platforms and buyers adjust.
- In general, we believe bigger platforms with more first-party data are better positioned to circumvent the challenges brought on by privacy changes and lost signal. Facebook can still offer the best targeting, for example, and this is a relative game of capturing market share. Ad dollars have to go somewhere, so long-term impairment is muted.

Ironically, privacy and scale are often at odds with one another. Regulators in the US and Europe have opened anti-trust investigations into big tech (Google, Facebook, and Amazon

in our coverage). The push to break up the tech giants or to increase interoperability of data between platforms would seemingly go against privacy rules.

- For example, the FTC fined Facebook US\$5bn due to insufficient user privacy controls. Yet, as part of the anti-trust suit against Facebook, the FTC calls for application programming interface (APIs) to be opened up so that third-party developers can leverage consumer data to build their own over-the-top features and functionality.
- A key learning in the privacy versus anti-trust landscape is that we're deep in uncharted waters without a clear, cohesive strategy on the way forward. The current path of roughly patched together rules and ideas that are often national (or even state-level in the US), inconsistent, and evolving has often resulted in adverse effects of intended regulations and policies.

Who are the winners/losers?

We believe **Facebook** is well positioned to drive sustained performance in its core digital ads business and is well positioned to enter adjacent markets as well as unlock bigger long-term structural shifts (i.e., metaverse). Though it's certainly not the only factor at play, the stock's multiple has been weighed down in large part by consumer sentiment, anti-trust, and privacy concerns, and it's unclear if we'll see any near-term resolution on these complicated issues. Despite this, we see Facebook as well positioned due to the following reasons:

- We think the long-term impact of IDFA and similar privacy changes will be muted, and Facebook is well positioned to cope in a post-IDFA world with its first-party data advantage.
- With peak impact likely to be felt in 2H21, management has indicated they believe they're reasonably positioned to come out the other side with effective workarounds. In general, Facebook is making significant investments in revamping its ad systems to be less reliant on single third parties (such as Apple).
- Long term, Facebook remains a share gainer with a best-in-class ad product and scale advantages. It should benefit from new monetization opportunities in core FB Blue (e.g., Groups and Marketplace), Instagram, and WhatsApp, while moving further down the funnel with eCommerce and customer service initiatives. Over a slightly longer timeline, we are also optimistic about Facebook's metaverse ambitions and future positioning.

EUROPEAN MEDIA

How should investors think about quantifying the financial impact of the trade-off between privacy and personalization?

We believe in deep, segment-level analysis to tease out the implications.

For the **marketing communication holding groups** WPP and Publicis, personalization is important.

- Within media agencies, 10-15% of group net revenue in our estimates is tied to online/addressable advertising media and data fees. This is reliant on external data providers, media owners, and ad tech partners as the agencies lack first-party access to consumers and their data. Regulatory compliance risk is largely limited to those external data controllers, but the agencies consequently risk disintermediation (especially by the integrated media/ad tech platforms of Google, Facebook, and Amazon) and being stuck on the service layer.
- Digital agencies and consultancies advising on technology and online experiences contribute up to 25% of group revenue. This business faces tough competition from consulting groups and the risk of marketing cloud vendors capturing more of the value. Compliance risk can be an opportunity, as clients act as data controllers and need technical/regulatory advice when personalization solutions are implemented. The impending cookie and IDFA removals have created a "Y2K" boon for agency consulting teams.

For AV Media, we consider content/service personalization, targeted user acquisition, and addressable advertising yield as important.

- In **TV advertising**, there's long been a debate on scale versus personalization. Even in the digital age, linear TV advertising with its mass reach still has superior average returns on investment compared to any online media — personalized or not.^{430,431} Especially large consumer brand advertisers still want to reach the whole category audience. For them, there's no such thing as a wrongly targeted audience member.
- Addressable advertising solutions (where ads can be personalized even for viewers of the same linear stream) can multiply the effective revenue yield (measured in cost-per-mille (CPM) of the ad impressions) of TV ad inventory, but so far, only low-cost remnant spots (mostly daytime) have been made available in Europe — typically around 5% of TV inventory. The fear is that setting aside primetime ad spots for addressable advertising hurts the performance of the main audience buys due to the most valuable viewers being cherry-picked. This is a Catch-22, as personalization requires inventory scale to work well (otherwise, target segments are too small to be economical).
- For the scarcer broadcaster online premium inventory, there has been little incentive to add more than basic targeting as CPMs are already 5-7x higher than for Facebook video, for example. ITV has only just begun to offer more targeting and bidding options for personalized advertising on its new Planet V platform — the CPM impact is not yet clear.
- Broadcasters and TV device OEMs are the main data controllers responsible for regulatory compliance. In Europe, leading addressable TV solutions such as Sky Ad-Smart have avoided individual-level targeting, even though it is technically possible on the system. Data sharing between broadcasters has been slow for competitive and compliance reasons, meaning cross-device audience measurement — let alone

⁴³⁰ <https://www.ebiquity.com/news-insights/research/re-evaluating-media-for-recovery-understanding-the-true-value-of-media-for-growing-brands-during-challenging-times/>

⁴³¹ https://effworks.co.uk/wp-content/uploads/2017/10/MEDIA_IN_FOCUS_FINAL_PDF_909.pdf

personalization — has been difficult to achieve at scale. In fact, we think the low-hanging fruit from data in TV and online video advertising is still simple audience measurement (e.g., unique ad impressions and frequency capping), not hypertargeting.

- **In pay-TV**, Vivendi's **Canal+** has long used personalization to grow subscriber engagement and to target user acquisition campaigns. The key metric to watch is, therefore, net subscriber additions, but the effect of personalization is hard to isolate. For ad monetization, the ability of Canal+ to do addressable advertising has been limited by lack of ad contracts with telco distributors, responsible for half of the 8 million subscribers in France and in control of first-party return path data from their set-top boxes. Moreover, until recently, regulation designed to protect the press and radio banned localized targeting for TV ads. Since 2019, Canal+ has begun cooperating with its telco partners Orange and Bouygues on addressable ads, but it's still early days for these implementations.
- **In recorded music**, labels such as **Universal Music Group** have an indirect consumer relationship, leaving both content personalization (in the form of automated playlists and recommendations) and personalized ad monetization to streaming platforms. The contracts they have with streaming platforms don't get their music any preferential treatment from recommendation algorithms, meaning they stand to benefit only from: (i) increased overall ad yields, and (ii) any streaming ARPU increases driven by personalization. So far, streaming ARPU for both ads and subscribers has declined, but we lack the counterfactual of what it would be like without personalization. The labels don't face direct compliance risk as a result of their indirect involvement role.
- **In mobile video games**, ~25% of Embracer Group revenue, sophisticated analytics, and personalization are used to optimize player retention and monetization. The effectiveness of this determines the potential scale of the games, as marketing efforts must weigh life-time-value (LTV) versus player acquisition cost. Personalized marketing can lead to higher LTV from acquired players but is typically hard to scale with good returns. The targeting and measurement of these user acquisition campaigns have been strongly linked to identifiers such as the IDFA and based on sharing them with third parties. We therefore see risks from both Apple's restrictions and the GDPR, although so far Embracer Group's mobile app publishers have been able to grow despite early IDFA headwinds. Search advertising on the app store is not affected, and Embracer's typical mobile game types rely less on identifying individual high-spending users.
- **We think content personalization has, in general, a lower regulatory risk than addressable/personalized advertising** (particularly if data is shared with third parties), due to an easier "balance test" of user benefits versus potential consumer harm. We think European media owners' lack of data scale will help them avoid regulatory scrutiny.

In professional publishing, we see increased benefits from personalization as both Wolters Kluwer and RELX move from providing reference content to more automated workflow

solutions. We think pricing power is the key test of success: delivering tangible user value should allow a product to grow pricing above inflation rates without losing share.

- Good examples to watch for products trying to increase their pricing power beyond inflation levels are UpToDate in Wolters Kluwer's Health segment and LexisNexis in RELX's Legal segment.
- RELX's LexisNexis Risk Solutions business uses detailed data on 200 million+ US consumers to enable insurance clients to automatically price and personalize insurance quotes and offers. This business sits in the Risk & BA segment, which accounted for 36% of 2020 group revenues and 45% of adjusted EBIT. Outside insurance, the subsegment has a growing fraud detection and consumer vetting business across eCommerce and other online verticals. So far, we see no quantifiable risk from regulatory restrictions on personalized insurance price optimization, while access to personal data from partners and public databases looks sustainable.

Who are the leaders and laggards?

Data solutions and assets helped Publicis outperform in a tough year for the industry.

In 2019, Publicis bought Epsilon, previously the loyalty data, data activation, and ad tech segment of Alliance Data Systems, for US\$3.95bn (8.2x EBITDA). Although the deal was widely criticized at the time, the acquired business units have helped Publicis outperform the industry's growth during Covid-19. We think some parts of the business will be hard to scale outside the US due to stricter privacy regulations, but we like the focus on helping clients use and poll their own first-party data. For more on Epsilon, see [Publicis Epsilon: A deep dive into marketing data solutions and assets](#).

We think ITV has been slow to invest and partner in addressable advertising as it prioritizes its linear TV broadcast ad business, although the company has been catching up by investing in Planet V. However, we think Planet V needs more partners to reach enough scale. A deal with Samsung is a good start, but we would have preferred a partnership with other broadcasters and Sky AdSmart. We think the slow growth of the online properties ITV Hub and Britbox (UK) has more to do with lacking content than personalization, but neither app is differentiated by content recommendation quality. Planet V allows advertisers to match their first-party data against over 32 million registered user data profiles, but we think the lack of daily reach makes a large portion of these profiles stale.

GLOBAL SOFTWARE

Enterprise software, as compared to consumer software, has traditionally focused on selling or renting software rather than monetization via the data it captures. As workloads have moved to the cloud and advertising has shifted from print to digital, new businesses (e.g., Digital Marketing and Experience Management) have arisen. This shift has brought customer and, especially, consumer data within the purview of the software, now cloud company. In addition, as consumer software has shifted to the cloud, new monetization strategies have been created akin to what is seen in consumer internet (e.g., advertising and the leveraging of consumer data).

More recently, we have seen a new and potentially disturbing trend as a few SaaS vendors, having access to information about their client's employees or possibly even customers, have started to leverage this data for their own purposes. As discussed in a recent note,⁴³² one SaaS vendor emailed a political position piece (whom to vote for and why) to the employees of the SaaS vendor's clients. This, we believe, is a highly slippery slope that could negatively impact the confidence companies have in their vendors and create data privacy issues.

Who are the leaders and laggards?

Within our coverage, some companies do not have any direct access to consumer data but have worked to protect their clients' data and, thus, indirectly consumer data. Among those who do have access to consumer data, predominantly through their cloud offerings, we believe **Microsoft** has taken a differentiated approach. As discussed earlier, it has been one of the companies that customers rate highly for the protection of consumer data within their software. But Microsoft has taken a step further in aggressively working to protect not only their customers but the internet in general against cybersecurity attacks, thus protecting consumer privacy.

Across the rest of our coverage, we also call out **Oracle**, which has built encryption into the hardware layer of its cloud databases to add a further level of privacy protection and created the most secure by default and possibly the most secure IaaS/PaaS offering in the market today.⁴³³ **Adobe and Salesforce** both have large SaaS digital marketing businesses that have been effective at protecting the consumer data in their systems and making it the responsibility of their customers to meet the privacy requirements of the GDPR and similar regulations.

How should investors think about quantifying the financial impact of the trade-off between privacy and personalization?

Software/cloud has become more focused on delivering end-user experiences that are more similar to consumer apps than traditional enterprise apps. That said, when it comes to privacy versus personalization, the focus is different because the customers are enterprises and the monetization strategy is through licenses or subscriptions paid by the enterprises. Unlike many other industries discussed in this chapter, most enterprise software would, in general, be focused far more on the privacy end of the spectrum than personalization, with the exception of companies with significant digital marketing exposure. But even there, as discussed earlier, the focus of these companies is meeting the requirements of enterprise customers rather than direct monetization.

US CABLE, TELECOM & SATELLITE

US telecom and cable companies provide the pipes through which customer data travel and manage direct relationships with customers. The companies primarily act as digital toll booths, generating revenue in the form of monthly bill payments for access to information highways. However, in recent years, many companies have either acquired media businesses (e.g., AT&T, Verizon, and Comcast) or else work with such businesses in order

⁴³² See report: [Weekend Tech Byte: The slippery slope of tech industry Activism](#).

⁴³³ See [Oracle OCI Gen 2: Has Oracle created a differentiated IaaS / PaaS? Does it shake-up the competitive landscape?](#).

to gain additional revenue derived eventually from advertising. While the underlying toll booth business is inherently US focused, media businesses have a broader reach and, as such, become subject to regulations in other regions, such as GDPR.

The primary difficulty that mobility companies encounter is the lack of standardized regulation across the US. When a regulation such as the CCPA appears in one state, the company essentially must adhere to the same regulation across the nation, as the business is necessarily mobile. It is too operationally difficult and expensive to attempt to segregate customers by their exact location at any point in time for regulatory needs. For illustrative purposes, it would be absurd to inform a customer of a data breach while in New York State, but not if the same customer was travelling through Kentucky. This is not even the most complex issue they deal with; sometimes, state laws conflict with each other. If a customer passes through two states, which rules should a service provider follow?

The greatest concern for these companies is the risk to brand equity that results from customer concerns over data. Customers need to feel networks are secure in order to buy goods or send personal data in a digital format. To assuage fears over the use of customer data, some companies, such as Verizon, are attempting to be as transparent as possible as to how customer data is used in simple terms. Customers can access their collected information through Verizon's website and delete some information (not all) that they do not want to share. In order to protect the network itself, these companies must consistently test their own network, allow external auditors to review the system, and ensure that employees – generally the weakest link in the network – are trained to a high standard. All these preemptive measures cost money, so it would not be surprising if a company neglected these expenses in times of financial stress, to the detriment of its long-term value.

Generally, attacks on information networks are digital in nature as opposed to attempts to physically alter equipment in the "field" to gain access to data. However, every day, there is a deluge of phishing attacks attempting to gain access to customer email accounts, and sometimes the hackers are successful. While gaining access to an email account is different from gaining access to customer data inside the corporate billing system, appropriate disclosure is important. Best-in-class disclosure will inform a customer about the source of the attack; for example, it is helpful information for a political activist to know that a foreign entity was targeting their email.

GLOBAL HOTELS & OTAS

Data privacy performance and personalized advertising are both a core competency and tail risk for hotel owners, large branded hotel groups, and online travel agents (OTAs).

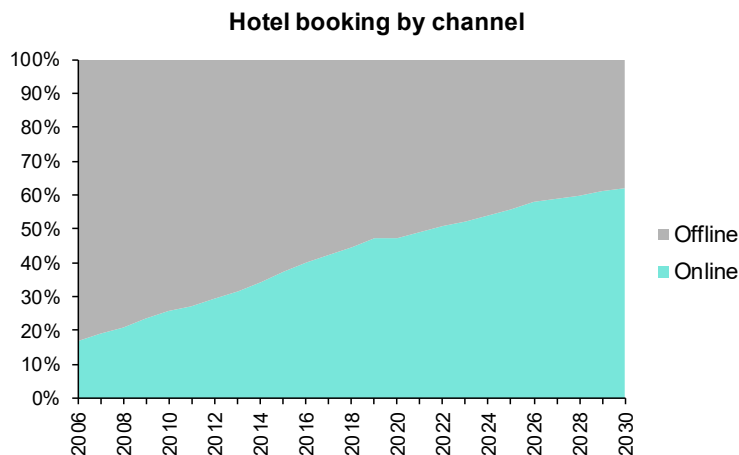
Marketing is one of the highest operating expenses for hotels. After labor and property costs, the primary cost hotel operators face is the cost of selling their rooms. As bookings continue to move online (see Exhibit 310), these hotel operators must optimize distribution across a wide number of sources (e.g., direct web traffic, OTAs, metasearch, tour operators, and bedbanks). Failure to use customer data in a smart way can have a material impact on margins and revenues.

Hotel owners have lost control of customer data by ceding bookings to OTAs, which don't share it. Over 2008-18, direct bookings went from 53% of all online hotel bookings to 39% (see Exhibit 311), as intermediaries such as Booking.com and Expedia took market share with their aggregated websites favored by consumers. As they "own the booking," they tend to keep the customer data, sharing only the legally required (and often limited) customer data with the hotels, but retaining the majority of transaction-informative data about the customer's search trends and booking preferences. This has made it harder for hotels to build a direct relationship with their guests online, reducing the ability to target offers and future stays to them.

Using data to intelligently target customers has huge potential to increase revenues and boost hotel margins. High commissions to OTAs mean direct bookings come through to hotels at higher margins if they can access them. Before the option existed to intelligently target certain customers on Facebook, Instagram, or Google, hotels used their marketing budgets to buy sponsored listings on Booking.com or blanket sponsored keyword advertising on Google, which in some cases saw OTA commissions rise to >30% of the final room rate. Targeted marketing by hotels to guests on social media is still at a nascent stage (OTAs and Google still provide the vast majority of bookings and traffic to websites), but could be an effective earnings driver in future if data can be used effectively and stored securely. See [Hotels vs OTAs Pt 2: Is there a 3rd way? Data-led direct booking and Google Hotel Ads as an alternative to Priceline and Brands](#).

This will require strong data controls and appropriate use. Hotel bookings require more customer data than most sectors: often obtaining passport and security numbers, and home addresses. This information is also given to the hotel well in advance of the date of travel, necessitating the need for strong data controls and appropriate use of this data. Unlike the OTAs and tech companies referenced in this chapter, the lack of modern IT and technology systems is still a huge problem for hotels (particularly small independent hotels) to overcome.

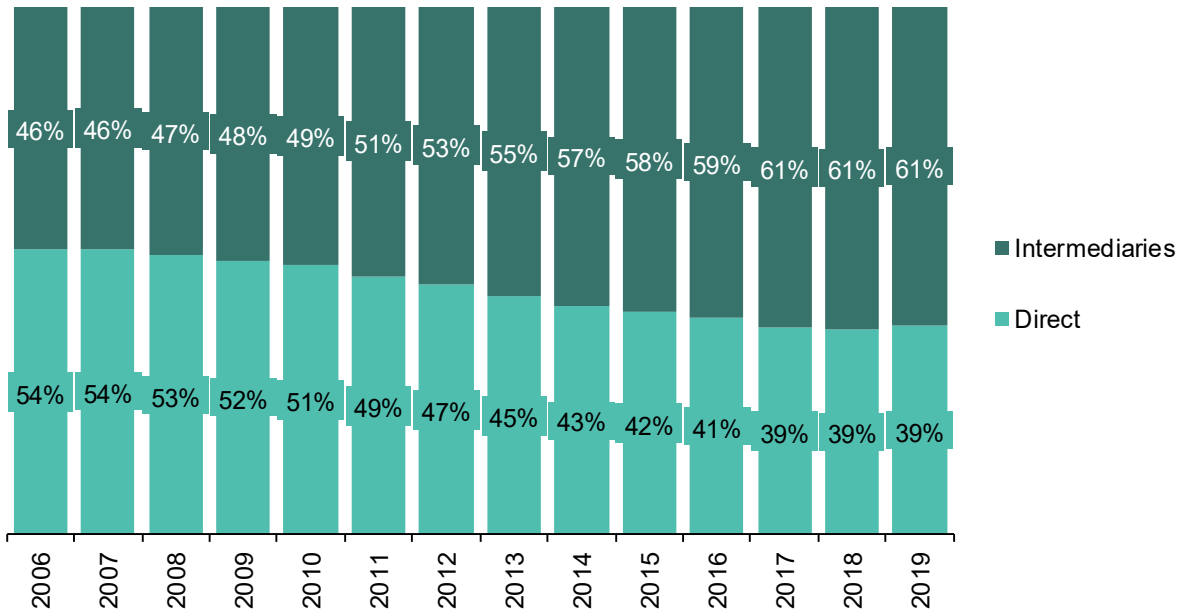
EXHIBIT 310: As bookings continue to move online, hotel operators must optimize distribution across a wide number of sources (e.g., direct web traffic, OTAs, metasearch, tour operators, and bedbanks); failure to use customer data smartly can have a material impact on margins and revenues



Source: Euromonitor (including estimates) and Bernstein analysis

EXHIBIT 311: Over 2008-18, direct bookings went from 53% of all online hotel bookings to 39%, as intermediaries such as Booking.com and Expedia took market share with their aggregated websites favored by consumers, and these intermediaries now control customer data as well

Market Share (Online Hotel Bookings)



Source: Euromonitor and Bernstein analysis

For hotel brands

Could branding be the answer? One way for a small independent hotel to both boost direct bookings and navigate the technological issues around data protection is to join a branded network (e.g., Marriott, Hilton, or Accor). Brands deliver more direct bookings to their hotels through loyalty schemes and strong corporate travel relationships, which means more effective opportunities for hotels to give relevant offers to customers. In addition, we expect technology to be a determinant of independents switching to brands in the coming years (see [Global Hotels, OTAs & Travel in 2021. Ready, set...](#)), and this will include access to centrally developed booking and IT systems with better data controls. As a result, we expect large hotel groups to be well placed as regulatory scrutiny over data protection increases, which also will make their data controls and technology a key determinant of performance.

The data risk is primarily a regulatory one, not seemingly one that impacts customer demand (yet). We argue that effectively using customer data to engage with and sell rooms to customers directly is a huge potential margin and revenue opportunity, as distribution costs can be cut by selling directly to the end consumer. Regulatory approval to do this will be critical and will rely on strong demonstrated data protection by hotels across the entire industry. The major Starwood data breach from 2014, in which Marriott was found liable for having acquired Starwood two years later, had regulatory consequences in the form of a fine but also brought additional scrutiny. Interestingly, that breach did not lead to customers leaving the brand; on the contrary, Marriott has now become the largest hotel

loyalty program in the world at over 100 million members, and continues to generate occupancy rates above the industry average. So we view the likely direct customer demand impact from data breaches to be low.

For OTAs

Operating purely as an agent between a guest and the hotel they stay at, there will always be a question about data rights. The OTA business model differs from, say, retail platforms as it simply connects a customer and a provider, and does not even offer any logistics or future support with the sale. Does a customer staying in the InterContinental Hong Kong's data belong to the hotel or to Booking.com — the website where they originally made the booking? Who owns the customer?

Customer data is a key competitive advantage for the OTA business model. Expedia's Media Solutions (advertising) website lauds its "billions of travel intent and booking data points" to entice hotels to advertise listings on their pages. As well as being able to optimize search list ordering, marketing offers, etc. to drive higher conversion rates, OTAs can also use the long lead times on hotel and flight bookings to market other services (e.g., car hire), with the knowledge of exactly where someone is traveling on an exact date. This makes OTAs more invaluable to hotels (who don't have the same access to traveler data), and keeps the virtuous cycle going.

For now, hotels do not appear to have the ability to advertise to specific customer segments on OTA websites. We would point out, however, that OTAs don't really seem to allow hotels to target customer segments within their sites very easily, with most campaigns or bids tending to simply get a hotel to the top of a list for a certain location search (e.g., Hotels Miami) or offering discounts to all members of the Hotels.com loyalty scheme. A future revenue opportunity for OTAs would be to allow hotels to target certain offers specifically at certain customer groups (e.g., those that have previously searched for hotels in their area, or just to married women between the ages of 30 and 45), but this may make them clash with data regulators.

Insufficient data controls would pose a risk to market share, as both guests and hotels can bypass them. Unlike hotel brands themselves, where the main risks to data security are regulatory only, OTAs would likely see more customer backlash from a data breach. Guests have plenty of sites to book their hotels on, and tend to be less loyal to OTAs (where price is the main factor) than to brands. In addition, hotels may choose to restrict content on certain OTA sites if their data protection was less good. Given how important data is to the OTA value proposition, and the amount they have invested in tech and IT, we expect their internal data protection to be far stronger than for hotel websites.

We expect hotels will look to drive direct bookings in future, in part to get access to more customer data (aided by tools like Google Hotel Ads). The OTA market share gains stopped in 2019, turning negative for the first time in over a decade. Google is one of the primary reasons for this — its hotel booking tools level the playing field for smaller hotels and give them a way to reach guests directly. In our view, Google poses a material risk to OTAs' market shares for this reason, and they may therefore look to share more underlying data with hotels in order to prevent this from happening. On the converse side, if Google and social networking sites face regulatory headwinds in their ability to target customers by

their historical activity — as suggested in this chapter — this may have the unintended regulatory consequence of giving distribution power back to the OTAs, harming smaller independent hotels' ability to compete for bookings online.

Related reading

[Global Lodging: Hotels vs. OTAs - BLACKBOOK](#)

[Hotels vs OTAs Pt 2: Is there a 3rd way? Data-led direct booking and Google Hotel Ads as an alternative to Priceline and Brands](#)

[Global Hotels: Beyond Boilerplate - Why ESG really matters](#)

[Online Travel Agencies \(OTAs\): No more worlds to conquer. Initiation of coverage](#)

[Online Travel Agencies: Alphabet Soup. Why Google matters? The key question post initiation](#)

[Quick Take: Global OTAs & Hotels - thoughts on the proposed EU tech regulations](#)

INVESTMENT IMPLICATIONS

US Internet

We rate Facebook, Alphabet, and Snap Outperform; and Twitter, Pinterest, and Lyft Market-Perform.

European Media

We rate Embracer Group and Wolters Kluwer Outperform; and ITV, Publicis Group, RELX, Universal Music Group, and WPP Market-Perform.

Global Software

We rate Microsoft, Oracle, and Adobe Outperform; and Salesforce Market-Perform.

US Telecom, Cable, & Satellite

We rate T-Mobile, Comcast, and Altice Outperform; and Verizon, AT&T, Charter, and DISH Market-Perform.

Global Hotels & OTAs

We rate TripAdvisor, Hilton, and Accor Outperform; Marriott, Expedia, and InterContinental Hotels Market-Perform; and Booking Holdings Underperform.

EXHIBIT 312: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021	Target	Ticker	Rating	Currency	29-Nov-2021	Target
			Closing Price	Price				Closing Price	Price
GOOGL	O	USD	2,910.61	3,350.00	DISH	M	USD	33.13	46.00
FB	O	USD	338.03	400.00	TMUS	O	USD	113.40	175.00
SNAP	O	USD	48.85	80.00	CMCSA	O	USD	51.53	70.00
TWTR	M	USD	45.78	75.00	ATUS	O	USD	15.99	38.00
PINS	M	USD	40.54	50.00	3690.HK (Meituan)	O	HKD	238.00	290.00
LYFT	M	USD	41.82	65.00	MAR	M	USD	150.77	169.00
EMBRACB.SS	O	SEK	95.08	144.00	BKNG	U	USD	2,182.01	1,890.00
ITV.LN	M	GBp	111.20	125.00	EXPE	M	USD	166.50	156.00
PBK.MK	U	MYR	3.94	3.20	TRIP	O	USD	26.58	52.00
REN.NA	M	EUR	27.64	25.47	HLT	O	USD	138.07	161.00
REL.LN	M	GBp	2,343.00	2,150.00	IHG.LN	M	GBp	4,600.00	5,000.00
UMG.NA	M	EUR	25.01	22.20	AC.FP	O	EUR	26.67	44.00
VIV.FP	M	EUR	11.20	12.50	MSDLE15			1,856.96	
WKL.NA	O	EUR	100.30	107.00	MXEF			1,218.99	
WPP	M	USD	71.10	67.60	SPX			4,655.27	
WPP.LN	M	GBp	1,060.50	990.00					
MSFT	O	USD	336.63	364.00					
ORCL	O	USD	92.94	98.00					
ADBE	O	USD	687.49	686.00					
CRM	M	USD	296.74	290.00					
VZ	M	USD	51.66	64.00					
T	M	USD	23.89	33.00					
CHTR	M	USD	668.19	824.00					

Source: Bloomberg, and Bernstein estimates and analysis

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GIG ECONOMY

What's the cost of regulation?

HIGHLIGHTS

- **The gig economy is redefining the future of work**, introducing new benefits and new challenges to how we think about employment. Roughly 10-20% of adults in developed markets have worked on digital platforms at some point. "Gig economy" definitions have evolved over the last decade to encompass a wide range of activities outside of standard, full-time employment. Popular examples include ridesharing, delivery, freelance, and home services. While the benefits of part-time work are clear, those pursuing full-time work in the gig economy face unique trade-offs, given the lack of security, benefits, and other protections that come with full-time employment.
- **As with other "born online" industries, regulators are playing catch-up.** Existing regulatory frameworks are not well equipped to handle the unique nature of the gig economy. Some European countries have classified gig workers as employees, while China requires delivery platforms to provide benefits and social insurance to 1P riders. The US is a patchwork of various state laws, with California recently passing Prop 22 to exempt rideshare and delivery drivers from being classified as employees.
- **ESG investors should feel comfortable including gig companies in their portfolios.** But, given increasing regulatory scrutiny and environmental considerations, company-specific analysis may lead to different conclusions and implications.

GIG ECONOMY REDEFINING THE FUTURE OF WORK

With the rise of the internet and digital platforms, workers can now be connected to customers and choose to work at their liberty. If anything, the pandemic has accelerated the growth of gig activities by showing us that work doesn't have to be bound by geographic or work hour constraints. Consumers also benefit greatly from the convenience of the gig economy — from Uber drivers to on-demand handymen to freelance designers, programmers, and consultants, we have already grown to rely on getting help or service that's just a click away.

But the gig economy is not without its issues. Many gig workers struggle to find sufficient well-paid work to earn a decent income, and don't have access to social protection or retirement savings, although they have more autonomy and flexibility.⁴³⁴ The environmental footprint of the gig economy is also debatable. In this chapter, we explore the many pros and cons of the gig economy, analyze the ever-evolving regulatory landscape, and assess potential implications for companies operating in gig sectors.

⁴³⁴ https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_771749.pdf

WHAT IS THE GIG ECONOMY?

The term "gig economy" was coined by former New Yorker editor Tina Brown in 2009 during the financial crisis to describe how workers were increasingly pursuing "a bunch of free-floating projects, consultancies, and part-time bits and pieces while they transacted in a digital market."⁴³⁵ The term has since evolved to describe a wide range of activities, such that it might be easier to define what the gig economy is not — it's activities outside of a standard, long-term employer-employee relationship (see Exhibit 313).⁴³⁶

The International Labour Organization (ILO) classifies the digital gig economy into two broad categories:

- **Online web-based platforms** (e.g., Upwork, Clickworker, and HackerRank) where tasks such as data processing, transcription, and programming can be performed remotely anywhere in the world; and
- **Location-based platforms** (e.g., Uber, Lyft, Didi, Grubhub, Meituan, Deliveroo, and TaskRabbit) where services such as taxi rides, food delivery, cleaning, and furniture assembly are mediated through a digital platform to match supply and demand real time.

What these platforms share in common is that they are typically based on algorithms to match workers with customers and to monitor workers' performance. These are also asset-light business models where the platform companies don't have to invest in capital equipment or bear operating costs. Instead, Uber drivers, for example, drive their own vehicles and are responsible for fuel, maintenance, and other costs. Lastly, these platforms typically have a small core workforce that's directly employed and a very large outsourced workforce (i.e., independent contractors whose work is mediated through the platform). The employment status and benefits of this outsourced workforce are often debated. For the purpose of this chapter, we primarily focus on location-based platforms as we discuss worker welfare and the regulatory landscape.

⁴³⁵ <https://hbr.org/2020/06/will-the-pandemic-push-knowledge-work-into-the-gig-economy#:~:text=The%20term%20%E2%80%9Cgig%20economy%E2%80%9D%20was,transacted%20in%20a%20digital%20marketplace.%E2%80%9D>

⁴³⁶ <https://www.gigeconomydata.org/basics/what-gig-worker>

EXHIBIT 313: **Examples of gig economy platforms**

Online web-based platforms				Location-based platforms		
Freelance	Content-based	Microtask	Competitive programming	Taxi	Delivery	On-demand
EPWK	Designhill	AMT	CodeChef	Beat	Cornership	Doit4u
Freelancer	Hatchwise	Appen	HackerEarth	Bolt	Deliveroo	Task Rabbit
Freelancehunt	99designs	Clickworker	HackerRank	Cabify	DiDi Food	Urban Company
Kabanchik		Microworkers	Kaggle	Careem	Glovo	Batmaid
PeoplePerHour			TopCoder	DiDi	GrabFood	BookMyBai
Toptal				Gojek	JumiaFood	SweepSouth
Upwork				Grab	Meituan	Care24
ZBJ				Little	Zomato	CareLinx
				Ola	Swiggy	Greymate Care
				Uber	UberEats	
					Toters	
					SinDelantal	
					Rappi	
					PedidosYa	

Source: ILO and Bernstein analysis

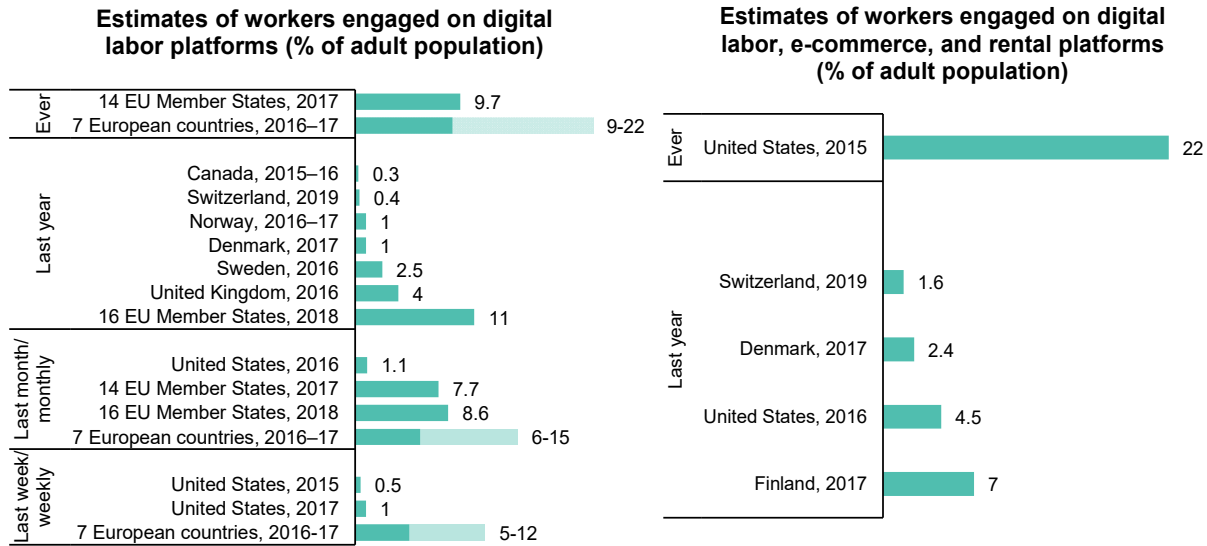
HOW BIG IS THE GIG ECONOMY?

The short answer is — it's too big to ignore and will only become a bigger part of the economy.

It's difficult, however, to pinpoint exactly how many workers are involved in the gig economy as different surveys use somewhat different methodologies and definitions. The ILO compiled results from a number of surveys/studies in North America and Europe, which show roughly 10-20% of the adult population have engaged on digital platforms at some point (see Exhibit 314):

- In the US, surveys indicate ~22% of the working-age population have offered some kinds of goods or services using a digital platform, and ~7% reported earning at least 40% of their monthly income from platform work. ~2-7% of workers have offered such goods or services on digital platforms in 2021.
- Focusing only on workers having earned income on digital *labor* platforms, the estimates vary between 9% and 22% for select European countries. An estimated 0.3-11% of workers have earned income through digital labor platforms in 2021.

EXHIBIT 314: **Estimates of workers engaged on digital platforms based on surveys (percentage of adult population)**



Source: ILO compilation and Bernstein analysis

WHO ARE THESE GIG WORKERS?

US

Taking a closer look at the characteristics of gig workers in the US, according to a Pew Research survey in December 2015, 8% of adults earned money from a digital gig platform over the previous year, mostly by doing online tasks such as surveys/data entry or providing services such as ride hailing, shopping/delivery, and cleaning/laundry.⁴³⁷ These gig workers tend to be younger, disproportionately Black or Latino, with high school degrees or less and below-average household incomes (see Exhibit 315 to Exhibit 318).

56% of gig workers say the money they earn from these digital platforms is essential or important to their financial situation, while 42% say it's nice to have. 57% and 52% of gig workers who are more reliant on their income from gig platforms have household income below US\$30k and have not attended college, respectively, versus 20-30% of casual gig workers who fall into the same buckets (see Exhibit 319). 39% of gig workers who are more financially reliant consider themselves employees of the platforms versus only 9% of casual gig workers. Financially reliant gig workers are also less likely to have full-time jobs and many say they choose this type of work because they need to control their own schedule and don't have many other job opportunities.

It is clear that gig jobs provide flexibility for people who want flexible schedules or who don't want to work full time (see Exhibit 320). However, only 16% of US adults surveyed believe gig jobs are something people can build careers out of. Whether gig jobs let companies

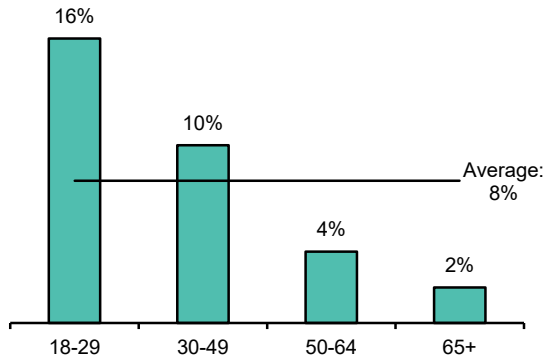
⁴³⁷ <https://www.pewresearch.org/internet/2016/11/17/gig-work-online-selling-and-home-sharing/>

take advantage of workers or place too much financial burden on workers is still up for debate — 21-23% of respondents agree with these statements and 20-30% disagree, while the remainder are unsure.

It's worth noting that the survey was conducted in late 2015, and public opinions have evolved since then. According to a McKinsey survey conducted in the spring of 2021, 62% of contract, freelance, and temporary workers would prefer to work as permanent employees.⁴³⁸ Many of these workers were hit the hardest during the Covid-19 pandemic, having suffered from decreased income with less access to affordable health insurance.

EXHIBIT 315: **Gig workers in the US tend to be younger...**

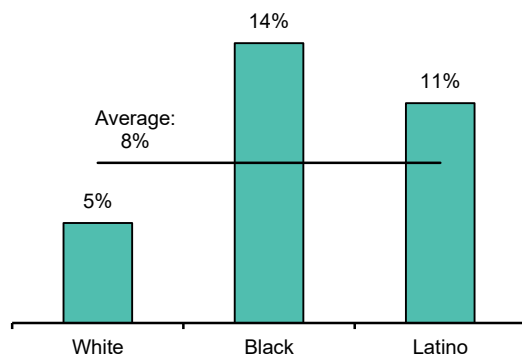
% of US Adults Who Have Earned Money via Digital Work Platforms (By Age Group)



Source: Pew Research and Bernstein analysis

EXHIBIT 316: **...disproportionally Black and Latino...**

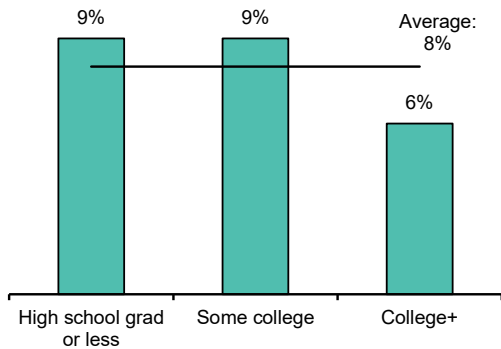
% of US Adults Who Have Earned Money via Digital Work Platforms (By Race)



Source: Pew Research and Bernstein analysis

EXHIBIT 317: **...with high school degrees or less...**

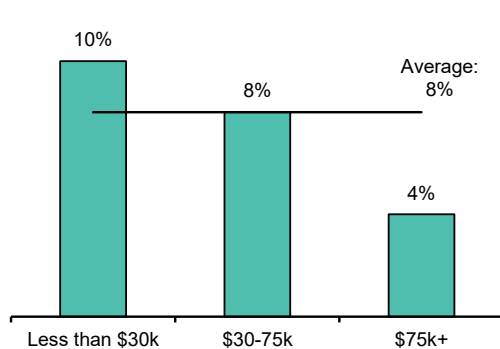
% of US Adults Who Have Earned Money via Digital Work Platforms (By Education Level)



Source: Pew Research and Bernstein analysis

EXHIBIT 318: **...and below-average household income**

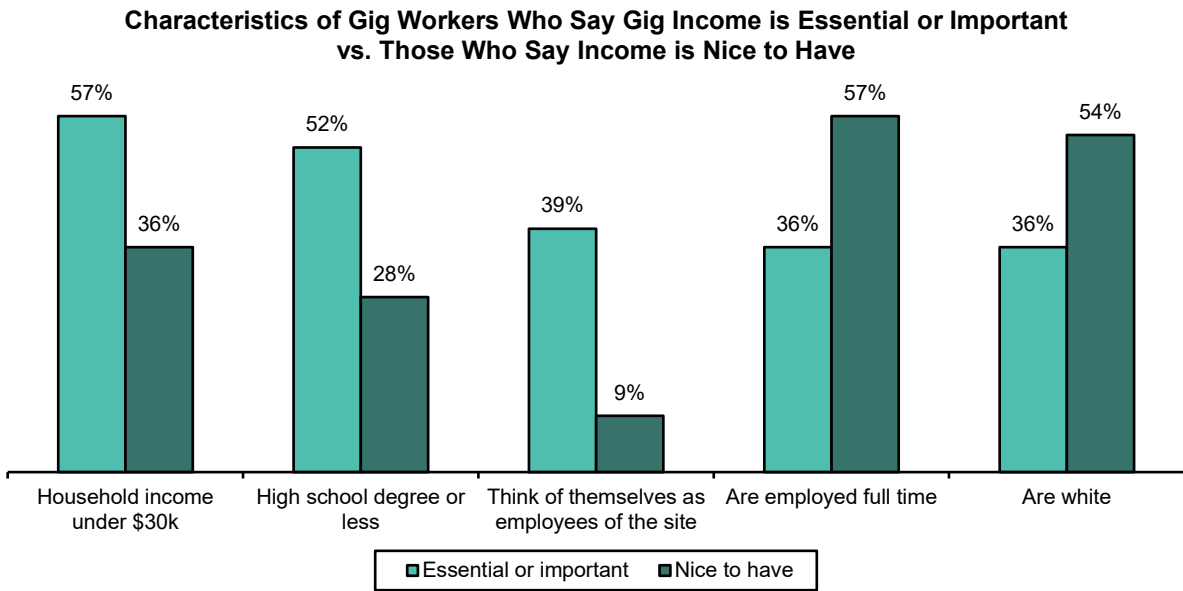
% of US Adults Who Have Earned Money via Digital Work Platforms (By Household Income)



Source: Pew Research and Bernstein analysis

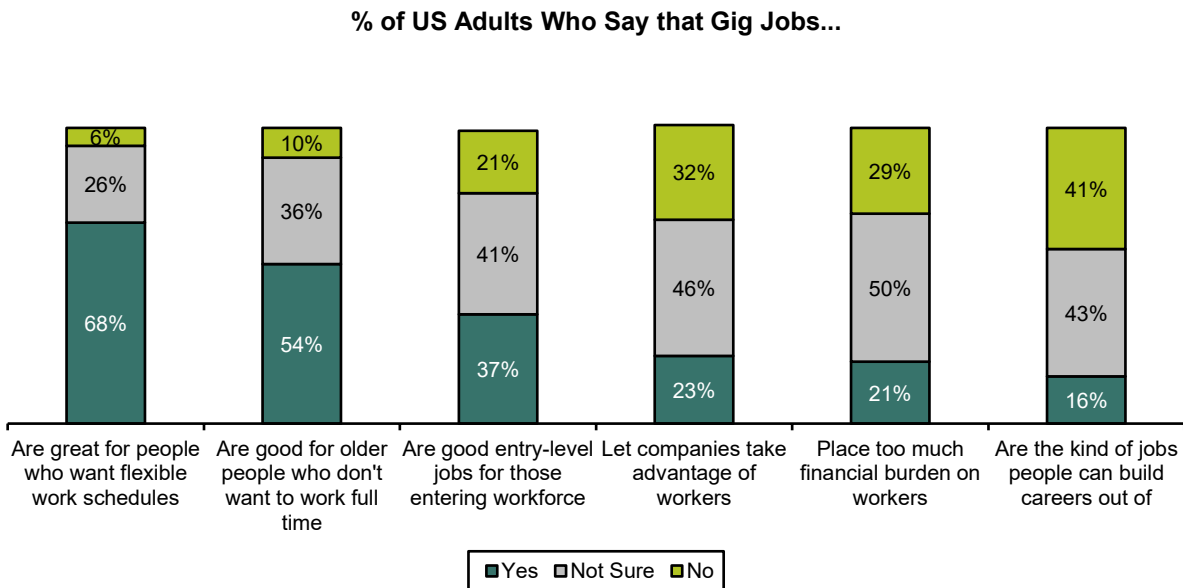
⁴³⁸ <https://www.mckinsey.com/about-us/covid-response-center/inclusive-economy/unequal-america-ten-insights-on-the-state-of-economic-opportunity#>

EXHIBIT 319: Gig workers who are more financially reliant on gig incomes are more likely to come from lower-income households, with high school degrees or less, and think of themselves as employees of the site platform



Source: Pew Research and Bernstein analysis

EXHIBIT 320: It is clear that gig jobs provide more flexibility for people, although few see gig jobs as a way for people to build careers out of



Source: Pew Research and Bernstein analysis

EUROPE

In Europe, a survey by the European Commission in 2016 shows 10% of the adult population has ever used online platforms to provide services, less than 8% do this kind of work with some frequency, less than 6% spend a significant amount of time on it (at least 10 hours per week) or earn a significant amount of income (at least 25%), and about 2% of the population are considered "main platform workers" who spend more than 20 hours a week or earn 50% or more of their income via platforms.⁴³⁹

Similar to findings of the Pew Research survey in the US, gig workers in Europe tend to be younger, with 50-60% under the age of 35 versus only 26% of offline workers under 35 see (see Exhibit 321). European gig workers are also more likely to come from less financially well-off households, with 26% in the bottom decile in terms of income versus 10% in the general population.

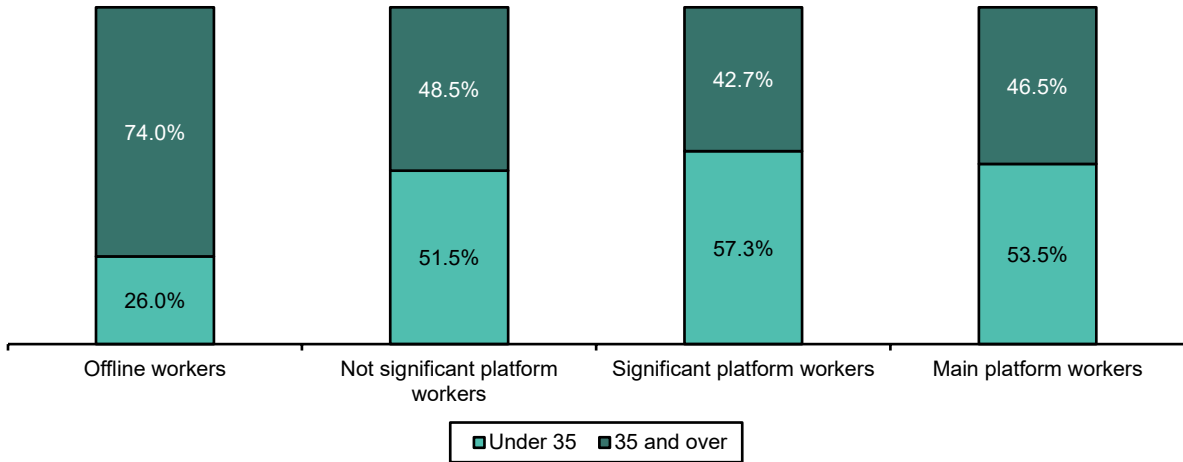
Interestingly, most European gig workers are married with children — 56% of main platform workers (i.e., those who spend more than 20 hours a week or earn >50% of their income from gig platforms) are married with children versus only 33% among offline workers (see Exhibit 322). This is likely as gig jobs offer the flexibility needed to balance work and life responsibilities. In fact, flexibility and autonomy are the top-cited motivations for people to seek out gig jobs; a lack of alternatives is also cited as an important motivation, similar to the results in the US.

However, the employment status of gig workers remains unclear. In Europe, gig workers are more likely to self-classify as employees or self-employed than the general population. ~76% of gig workers in Europe claim to be an employee (~68%) or self-employed (~8%), which compares to 64% of non-gig workers classifying themselves as employees or self-employed (see Exhibit 323). While some gig workers do have regular jobs in the traditional sense, some may see themselves as employees despite gig platforms classifying them as independent contractors in most cases. This disconnect creates societal issues as gig workers are often not protected by traditional labor laws and do not receive regular social security benefits.

⁴³⁹ https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112157/jrc112157_pubsy_platform_workers_in_europe_science_for_policy.pdf

EXHIBIT 321: Gig workers in Europe tend to be younger, with 50-60% under the age of 35 versus only 26% of offline under 35

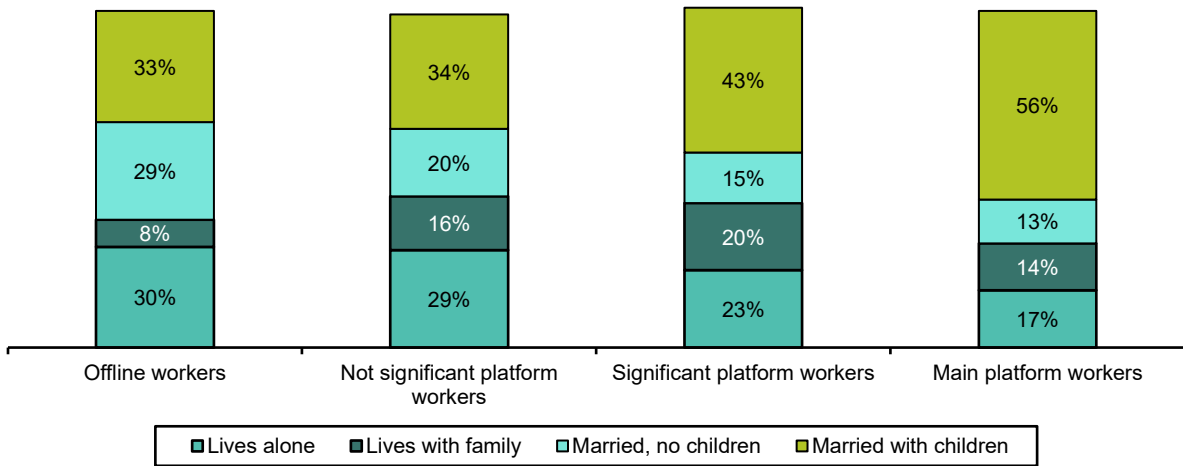
Age Distribution of European Offline vs. Platform Workers



Source: European Commission and Bernstein analysis

EXHIBIT 322: European gig workers are also more likely to be married with children, likely as gig jobs offer the flexibility they need to balance work and life responsibilities

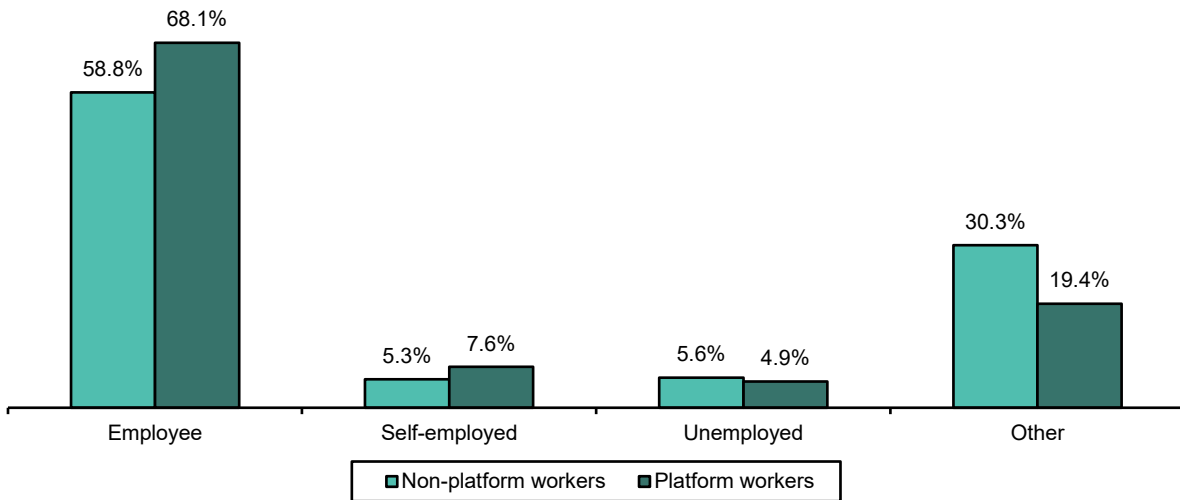
Household Composition of European Offline vs. Platform Workers



Source: European Commission and Bernstein analysis

EXHIBIT 323: **In Europe, gig workers are more likely to self-classify as employees or self-employed than the general population, despite most platforms treating them as independent contractors, which shows that the employment status of gig workers is unclear**

Self-declared Employment Status of Platform vs. Non-platform Workers



Source: European Commission and Bernstein analysis

+ CHALLENGES FACED BY GIG WORKERS

Besides the lack of benefits and protection, as gig workers are not recognized as formal employees, **they also face challenges in terms of not having a sufficient amount of work**, which has been exacerbated during the Covid-19 pandemic. According to the ILO's survey of crowd workers in 2017,⁴⁴⁰ 86% of gig workers would like to undertake more work. 45% of respondents cited the lack of sufficient work on these platforms as the main reason preventing them from doing more work, while others cited not being able to find well-paid tasks and difficulty in finding clients as key challenges.

Average hourly pay may be low for gig workers. The ILO recently ran an analysis suggesting wages of US\$6.1/hour in developed countries and US\$4.1/hour in developing countries, versus the federal minimum wage of US\$7.25/hour in the US. And after factoring in the unpaid time gig workers spend searching for jobs or waiting for clients, their average pay drops to US\$4.5/hour in developed markets and US\$2.8/hour in developing markets (see Exhibit 324). In particular, earnings are impacted by various types of platform fees as well as competition among workers for jobs. Gig workers are also expected to cover the costs associated with their work (e.g., gas and maintenance). We urge a bit of caution on drawing general conclusions around wages, as both Uber and Lyft have recently reported drivers earnings north of US\$35+/hour in some cities. But if the relatively lower pay and

⁴⁴⁰ https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_771749.pdf

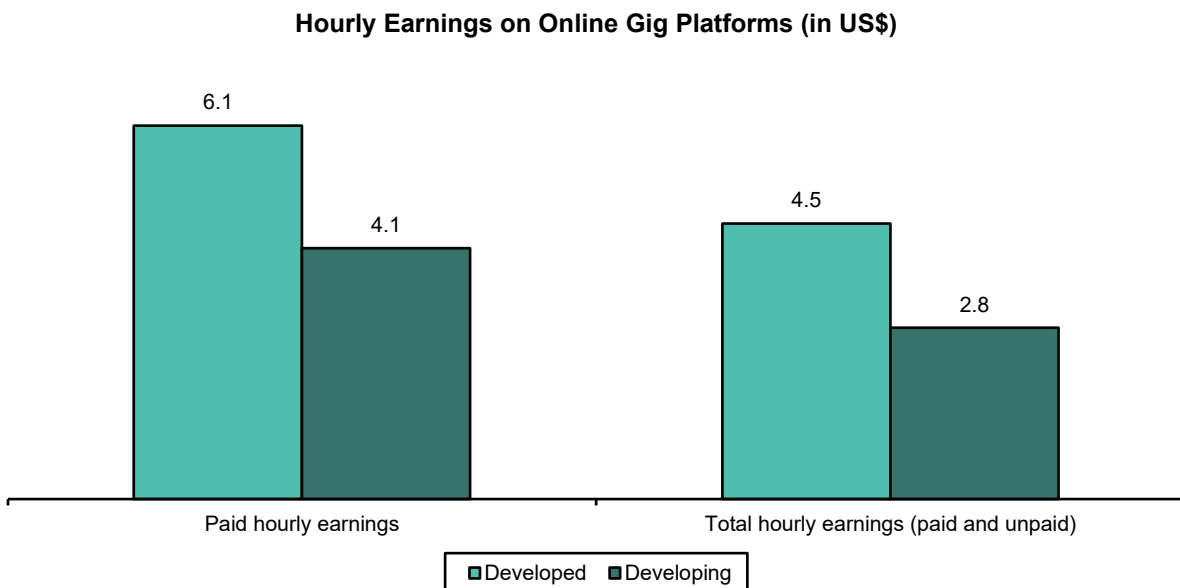
unpredictable nature of gig jobs is indeed more representative, we could see increased financial instability (and churn) for gig workers.

Although most people seek gig jobs for more flexibility, some end up working long hours, as many platforms incentivize workers to work longer hours to access higher bonuses (through gamification). In addition, workers spend a lot of time doing unpaid work — for every hour of paid tasks, workers spend about 20-23 minutes doing unpaid tasks. Gig workers also face limitations in terms of choosing their work schedules, which are often dependent on when there is demand from customers. Given these constraints, gig jobs may not offer as much flexibility as people hoped for.

With autonomy comes pressure to maintain client ratings. Many gig workers in the ride hailing and delivery businesses find it difficult to decline certain orders as it could negatively impact their ratings and could result in financial penalties. Gig workers are also heavily monitored by platforms as to their whereabouts and activities, not to mention their jobs and pay are dependent on client ratings. Most workers are either unaware of or have limited channels to dispute unfair client ratings, which in some cases could get them suspended by platforms.

Despite these challenges, many workers still actively seek gig jobs for the incremental flexibility or a lack of alternatives. As the gig economy shapes the future of work, regulators are playing catch-up. In the next section, we review the regulatory landscape and the potential implications for companies operating in the gig economy.

EXHIBIT 324: **Average hourly pay is low for gig workers, especially after accounting for unpaid time spent on searching for jobs, waiting for clients, etc.**



Source: ILO and Bernstein analysis

REGULATORY LANDSCAPE – ARE GIG WORKERS EMPLOYEES?

As the gig economy is pushing the boundaries of traditional employment definitions, the ILO recommends countries develop national policies on employment relationships and use appropriate criteria to differentiate between employment and self-employment. In particular, the ILO notes that whether a worker is recognized as an employee should not be dependent on the contractual agreements but on the actual facts relating to "the performance of work and the remuneration of the worker."⁴⁴¹ This is specifically in response to the fact that many gig platforms unilaterally determine gig workers are "self-employed" or "independent contractors" in their terms and conditions.

In practice, regulators across the world have taken quite different approaches toward classifying gig workers and regulating the gig economy. The lack of consistency is partly because regulating the gig economy is complicated. For example, should governments regulate ride hailing and food delivery platforms the same way they regulate platforms such as Upwork and TaskRabbit that connect freelance graphic designers or handymen with customers? Even ride hailing and food delivery platforms are different, as ride hailing companies have disrupted the traditional taxi industry where taxi drivers who paid hundreds of thousands of dollars for their Taxi medallions are now losing business to Uber and Lyft, whereas food delivery has been less of a disruption and more a supplement to the historically more informal restaurant delivery ecosystem.

Another question is the motivation behind regulations — are more governments starting to regulate the gig economy to raise tax revenue or to actually protect worker welfare? Although they seem like two sides of the same coin, focus on tax revenue collection will lead to better tracking of gig workers and their income, rather than providing actual benefits and protection to gig workers. In the following section, we review some key regulatory developments in major markets, primarily discussing regulations that focus on promoting worker welfare rather than those that just create another channel for tax collection.

US

In the US, California signed Assembly Bill 5 (AB5) into law in September 2019, which came into effect in January 2020 and extends employee classification status to gig workers. Rideshare and delivery companies including Uber, Lyft, Instacart,⁴⁴² and DoorDash raised more than US\$200mn in opposition to AB5, and passed Prop 22 in November 2020, which exempts app-based rideshare and delivery drivers from AB5 (i.e., platforms can continue to classify them as independent contractors and adopt labor and wage policies specific to app-based drivers and companies).⁴⁴³ This was a major win for gig platforms and drove stock prices of Uber and Lyft up 10-15%, among other effects (see Exhibit 325). Although driver pay may go up further (e.g., Uber and Lyft are now guaranteeing minimum earnings

⁴⁴¹ https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/publication/wcms_777866.pdf

⁴⁴² Private, not covered.

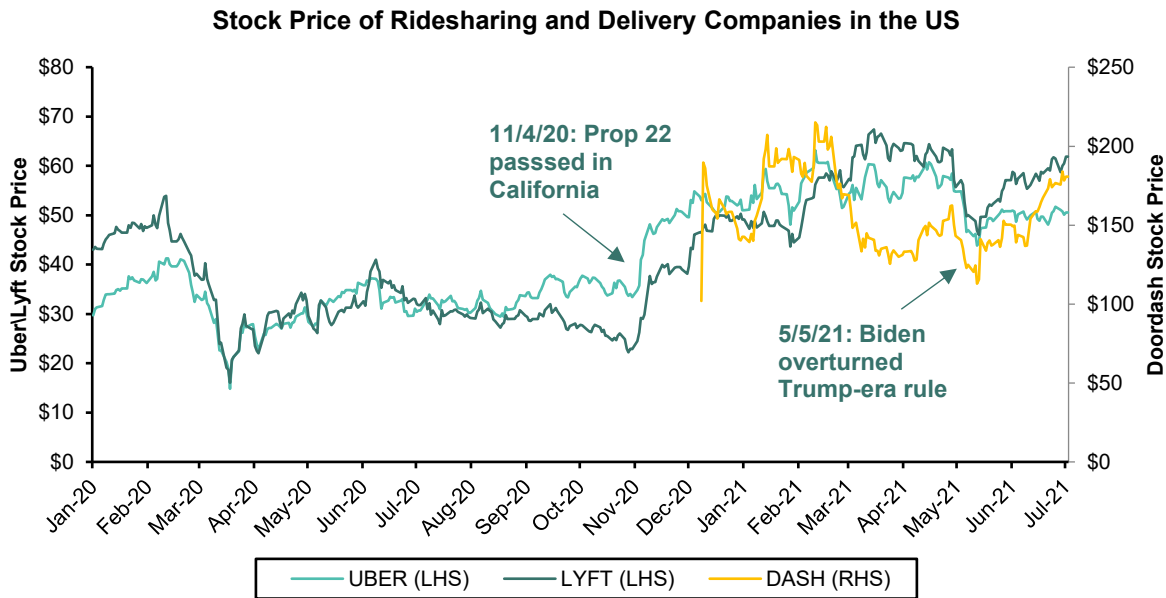
⁴⁴³ <https://voterguide.sos.ca.gov/propositions/22/>

and providing a healthcare stipend for drivers working more than 15 hours a week),⁴⁴⁴ the cost and operational burden will be far more manageable than under AB5.⁴⁴⁵

More recently, however, the Biden administration overturned a Trump-era regulation tied to the Fair Labor Standards Act that would have made it easier for businesses to classify gig workers as independent contractors.⁴⁴⁶ While not explicitly tied to gig workers, repealing the rule could call into question the gig worker classification. Uber, Lyft, and DoorDash all traded down on this news, although it's hard to single out the impact of the Biden rule as the news came out right in the middle of the earnings season (see Exhibit 325). Biden's Labor Secretary also spoke in support of classifying gig workers as employees, which could signal a change in direction at the federal level.⁴⁴⁷

In response to this, Uber and others continue to advocate for the "third way" of classifying gig workers, essentially looking to replicate the California model nationally. According to this model, companies will continue to classify gig workers as independent contractors or self-employed, but provide some benefits like insurance or paid time off (below what full-time employees get) as a middle ground.⁴⁴⁸

EXHIBIT 325: **Share prices of ridesharing and delivery companies have been sensitive to regulatory developments regarding gig worker classification**



Source: Bloomberg and Bernstein analysis

⁴⁴⁴ <https://www.theverge.com/2020/12/14/22174600/uber-lyft-new-benefits-california-drivers-prop-22-gig-economy>

⁴⁴⁵ See report: [US and EU Internet Regulation update: The nationalization of the Internet is well underway.](#)

⁴⁴⁶ <https://www.wsj.com/articles/biden-blocks-trump-era-gig-worker-rule-11620219168>

⁴⁴⁷ <https://www.reuters.com/world/us/exclusive-us-labor-secretary-says-most-gig-workers-should-be-classified-2021-04-29/>

⁴⁴⁸ <https://www.nytimes.com/2020/08/10/opinion/uber-ceo-dara-khosrowshahi-gig-workers-deserve-better.html>

EUROPE

Despite having convinced the majority of voters in favor of Prop 22 in California, Uber lost a similar fight in the **UK** around driver classification in February 2021. The UK Supreme court has sided with a cohort of drivers who brought a suit against the company back in 2016. They will now be classified as "workers," entitling them to benefits such as minimum wage and paid holidays.

The UK has three employment classifications — self-employed/contractors, workers, and employees. The court determined that "the transportation service performed by drivers and offered to passengers through the Uber app is very tightly defined and controlled by Uber," and that "in practice the only way in which they [drivers] can increase their earnings is by working longer hours while constantly meeting Uber's measures of performance," which makes Uber drivers "workers" rather than "self-employed/contractors."⁴⁴⁹ The court also ruled that time spent on the job extended beyond just time spent with passengers to include time when drivers are logged into the app within the relevant territory and ready to accept trips.

This ruling clearly sets a precedent for how drivers are to be paid and classified in the country across the gig economy, beyond just Uber or ridesharing. Investors also are wrestling with the contagion risk across Europe as other countries are potentially prompted to follow the UK's lead here.

In **Spain**, the Rider Law was ratified in May 2021, requiring online delivery platforms to classify their couriers as employees within three months.⁴⁵⁰ The government also approved new rules requiring companies to explain to their staff how their algorithms work.

In **Italy**, the Lazio regional law circumvents the complicated question of employment status and guarantees minimum protection to workers, including safety, training, and insurance.⁴⁵¹

Elsewhere, courts in **France, the Netherlands, and Belgium** have ruled in favor of recognizing individual gig workers as employees, although the rulings haven't applied to all gig workers in these countries.⁴⁵²

Across the region, the **European Commission** launched a consultation into labor conditions in the gig economy earlier in 2021. EU lawmakers are asking gig platforms to negotiate with unions or other workers' representatives or risk facing new EU-wide legislation. In response, companies have lobbied the EU to adopt the California model, although the UK, Spain, and Italy could set precedents for the rest of Europe to follow suit.

⁴⁴⁹ <https://techcrunch.com/2021/02/19/uber-loses-gig-workers-rights-challenge-in-uk-supreme-court/>

⁴⁵⁰ <https://www.reuters.com/business/sustainable-business/gig-economy-riders-spain-must-become-staff-within-90-days-under-new-rule-2021-05-11/>

⁴⁵¹ See report: [Initiating coverage on EU Food Delivery: A state of war is the state of nature.](#)

⁴⁵² <https://www.reuters.com/article/us-uber-britain-breakingviews/breakingviews-europe-is-now-the-main-front-in-gig-economy-war-idUSKBN2AJ214>

In **China**, the Nanjing local government published a draft "Guidelines on the Regulation of Food Delivery Platform Delivery Riders" in April 2021, which was the first time Chinese regulators laid out a regulatory framework for so-called flexible workers, including food delivery riders but also logistics couriers and beyond.⁴⁵³ In early August, two landmark announcements were made by top Chinese government ministries pertaining to the food delivery industry, including the Guiding Opinions on Implementing Internet Food Platforms Responsibilities and Protecting Food Delivery Riders Rights (关于落实网络餐饮平台责任切实维护外卖送餐员权益的指导意见) and the Guiding Opinion on Protecting New Employment Workers' Protection and Rights (关于维护新就业形态劳动者劳动保障权益的指导意见).

Significantly, the Guiding Opinions acknowledged for the first time the existence of flexible workers, and allowed them to remain exempt from social insurance obligations. Under the Nanjing and national-level guidelines, food delivery riders will be classified into dedicated riders and crowdsourced riders, which determines their employment status and benefits:

- Dedicated riders are those managed by delivery partner companies contracted by gig platforms and can be further categorized into: (1) full-time riders, (2) labor dispatch riders, and (3) part-time riders. Full-time riders are hired by delivery partner companies and should be classified as employees. Labor dispatch riders are hired by labor agencies and dispatched to work at delivery partner companies; they should be classified as employees of the labor agencies. Part-time riders are those who work less than four hours a day and less than 24 hours a week. They should be covered under part-time employment contracts.
- Delivery partners and labor agencies should enroll delivery riders into China's social insurance scheme and offer benefits including holidays and occupational safety insurance. Part-time riders can also self-enroll into China's social insurance scheme.
- Crowdsourced riders are individuals willingly working for gig platforms or their delivery partners on a freelance basis. Although crowdsourced riders do not have formal employment contracts, the draft guidelines state they should be treated as employees if they follow gig platforms' work schedules, salary structures, and policies. However, the guidelines stopped short of requiring social insurance for crowdsourced riders.

Experts we spoke with pointed to expectations that various city governments in China will follow up with policy documents of their own, clarifying implementation on a local level — the Beijing government has already done so. These local documents are expected to mostly follow the central Guiding Opinions.

At a high level, the Guiding Opinions focused on: (1) worker protection and (2) social insurance. The former included requiring the platforms (e.g., Meituan) to provide data to show what constituted "reasonable work performance," the unionization of riders, and requiring the platforms to assume responsibility for work-related accidents and labor

⁴⁵³ See report: [Meituan: ESG in Action... dimensioning the impact of rider social insurance](#).

disputes. But while worker protection compliance was expected to be strict, the associated financial impact (e.g., reduction of fines for late deliveries) was expected to remain manageable. On the margin, the financial impact of social insurance was expected to be greater, but this was also expected to be tempered by the fact that: (1) 3P riders will not be required to contribute social insurance under the new rules, (2) workers with rural hukou⁴⁵⁴ will not be required to pay social insurance while working in the cities, and (3) enforcement of social insurance is typically much more relaxed outside China's top cities.

In **India**, the country's Code on Social Security 2020 included provisions for gig and platform workers for the first time. The code will require gig platforms to allocate 1-2% of their annual turnover or 5% of wages paid to gig workers, whichever is lower, to a social security fund for gig workers. The code also requires a portal to be set up to collect information on gig and platform workers to determine their eligibility and to administer social security benefits. To gig platform companies' relief, however, the implementation of the code has been delayed from April 1, 2021 to a later date.⁴⁵⁵

While the implementation of gig economy regulations has been bumpy and we still lack clarity in many markets, there has clearly been a concerted effort across major markets globally to better regulate the gig economy, which might have been accelerated by the Covid-19 pandemic when many gig economy workers struggled to make enough money (although others such as food delivery workers probably benefited). Beyond the regulatory focus on worker welfare within the gig economy, what other ESG considerations should investors take into consideration? In the next section, we take a stab at assessing the environmental pros and cons of a shared economy.

IS RIDE HAILING GOOD FOR THE ENVIRONMENT?

The debate is still out there.

On one hand, one study has shown that non-pooled ride hailing could increase emissions per trip mile by 47% relative to a private vehicle trip (see Exhibit 326).⁴⁵⁶ This is largely because of "deadheading," or miles a ride hailing vehicle travels without a passenger between rides. This analysis assumes an average deadheading of 42% of total miles traveled. Meanwhile, although ride hailing provides convenience and reduces the need for private car ownership, especially in big cities, the convenience has incentivized more people to opt for an Uber ride instead of walking and/or taking public transportation, which are much less environmentally costly ways of commuting. The increased number of trips has also resulted in more congestion on the road and more emissions as a consequence.

That said, pooled ride hailing (assuming that 15% of ride hailing trips are pooled) could reduce emissions slightly compared to a private vehicle trip. And if we are able to shift the ride hailing fleet to EVs, we can generate much more significant emission reductions in the

⁴⁵⁴ System of household registration used in mainland China.

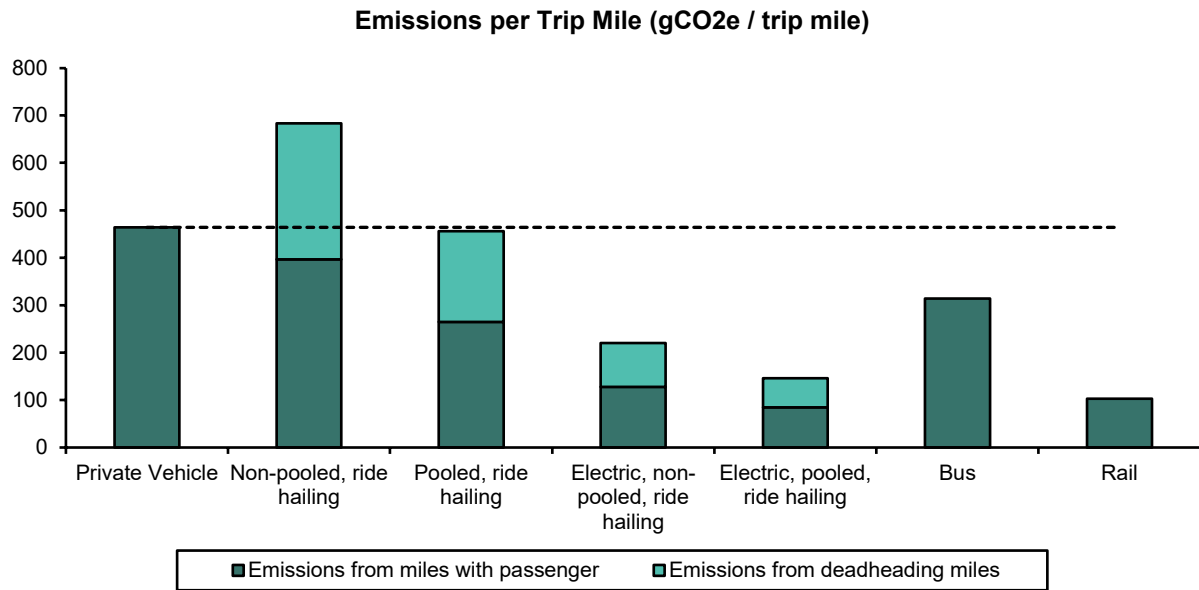
⁴⁵⁵ <https://inc42.com/buzz/india-defers-new-labour-codes-including-social-security-for-gig-workers/>

⁴⁵⁶ https://www.ucsusa.org/sites/default/files/2020-02/Ride-Hailings-Climate-Risks-Methodology_0.pdf

~50% (non-pooled) to ~70% (pooled) range, making EV ride hailing more environmentally friendly than an average bus trip today.

In a separate study, the California Air Resources Board estimates that in 2018, the ride hailing fleet emitted 301 gCO₂e/passenger mile traveled (PMT), approximately 50% higher than the statewide passenger vehicle fleet average of 203 gCO₂e / PMT, again largely due to deadheading (~39% of miles traveled without a passenger in the car). This is despite the ride hailing fleet having newer and more fuel-efficient cars.⁴⁵⁷

EXHIBIT 326: One study has shown that non-pooled ride hailing could increase emissions by 47% relative to a private vehicle trip; however, this doesn't take into consideration the fact that private vehicles cold start much more often than ride hailing vehicles – the cold start phase accounts for >50% of urban driving emissions



Source: Union of Concerned Scientists (UCS) and Bernstein analysis

What these studies don't take into consideration, however, is that ride hailing vehicles typically do chain rides rather than having to restart the vehicle for every single trip. Most pollutants are emitted during the cold start phase of a vehicle. Some studies suggest cold start emissions can make up over 50% of urban driving emissions as the majority of trips are less than three miles in length.⁴⁵⁸ The amount of cold start emissions could be much more significant in cold weather conditions or for very short trips. This consideration could make ride hailing a more attractive option environmentally versus private vehicles.

However, a recent survey of California riders shows 24% of non-pooled trips and 36% of pooled trips would have been by mass transit, walking, biking, or not taken at all (see Exhibit

⁴⁵⁷ https://ww2.arb.ca.gov/sites/default/files/2019-12/SB%201014%20-%20Base%20year%20Emissions%20Inventory%20December%202019.pdf?utm_medium=email&utm_source=govdelivery

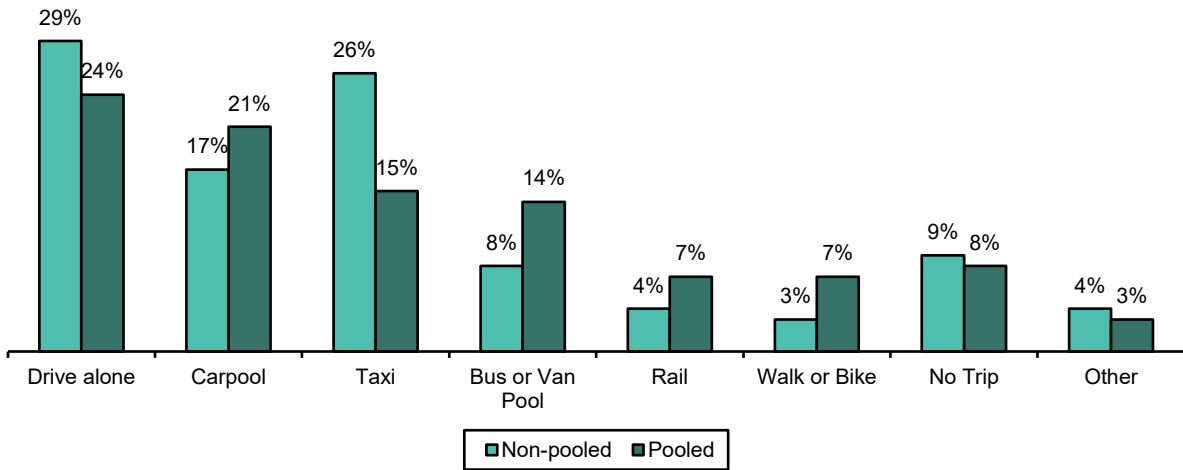
⁴⁵⁸ https://apps.weber.edu/wsuiimages/ncast/projects/Cold_Hot_Start_Idle_Emissions_Final_Report.pdf

15). For these trips, ride hailing still takes a toll on the environment until we shift to an EV fleet.

Speaking of an EV fleet, the California Air Resources Board issued a requirement in May 2021 for EVs to account for 90% of ride hailing miles traveled by 2030.⁴⁵⁹ This is less than what ride hailing platforms have committed to — both Uber and Lyft expect to shift to 100% EVs by 2030.⁴⁶⁰ However, this will require significant investments from ride hailing platforms, governments, and other stakeholders to make EVs affordable for drivers. Bloomberg estimates only 0.5% of ride hailing vehicles in the US today are electric and 3.4% in Europe, versus 21% in China where many municipalities now require all new ride hailing vehicles to be either fully electric, hybrid, or fuel cell vehicles. There is still a long way to go to reach 100% EVs. Although companies such as Uber are providing some incentives for drivers to go electric (e.g., US\$0.5-US\$1.5 extra earnings per trip, discounts offered in partnership with EV OEMs and charging stations, etc.), the average price of an EV is US\$19,000 higher than an average gasoline-powered vehicle, and more subsidies will be needed to drive further EV adoption among ride hailing drivers.⁴⁶¹

EXHIBIT 327: While the emissions of ride hailing versus private vehicles is debatable after factoring in the cold start impact, 24% of non-pooled trips and 36% of pooled trips would have been by mass transit, walking, biking, or not taken at all; for these trips, ride hailing still takes a toll on the environment

% of Trips Displaced by Ride Hailing by Travel Modes
California Rider Survey Results (2019)



Source: UCS, Circella et al. (2019), and Bernstein analysis

⁴⁵⁹ <https://www.reuters.com/technology/california-regulator-adopts-ev-mandate-uber-lyft-ride-hail-fleets-2021-05-20/>

⁴⁶⁰ For Uber, this commitment applies to the US, Canada, and European cities by 2030. The company has also committed to a zero-emission platform by 2040. <https://www.uber.com/en-AE/newsroom/driving-a-green-recovery/>

⁴⁶¹ <https://www.nrdc.org/stories/electric-vs-gas-it-cheaper-drive-ev>

WHAT DOES IT MEAN FOR GIG PLATFORMS – WINNERS AND LOSERS?

US INTERNET

For US rideshare and delivery stocks, driver supply is front and center for investors as we emerge from Covid-19

In part, this comes down to the classification of drivers, which has very real implications for how these gig-supported marketplaces are structured and scale:

- These businesses have grown on the value propositions of price and convenience. In a world where drivers become full-time employees, the cost to operate the marketplace goes up, which in turn would raise prices for consumers. Higher driver cost → higher prices → value destructive for consumers → lower adoption rates.
- If held to full-time equivalent (FTE) standards, platforms would also likely have to cut down on the number of drivers they can support to moderate costs, which would hurt the very drivers that regulators are trying to protect. This would worsen wait times and eat into the convenience value proposition for end users.
- Beyond regulation, investors are also asking questions about the long-term supply funnel, given the driver shortage challenges rideshare companies have faced in the US through 2021 (i.e., post-Covid-19 demand started recovering faster than supply domestically, creating an imbalance in the market). Structural versus temporary challenges have been the debate, though 3Q 2021 earnings reports suggest both companies are past the worst of it.

Investing more in drivers will be an important mandate for the industry going forward. The market has always been more supply-constrained than demand-constrained, and Covid-19 brought those challenges to the forefront. Regulators are also more focused on the market now and there's growing competition for drivers for rideshare, food and quick-commerce delivery, and eCommerce services.

Regulation and headline risk

First it was AB5 in California (ultimately a positive outcome for rideshare stocks with Prop 22), then it was Uber's UK settlement and commentary from the DOL around classifying gig workers as "employees." Headline risk is ever present in these stocks, but we think the market is likely to settle on a middle-ground solution.

Our base case assumption for the US is that driver classification is likely to be determined at the state level. We think legislative change will be hard to engineer. There are 55 million gig workers in the US, so changing the rules here could involve various parties and interests, with the risk of unintended consequences as we saw with AB5.

Passing legislation may be further complicated by voters leaning toward independent status, at least in California where 58% voted for Prop 22 over AB5.

Massachusetts (where companies are pursuing a Prop 22 model) and New York (ongoing negotiations with unions) are important markets to watch over the next six to 12 months, with resolutions to come in 2022.

Outside the US, the UK settlement has sparked concerns about contagion risk, and other Western European markets are in focus. Nonetheless, the ultimate outcome in the UK is one that we believe Uber can manage, creating a playbook for other markets as well.

Competition for drivers

It's competitive out there — rideshare drivers have been slow to return to work, on-demand delivery businesses have scaled massively through Covid-19 and will likely eat into some of the available supply, and businesses such as Amazon have been raising pay and ramping hiring efforts as well.

All of this points to questions around driver retention and engagement, which is an issue rideshare and food delivery will have to improve upon going forward, in our view.

Higher pay helps bridge the gap partially. And currently, Uber and Lyft can boast driver earnings of US\$35+ per hour (bolstered by aggressive incentive spend), but eventually ride prices and driver bonuses will normalize and higher volumes will have to take over.

Companies will likely have to make a concerted effort to ensure driver pay keeps pace with wage inflation broadly and doesn't revert to pre-Covid-19 levels.

Incentivizing more engaged drivers with structurally higher payouts (e.g., better take rates) could also go a long way to bolster supply.

Without security for "full-time" equivalent workers (i.e., those driving ~40 hours per week), the gig model could be at a structural disadvantage to minimum wage jobs in other industries for the most valuable cohort of drivers.

Flexibility and autonomy are aspects of the job that drivers appreciate and a big reason they keep coming back, with rideshare and delivery supplementary for most:

- Uber and Lyft have reported ~50% and ~75% of drivers drive fewer than 10 hours per week, respectively, and Uber stated ~90% drive fewer than 40 hours per week.
- We think there's more that rideshare companies can iterate on the margin to keep driver net promoter score (NPS) up (e.g., incremental preference settings).
- The ability of drivers to toggle between rideshare and food delivery opportunities could add to the flexibility dynamic, increasing driver retention and utilization. Uber is uniquely positioned to address this with a single app for mobility and delivery. On the 3Q 2021 earnings call, Uber management noted one-third of new drivers signed up for both services.

Improving accessibility can help. Uber has been investing here on the delivery side, with courier onboarding time now cut by over 90%.

Relative implications for Uber and Lyft

Putting it all together, our view is driver pay is likely to remain above pre-Covid-19 levels as we exit the pandemic, given increased regulatory oversight in core markets (the US and Europe) and elevated levels of competition for minimum wage workers.

Quantifying this delta is difficult, especially as we sit in an air pocket where driver earnings have shot up significantly, but we can imagine driver pay being up 5-15% versus pre-Covid-19 levels, especially in markets where regulators are taking a stronger stance, such as California (see Exhibit 16).

In this scenario, we expect marketplaces to pass on the costs to consumers and preserve their unit economics, as we've seen with previous government-led surcharges and Prop 22 (see Exhibit 17).

While higher prices have negative implications for demand and growth, post-Covid-19 recovery has highlighted that there is more pricing power in the model than investors initially believed. Consumers have come to rely heavily on these networks, especially in urban markets, and taxi supply is not robust enough to support demand. The price versus volume dynamic is certainly a delicate balance to strike, but we feel incrementally confident in the durability and profitability of rideshare businesses.

On a relative basis, we think Uber is better positioned than peers to absorb pressures on the supply front, for the following reasons:

- On rideshare, its global footprint offers more of a hedge to changes in the US relative to Lyft.
- On delivery, its urban footprint for Uber Eats should also be easier to manage in scenarios of higher pay or changed driver status to FTEs, considering driver liquidity and route density are better.
- The ongoing addition of delivery verticals at Uber (e.g., grocery) also gives Uber more opportunity to improve driver acquisition costs, retention, and utilization rates.
- At this point, we believe headline risk around regulation is priced into Uber shares.

EXHIBIT 328: Lyft's ESG report highlights the importance of driver pay and working conditions

STAKEHOLDER CONCERN	Very High		Congestion	Driver Working Conditions & Pay Community Safety Greenhouse Gas Emissions
	High	Energy Consumption for Data Centers	Road Safety LyftUp Community Impact Program Supply Chain Sustainability - Hardware Inclusion & Diversity	Data Privacy & Security Corporate Stewardship & Governance Air Quality
	Moderate	Water Use	Employee Benefits & Health & Safety	
		Moderate	High	Very High
		COMPANY IMPACT		

Source: Company reports

EXHIBIT 329: **Operational impact of regulation – Uber's assessment of what AB5 could've done to its California business on ride prices, trip demand, and driver work opportunities**

Rider Price Increase by Market		Trip Reduction by Market		Quarterly Work Opportunity Loss by Market	
San Francisco	20-30%	San Francisco	20-30%	San Francisco	70-75%
Los Angeles	30-40%	Los Angeles	20-30%	Los Angeles	80-85%
San Diego	30-40%	San Diego	30-40%	San Diego	85-90%
Palm Springs	70-80%	Palm Springs	40-50%	Palm Springs	95-100%
Orange County	50-60%	Orange County	40-50%	Orange County	95-100%
Sacramento	40-50%	Sacramento	30-40%	Sacramento	90-95%
Santa Barbara	20-30%	Santa Barbara	20-30%	Santa Barbara	90-95%
San Luis Obispo	40-50%	San Luis Obispo	30-40%	San Luis Obispo	90-95%
Fresno	60-70%	Fresno	40-50%	Fresno	95-100%
Bakersfield	60-70%	Bakersfield	40-50%	Bakersfield	95-100%
Inland Empire	110-120%	Inland Empire	50-60%	Inland Empire	95-100%
Modesto	70-80%	Modesto	40-50%	Modesto	95-100%
Ventura	50-60%	Ventura	40-50%	Ventura	95-100%

Source: Company reports

EU FOOD DELIVERY

The story is complex

The story is complex for European Food Delivery players. There is a huge difference in business models, geographies, and operating models across Delivery Hero, Just Eat Takeaway, and Deliveroo, which alters the exposure to the traditional gig economy model. Players who are more exposed to the 3PL model (rather than the marketplace model) and those who operate more in the European and North American markets are more exposed to challenges around the gig economy model. However, even then, food delivery platforms are evolving in the face of the challenge. Just Eat Takeaway has created its Scoober model, which is an hourly paid model where riders are employed directly or indirectly by the platform. We highlight Deliveroo as the most at risk and most exposed to gig economy challenges as it operates 100% 3PL (predominantly in Europe), while Delivery Hero and Just Eat Takeaway have lower risk and exposure. Both have strong marketplace businesses (40-55% orders); Delivery Hero skews more to emerging markets where there is less pressure or contention on the gig economy model, while Just Eat Takeaway has circumvented the issue by directly or indirectly employing its riders. Whichever model is chosen, the concept of the gig economy will remain a complex and challenging issue for all players involved.

Not all food delivery riders are gig economy riders. It is often assumed that all food delivery riders are paid per delivery and have no agreements with the platforms. This isn't the case. Marketplace orders typically use a rider employed/contracted by the restaurant and, therefore, pose a lower risk to the platform. For 3PL orders, there is a mixture of models in place globally: some riders are employed by the platform, some by agencies or third parties, and some are independent freelancers (i.e., the typical gig economy model). This means the regulation of the gig economy does not affect all platforms equally — Deliveroo is the most at risk (~100% 3PL); Delivery Hero 48-62% 3PL) and Just Eat Takeaway (44% 3PL) have

lower risk (see Exhibit 330). There are two further considerations to take into account: employment models vary across markets, and an hourly pay model (as employed by Just Eat Takeaway) isn't cataclysmic to the industry.

- **Models of employment vary significantly:** Even within the 3PL delivery model, there are different models at work across the world that mean the gig economy isn't one homogenous employment model. For example, Delivery Hero uses a freelance-only model in Thailand, indirect contracting in the UAE, employment-only in Turkey, and a mixed model in Argentina. This is further complicated by collective bargaining or unionization. For example, in Austria and Norway for Delivery Hero and in the Netherlands for Deliveroo, freelance riders have collective bargaining relationships with the platforms. This gives riders additional protections and rights of dispute with the platform.
- **An hourly pay model can hold up versus pay per delivery:** We don't see the challenge of gig economy regulation as cataclysmic to the industry. Using the example of Just Eat Takeaway's hourly wage Scoober model, the pay per hour model can compete with the pay per delivery model as long as there is enough scale and demand in the network. As we show in Exhibit 331, if you assume a £10.20 hourly wage with 25% social costs loaded (£12.75 total wage), the hourly pay model is fairly comparable to a pay per delivery model when the rider is delivering two to three orders per hour. We think this is more than feasible, given the scale of demand for quick service restaurants (QSRs) in Central London. The bit that isn't represented is that a player like Deliveroo, who pays ~£6 per order in the UK, also does surge pricing for its riders, so many riders are achieving 1.3-2x the normal pay per delivery. During peak periods, an hourly pay model will be significantly more profitable than a pay per delivery model.

Markets matter. Even though we look at food delivery players listed in Europe, they operate in a diverse range of geographies globally. Delivery Hero is less exposed to the risk of regulatory challenges to the gig economy as it operates in predominantly Asian and Middle Eastern markets, where there is less scrutiny over the model. However, in the European and LATAM markets where it operates, it has responded and adjusted to the challenges. It employs its riders in Greece, and has mixed models in Austria, Argentina, and Norway. Just Eat Takeaway and Deliveroo are more exposed to these challenges as they operate predominantly in Western Europe. However, Just Eat Takeaway has circumvented the challenge by directly or indirectly employing its workers, whereas Deliveroo operates a full gig economy model in high-risk markets.

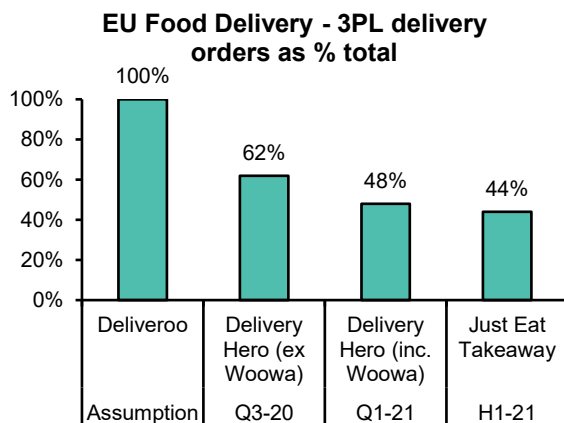
The response is varied. It is almost impossible to understand the huge variety of responses to the gig economy across Europe and the markets that European food delivery players operate in. The problem is the gig economy encompasses a wide range of issues. It's not just employment but also a question of taxation, anti-trust, and worker safety. Some countries have legislated on fair competition (e.g., Denmark, the Czech Republic, and Hungary) while others have legislation on revenue and taxation (e.g., Belgium, Italy, and France). In other markets such as Sweden, there's no limited legislation, but health and safety authorities have been concerned about the provision of winter tires for cyclists. This is further complicated by the supra-national and regional bodies that have made their own attempts at broaching the topic. The EU is looking into wider P2B (Platform to Business)

legislation, while in Italy, where there is no national legislation, authorities in Lazio have introduced legislation that circumvents the complicated question of employment status and guarantees minimum protections to workers, including safety training and insurance. We expect this complicated landscape to continue in the future.

Even if you take the example of case law within Europe, you find very complex — often contradictory — rulings that hinge on very specific details and don't have wide-reaching implications (e.g., some cases focused on the idea that a gig economy worker could not be phoned by the platform if they missed a shift). For example, in Amsterdam, a court ruled that a Deliveroo rider was not an employee in 2018 but that they were in 2019. In Spain, seven cases about Glovo riders were resolved differently — four were classed as employees and three weren't. However, in the UK, Deliveroo has now had four rulings (one at the Central Arbitration Committee, two at the High Court, and one at the Court of Appeal) that upheld the concept of riders being self-employed. With a lack of legislation, legal cases will continue and increase volatility in the sector.

The question of autonomy will define the issue. Although the gig economy model should give full autonomy to workers to log onto the app whenever they want and accept whichever orders they want to, this isn't the case. There is often a complex system of ratings and performance management, which can penalize riders for rejecting orders, not working enough hours, or only wanting to work at peak or non-peak times. For example, on some platforms, a rider may only be able to access the best time slots (i.e., Friday evening) or may be able to book those slots (ahead of other riders) if they get good ratings from customers and work a certain number of hours per week. They may also see their performance rating decline if they fail to accept enough jobs or work enough hours. The level of control over platform workers will increasingly be challenged in the future.

EXHIBIT 330: **R00 most exposed to 3PL orders, followed by DHER then TKWY**



Source: Company reports, and Bernstein estimates (all data) and analysis

EXHIBIT 331: **Assuming a £12.75 loaded wage cost for Scoober, a pay per hour model can pay back with enough demand**

Pay per delivery	No. of orders per hour			
	1	2	3	4
£4	318.8%	159.4%	106.3%	79.7%
£5	255.0%	127.5%	85.0%	63.8%
£6	212.5%	106.3%	70.8%	53.1%
£7	182.1%	91.1%	60.7%	45.5%
£8	159.4%	79.7%	53.1%	39.8%

Source: Bernstein estimates and analysis

Who is most at risk?

Deliveroo has the most to lose. It is the biggest user of gig economy workers; it is almost 100% 3PL and it operates predominantly in countries that are taking an interest in the topic (Western Europe). So far, rulings have been in its favor and it has made a number of changes to support workers, including free insurance, safety training, and protective uniforms (including PPE). There are still questions to be asked about its ranking system (including access to the "best" shifts) and management of riders (e.g., payment times). However, we don't see any immediate catalysts that would put Deliveroo at risk, but it is likely to have the highest volatility impact from the gig economy.

Deliveroo provides free insurance, safety training, and protective kits. The Deliveroo Rider Academy offers opportunities for online learning, scholarships, and business plan development. Riders have completed >6,000 courses, been awarded >140 scholarships, and been provided with £200k in business funding. Deliveroo also highlights >80% riders are on two wheelers and >50% ride alongside other work, working on average 24 hours per week.

Delivery Hero has some exposure to shifting gig economy regulations. Its market exposure reduces its risk, but it is increasingly focused on a 3PL model (50%+ orders in 2020) and its rider model is highly variable by country. Many of its markets in the Middle East & North Africa (MENA) and Asia Pacific (APAC) have not yet legislated on the issue and the freelance status of platform workers is not widely disputed, whereas some of its markets in Europe and the Americas have made efforts to look at or control the gig economy. It is more complicated to understand the exact impact as its rider model is mixed — it has freelancers in most APAC markets, agencies and third-party companies in MENA, employment models in Greece and Turkey, and a hybrid model in Austria, Argentina, and Norway. Interestingly, in Norway, riders are able to choose to be employees or independent contractors; ~70% choose to be freelance contractors. There will be attempts in its markets to legislate, but we think Delivery Hero will respond and change its model appropriately. It is also lower risk because of its lower dependency on any one market.

Delivery Hero has recently launched its Global Rider program, which covers all markets in which it operates and focuses on improving rider experience across eight projects (see Exhibit 332). It covers a wide range of topics from payment of riders to rider safety, and from contracting to public policy challenges.

Just Eat Takeaway has a limited impact from gig economy changes. Although it operates in Western Europe and the US, where there is increasing action on the issue, only 25% of its orders came from 3PL delivery in 2020. While Takeaway is rapidly shifting toward the 3PL model (44% orders in H1-21), it has also taken steps to move away from the traditional gig economy model with its creation of the Scoober model, whereby riders are employed either directly by Just Eat Takeaway or through agencies. They are also provided with equipment (bikes and uniforms), insured, paid hourly, and receive sick and holiday pay. Its only exposure to the independent contractor model is in North America due to the legacy of the Just Eat business there and the Grubhub acquisition, and it currently uses some third-party delivery companies in some legacy Just Eat markets.

EXHIBIT 332: **Delivery Hero is addressing its riders' experience across eight different projects**

Introduction to the Global Rider Program



Summary

- **Scope:** All markets Delivery Hero is operating in
- **Duration:** The program consolidates ongoing rider initiatives since June 2019
- **Senior Management Involvement:** Delivery Hero CFO, CPO and management functions for every country
- **Purpose:** The Global Rider Program strives to further improve the experience of riders while also contributing to the business objectives of Delivery Hero. The program currently consists of 8 projects that have been initiated to tackle key critical rider areas ensuring a compliant, safe & effective work environment for both riders and Delivery Hero.



29

Source: Company reports and Bernstein analysis

CHINA INTERNET

Food delivery in China is by Meituan and Ele.me (owned by Alibaba), with the pair taking a 70% and 30% market share, respectively. The platforms split the food delivery business into 1P and 3P delivery models. 1P more or less aligns with the dedicated riders covered in the Nanjing guidelines published earlier in 2021. 3P includes "speedy delivery" (众包) riders and "Lepao" riders (乐跑 for Meituan; the Ele.me equivalents are called 蓝骑士 or blue riders), who are similar to speedy delivery riders but attend daily morning meetings and are subject to fixed working hours and order volume targets, and a small number of instances where restaurant employees deliver their own orders (see Exhibit 333).

In all four cases, riders have no direct relationship with Meituan or Ele.me. Meanwhile, our understanding is a small proportion of 1P premium delivery riders have signed employment contracts with their delivery partner companies. In addition to recruiting 1P riders on behalf of Meituan and Ele.me, delivery partner companies are sometimes also responsible for attracting restaurants to the platforms. Day to day, delivery partner companies manage their riders through nodes referred to as "stations," where station leaders organize daily morning meetings and distribute orders that come into the platform.

In contrast, 3P "speedy delivery" and "Lepao" riders are considered self-employed contractors and do not sign an employment contract with either the platform or delivery partner companies. These riders typically do not work full time and are simply sent orders by the platform algorithm during the hours they're signed on. The compensation of these riders is referred to as "incentives" — an arrangement stated in the platforms' terms of

use⁴⁶² and supported by legal precedent.⁴⁶³ Empirically, we've heard feedback suggesting the platform tended to allocate less attractive orders (e.g., lower-order value and more distant) to these riders.

Meituan accounts for 1P revenue per order on a gross basis and includes rider costs within COGS. 3P revenue per order is booked on a net basis excluding rider costs. In practice, the implied 3P rider cost is lower than 1P, reflecting the fact that 3P skews in favor of lower-tier cities, and some restaurants deliver their own orders and therefore incur no rider costs.

Meituan has ~1 million daily active riders, of which ~350k worked on a 1P basis

In its 2020 annual report, Meituan noted that some 9.5 million riders earned income on its platform during the year. At any given point though, QuestMobile data suggested the number of active riders is far lower — attributed to days off and rider turnover. Since the start of 2021, Meituan's rider apps pointed to an average of 1.2 million 1P "premium delivery" MAUs and 3.2 million 3P "speedy delivery" MAUs, and 790k premium delivery DAUs and 1.7 million speedy delivery DAUs (see Exhibit 334 and Exhibit 335). The company reported a smaller number — according to the management it had ~1 million daily active riders, of which ~350k worked on a 1P basis.

Updating our view on Meituan's social insurance costs

We've spoken with a wide range of industry experts to try to understand the new Guiding Opinions in the food delivery industry and the financial impact on the platforms. Bottom line — we were left encouraged by our discussion. The Guiding Opinions were drafted by seven and eight government ministries, respectively, and represented the highest level of policymaking authority in China. The hope then is the food delivery industry will look relatively clear of "policy headline risk" from here — at least as far as the central government is concerned.

At a high level, the Guiding Opinions focused on: (1) worker protection and (2) social insurance. The former included requiring the platforms (e.g., Meituan) to provide data to show what constituted "reasonable work performance," the unionization of Meituan's riders, and to assume responsibility for work-related accidents and labor disputes. But while worker protection compliance was expected to be strict, the associated financial impact (e.g., reduction of fines for late deliveries) was expected to remain manageable. On the margin, the financial impact of social insurance was expected to be greater, but this is also expected to be tempered by the fact that: (1) 3P riders will not be required to contribute to social insurance under the new rules, (2) workers with rural hukou will not be required to pay social insurance while working in cities, and (3) enforcement of social insurance is typically much more relaxed outside China's top cities.

Social security cost per rider was adjusted upward in June 2021

The incremental labor cost per rider driven by social insurance compliance is determined by benchmark salary levels, which vary by city (set with reference to minimum wage levels, which also vary by city). In June 2021, we understand there was a round of benchmark

⁴⁶² [Ele.me Fengniao user agreement](#)

⁴⁶³ <https://wenshu.court.gov.cn/website/wenshu/181107ANFZ0BXS4/index.html?docId=24e778df979b42799706ab9c00fa590e> (requires WeChat login).

salary levels across China — due to be implemented from August. Most major cities in China saw 5-15% increases in minimum wage, while benchmark salaries used to calculate social insurance payments were increased in the 10-30% range, translating to absolute increases in the range of RMB400-RMB1,100 and incremental social insurance costs in the RMB100-RMB300 range. The experts we spoke with referred to average national social insurance costs per rider rising to around RMB1,000 per rider per month — higher than the RMB800 per month prior to the latest adjustment (see Exhibit 336). Divided by ~1,000 monthly orders for the average Meituan rider in higher-tier cities, this translates to incremental cost of ~RMB1 per order.

Key variables: (1) 1P-3P split, (2) proportion of riders with rural hukou, and (3) social insurance enforcement

Three critical variables affect how the RMB1 per rider translates into the operating profit per order impact that Meituan feels. Firstly, it's worth noting only 1P riders are affected by the social insurance rules, while 3P riders are not. Meituan reports around two-thirds of its orders are currently fulfilled by 1P riders. Secondly, our expert noted that riders with rural hukou are not required to contribute to social insurance while working in cities — this was estimated at around 30% of all riders. Finally, it was argued that social insurance compliance would most likely be less stringent outside top cities. According to Meituan data from 2019, 17.5% of the company's order volume during the year came from the four tier 1 cities (Beijing, Shanghai, Guangzhou, and Shenzhen), while 15 "new tier 1" cities, including Nanjing and Hangzhou, added a further 25.6% of the orders.

Social insurance costs expected to be less than RMB0.50 per order

Compared with the RMB1 per order impact estimated in the previous section, we expect the impact of social insurance compliance on Meituan's group level operating profit per order to be much more manageable. If we assume every 1P rider nationwide who has urban hukou becomes compliant, for example, the impact on group operating profit per order comes to around RMB0.47 per order. Encouragingly, the company also indicated the overall impact on food delivery profit should remain lower than RMB0.50 per order at the group level. Exactly when this would kick in remained unclear, however — we've assumed 2022 in our estimates for Meituan.

Meituan mentioned that not all riders (ostensibly determined by the number of hours worked) would require full social insurance contributions, while the rest could opt to pay a much cheaper form of "residential social insurance" amounting to just a few hundred RMB p.a.. Workers preferring more cash up front could also choose to switch from working on a 1P basis to 3P. Top down, it was argued the government ultimately wanted to strike a balance between boosting worker welfare and enabling platforms to create more jobs — including on a flexible work basis. Payment of worker injury insurance (RMB0.05 an order) was said to begin at the start of 2022, starting first in seven or eight provinces.

Chinese government's balancing act — employment versus labor protection

One of the encouraging implications of the recent Guiding Opinions related to the fact that for the first time, China formally acknowledged the existence of workers outside the social insurance construct. On the risk of this provision being changed — meaning Meituan needs to pay social insurance even for 3P riders — our experts were generally relatively relaxed.

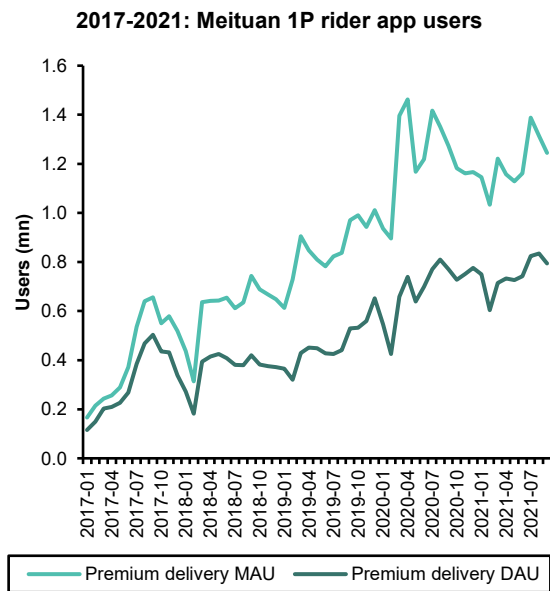
They argued that the Chinese government's need to ensure high employment balanced against measures that would make hiring flexible workers impractical or uneconomical (and cause greater unemployment or underemployment among this group of individuals).

EXHIBIT 333: Meituan riders can be divided into several categories, depending on their relationship with delivery partner companies and the level of management power the platforms have over them

	Premium delivery riders 专送	Speedy delivery riders 众包	Lepao/Blue riders 乐跑/蓝骑士	Restaurant self-delivery
1P vs. 3P	1P	3P	3P	3P
Accounting treatment	Rider cost recorded in COGS	Revenue booked net of rider costs	Revenue booked net of rider costs	Revenue booked net of rider costs
Employment status with platform	No relationship	No relationship	No relationship	No relationship
Contract status with delivery partner	Some employment contract; some labour dispatch contract	Labour dispatch contract	Labour dispatch contract	No relationship
Delivery partner responsibilities	Recruitment, supervision, compensation	Compensation	Compensation	No relationship
Rider work obligations	Morning meetings, fixed work hours, cannot refuse assigned orders	Flexible working hours, some discretion on workload	Morning meetings, fixed work hours, cannot refuse assigned orders	Depend on restaurants
Current social insurance status	Almost no employer commitment	No employer commitment	No employer commitment	Depend on restaurants
Work injury insurance status	Paid by delivery partner	Self-paid by rider	Self-paid by rider	Depend on restaurants
Payroll cycle	Monthly	Daily	Weekly	Depend on restaurants

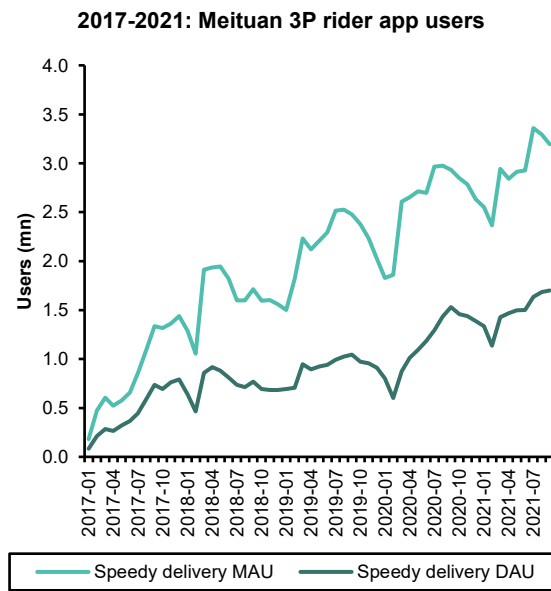
Source: Company websites and Bernstein analysis

EXHIBIT 334: Meituan's 1P rider app has about 1.2 million MAUs and 790k DAUs as of September 2021



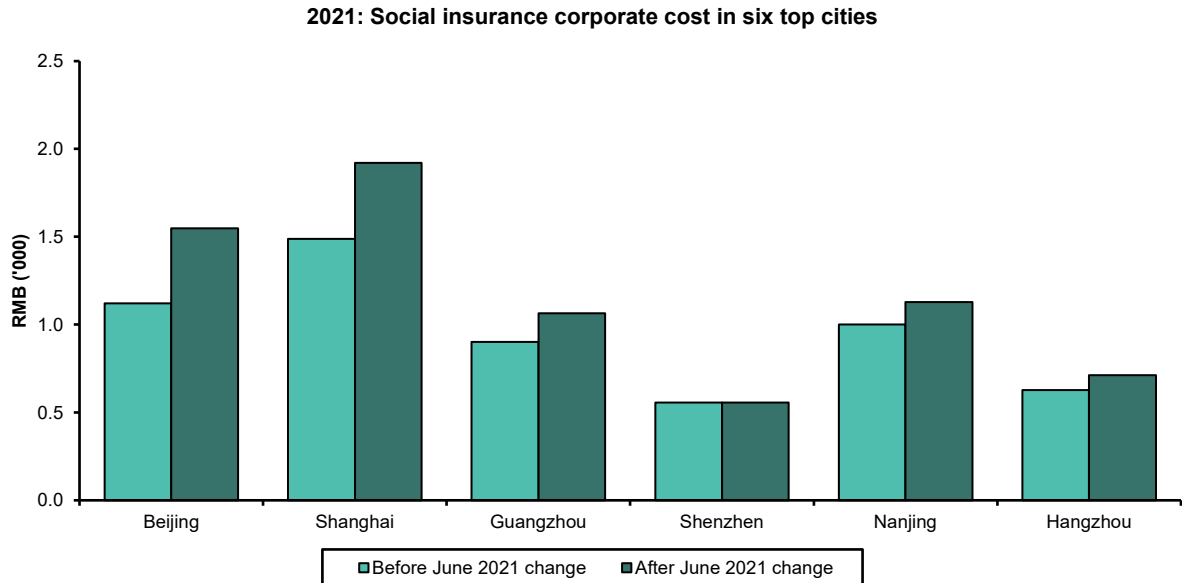
Source: QuestMobile and Bernstein analysis

EXHIBIT 335: Meituan's 3P rider app has about 3.2 million MAUs and 1.7 million DAUs by Sep 2021



Source: QuestMobile and Bernstein analysis

EXHIBIT 336: **Benchmark salaries used to calculate social insurance costs grew by 10-30%; our experts estimated average nationwide social insurance burden at around RMB1,000 per 1P rider per month**



Source: Government websites and Bernstein analysis

SOUTH & SOUTHEAST ASIA
CONSUMER TECH

Like many other global markets, gig workforce (*which is largely deployed for ride hailing and food delivery*) in Southeast Asia are not a part of formal "employee" benefits under labor laws. This is more because of the nature of the contract between the employer and gig workforce — the work agreement contract between the two is normally a "contract for service," which treats gig workforce as independent contractors. For such "independent contractors," the labor and regulatory environment in a few countries, such as Singapore and Malaysia, does mention social security benefits like safety at the workplace and social security for gig workforce, but this is mostly voluntary. As such, there is no regulatory cost for deploying gig workforce in Southeast Asia (see Exhibit 337).

EXHIBIT 337: **There is limited regulation related to gig workforce in Southeast Asia**

Country	Regulatory Environment
Indonesia	No separate regulation for gig workforce. There is no labour-related guarantees, like employment security, income or social protection etc.
Singapore	Gig workers are labelled self-employed in Singapore and not protected by regular employment act. However, there is Workplace Safety and Health Act which imposes a duty on every employer and every principal (which would include Grab) to take, so far as is reasonably practicable, such measures as are necessary to ensure the safety and health of its employees, and any contractor, any direct or indirect subcontractor, and any employee employed by such contractor or subcontractor, when at work
Thailand	According to the Social Security Act of 1990, gig workers are not covered by the formal social protection scheme, receiving only partial protection instead as voluntarily insured persons.
Malaysia	Gig workers in ride hailing and food delivery are not classified in employee category and hence, not eligible for any labour related benefits. The Government offers voluntary social security scheme for gig worker, but not many have subscribed to it
Philippines	Contracting and subcontracting of work is allowed but is heavily regulated by the Philippine Labour Code. Gig workers in ride hailing and food delivery are more an independent contractors.
Vietnam	Gig workers in ride hailing and food delivery are independent contractors and not obliged to participate in statutory social insurance, health insurance and unemployment insurance, which equates to the companies not being obliged to contribute to social security funds

Source: Government data of respective countries and Bernstein analysis

Companies have started offering some benefits for the gig workforce — case study on Grab

While new-age internet companies are not mandated by law to offer any employee benefits to gig workforce, there are many who offer certain benefits to these workers. As a case study, we look at Grab, the leading ride hailing player in Southeast Asia, and the benefits it offers to its gig workforce:

- **Financial support during Covid-19.** The company launched a separate "**Partner Relief Fund**" in 1QCY20 to help its partners, including the gig workforce, who were severely impacted by the Covid-19 pandemic. For this fund, Grab matched donations at 1:1 for every dollar raised from its regular employees. In total, the fund-raised US\$600k for its drivers, which was used to "*purchase food and basic necessities for needy partners and also donated to the causes that directly support our driver and merchant-partners.*"
- **Financial empowerment.** The company formed Grab Financial Group (GFG) in 2018, which provides "financial services and solutions to address the needs of driver- and merchant-partners and consumers, including digital payments, lending, insurance, and wealth management."
 - GFG has partnered with financial institutions to offer microloans to its driver-partners to meet cash flow requirements for purchasing household items or smartphones and even personal loans. The loan application process is very simple and available to a wider audience, who otherwise face challenges in getting loans through traditional financing institutions.
 - Grab's driver-partners, including food delivery agents, are covered by Grab's Group Personal Accident insurance policy that is provided free of cost.

Additionally, Grab offers innovative microinsurance policies to its partners, which are affordable and accessible to a wider audience.

- **Partner training and upskilling opportunities.** From time to time, the company offers training opportunities under "GrabAcademy" initiatives to its driver-partners to improve their overall literacy. For example, the company partnered with Microsoft to enable its driver-partners to learn new digital skills, which has benefited over 250k driver-partners. Similarly, the financial literacy program was launched in Indonesia, in partnership with **Integrita**. Across Southeast Asia, in CY20, around 1.7 million driver-partners participated in different learning programs facilitated by Grab.
- **Support for partners' families.** The company offers educational scholarships to the children of its driver-partners, which ensures meritorious students are not deprived of education because of financial constraints. From May 2018 to the end of CY20, the company disbursed around US\$670k in education scholarships, which has benefited over 3,000 students.
- **Other benefits.** Apart from the abovementioned benefits, the company also offers its driver-partners discount vouchers related to fuel purchases, vehicle maintenance, lifestyle, entertainment, etc.

INVESTMENT IMPLICATIONS

US Internet

We rate Uber Outperform and Lyft Market-Perform.

EU Food Delivery

We rate Just Eat Takeaway and Delivery Hero Outperform; and Deliveroo Market-Perform.

China Internet

We rate Meituan Outperform and Alibaba Market-Perform.

South & SE Asia Consumer Tech

We rate Sea Ltd Outperform.

EXHIBIT 338: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price
UBER	O	USD	39.70	60.00
LYFT	M	USD	41.82	65.00
3690.HK (Meituan)	O	HKD	238.00	290.00
9988.HK (Alibaba)	M	HKD	127.30	170.00
BABA	M	USD	131.61	165.00
SE	O	USD	297.96	430.00
ROO.LN	M	GBP	313.30	330.00
DHER.GR	O	EUR	119.60	175.00
JET.LN	O	GBP	4,931.00	8,200.00
TKWY.NA	O	EUR	58.15	95.00
MSDLE15			1,856.96	
MXAPJ			624.39	
SPX			4,655.27	

Source: Bloomberg, and Bernstein estimates and analysis

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BERNSTEIN

THE PRICE OF MEDICAL INNOVATION

The affordability & innovation trade-off in the US healthcare system

HIGHLIGHTS

- When the groundbreaking hepatitis C treatment, Sovaldi, was launched in 2013, the treatment was priced at US\$84,000 in the US. One month later, the drug was priced at a ~20-30% discount in Europe. Globally, the lowest identified price was US\$900 in Egypt, ~1% of the cost in the US. The differential pricing model is hailed as the best way to improve global access to healthcare. But should the US bear a disproportional amount of the burden to pay for medical innovation (note drug spend — 10% of US healthcare spend — is only one piece of the puzzle)? How could the US improve its healthcare affordability without draining the innovative power? We review long-term options and stock implications in this chapter.
- **The healthcare system in the US today has little control over costs, and funds innovation generously. Is there another way?** High purchase prices in the US generate significant returns for global pharmaceutical companies, while enabling high spend on R&D. Meanwhile, the US tends to prioritize new treatments instead of preventative care, which has also contributed to the high costs of the system. There may not be a perfect solution that improves affordability while fully preserving the innovative power of the US. However, a shift to value — for example **value-based care** (VBC) (i.e., paying for outcomes) — could be a plausible middle ground that lowers overall costs but still rewards innovation. While the transition to VBC has been slow, the next five to 10 years could be critical to realize VBC's full potential. But to do so, the US system must engage key stakeholders, put in place the necessary IT infrastructure, align incentives via risk sharing, and address social determinants of health. A transition to VBC could have a negative revenue impact on healthcare providers in the near term, but this should be offset by cost savings and incremental VBC incentives over time.
- **Who are the winners and losers?** We expect a shift to VBC to be neutral to positive for **managed care organizations (MCOs)** as they can pass on the cost pressure to downstream providers. Downstream, we expect **hospitals** to see the most amount of disruption as we shift volume from high-cost to lower-cost care settings. **Pharma and medical device providers** could also face pricing pressure and might need to engage in risk sharing agreements to be held accountable for health outcomes. Conversely, providers of **high-quality generics** could benefit from this shift. Further, **cloud computing and data analytics/AI providers** could be key enablers to more holistically evaluate patients' health outcomes.

INTRODUCTION

When the groundbreaking hepatitis C treatment — Sovaldi that essentially cures Hep C — first came out in 2013, the 12-week treatment was priced at US\$84,000 (or roughly US\$1,000 per pill) in the US.⁴⁶⁴ The jaw-dropping pricing drew a lot of criticism. The Kaiser Family Foundation (KFF) estimated the new Sovaldi treatment could increase Medicare spending by US\$2bn and increase Medicare drug premiums from 5% to 8% in 2015.⁴⁶⁵ On the other side of the Atlantic, European governments are authorized by law to manage the healthcare budget and to negotiate healthcare pricing. As a result, the price for the same treatment was negotiated down to US\$55,000 in the UK and US\$67,000 in Germany, a ~20-30% discount to the price in the US.⁴⁶⁶ To further provide global access to the new treatment, tiered pricing strategies were adopted and the technology was licensed to generic producers in India to significantly reduce the price in lower-income countries. According to the WHO, the lowest identified price for the treatment was US\$900 in Egypt, only ~1% of the cost in the US.⁴⁶⁷

The differential pricing model is hailed as the best way to improve global access to healthcare. And it's not unique to Sovaldi or drug prices. We are simply using the drug price differential as an example, given the level of transparency there is; in fact, drug spend is only 10% of US healthcare spend. But should the US effectively subsidize the rest of the world, including other developed countries, when it comes to healthcare? The Brookings Institute estimates that US consumers contribute to 64-78% of global pharmaceutical profit, despite only accounting for 27% of global income, as Americans use newer drugs and pay higher prices than patients in other developed countries.⁴⁶⁸ At the end of the day, who should pay for the expensive R&D to drive medical innovation that benefits the whole world?

It turns out pricing and affordability issues in the healthcare sector are far from black and white, depending on your perspective. While you will typically find us taking a global comparative view in our thematic ESG research, in this chapter, we have inevitably focused on the US where paying more for healthcare doesn't necessarily get you better results for the population as a whole. We dig into the historical roots of the convoluted US healthcare system to understand how we got here. And, more importantly, we look to the future to discuss what can be done to improve healthcare affordability in the US without draining the innovative power it finances, as well as the financial implications for a number of sectors ranging from managed care providers to pharmaceutical companies to cloud computing and fitness tracker providers.

⁴⁶⁴ Rangan, V. Kasturi, Vikram Rangan, and David E. Bloom. "[Gilead: Hepatitis C Access Strategy \(A\)](#)." Harvard Business School Case 5 15-025, October 2014. (Revised January 2020).

⁴⁶⁵ <https://www.healthaffairs.org/doi/10.1377/hblog20140605.039396/full/>

⁴⁶⁶ <https://www.forbes.com/sites/johnlamattina/2015/12/04/for-hepatitis-c-drugs-u-s-prices-are-cheaper-than-in-europe/?sh=6ef0cb0332d7>

⁴⁶⁷ <https://www.who.int/bulletin/volumes/93/11/15-157784/en/>

⁴⁶⁸ <https://www.brookings.edu/research/the-global-burden-of-medical-innovation/>

AFFORDABILITY ISSUES IN THE US HEALTHCARE SYSTEM

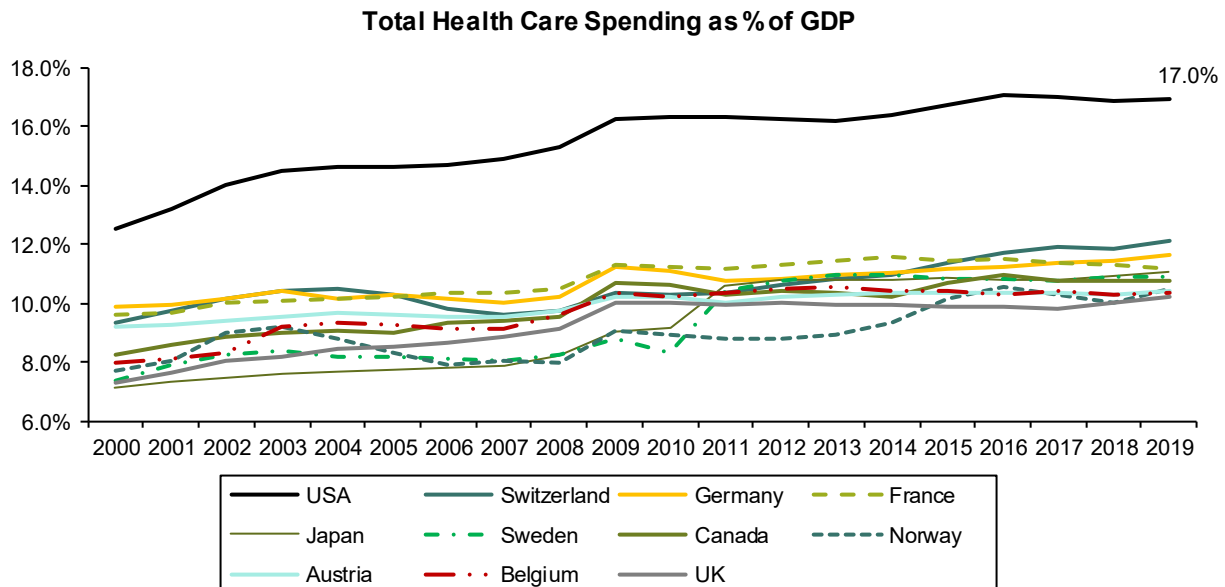
"America's healthcare system is neither health, caring, nor a system."

Walter Cronkite

Taking a look around the world, the US has the most expensive healthcare system without an obvious benefit in terms of better health outcomes for the population.

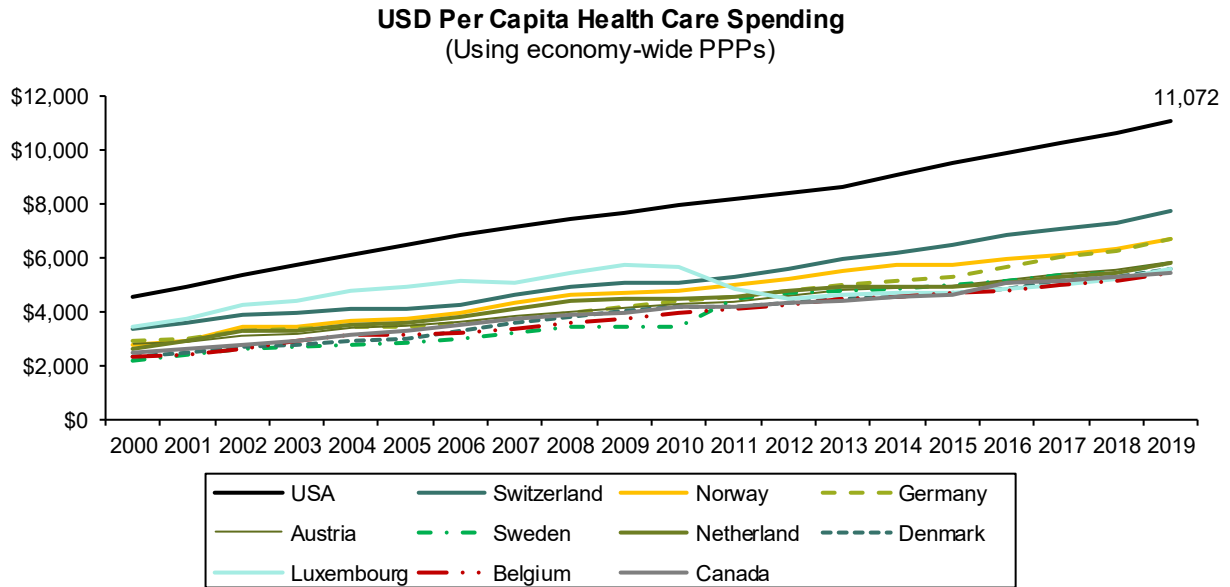
The US spent 17% of GDP on healthcare in 2019 versus the OECD average of 8.7% of GDP. This was far ahead of Switzerland in second place with 12.1% of healthcare spending (see Exhibit 339). On a per capita basis, the average American spent US\$11,072 on healthcare in 2019, versus the OECD average of US\$4,036 (see Exhibit 340).

EXHIBIT 339: **US spent 17% of GDP on healthcare in 2019 versus OECD average of 8.7% of GDP**



Source: OECD and Bernstein analysis

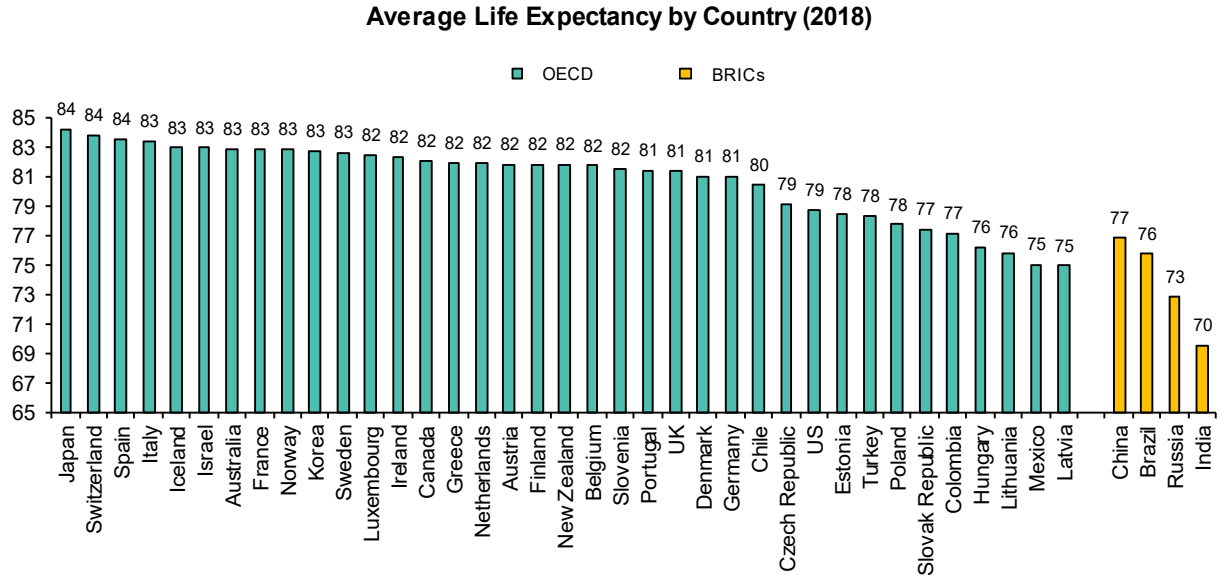
EXHIBIT 340: On a per capita basis, the average American spent US\$11,072 on healthcare in 2019, versus the OECD average of US\$4,036



Source: OECD and Bernstein analysis

Despite the higher healthcare spending by the US, the US average life expectancy at 78.7 years as of 2018 was below the OECD average of 80.7 years, and 5.5 years below Japan's average life expectancy of 84.2 years (see Exhibit 341). Yet the US population structure doesn't seem to explain its higher healthcare spending. According to the OECD, 16.5% of the US population were 65 and older as of 2019, below the OECD average of 17.6% (see Exhibit 342).

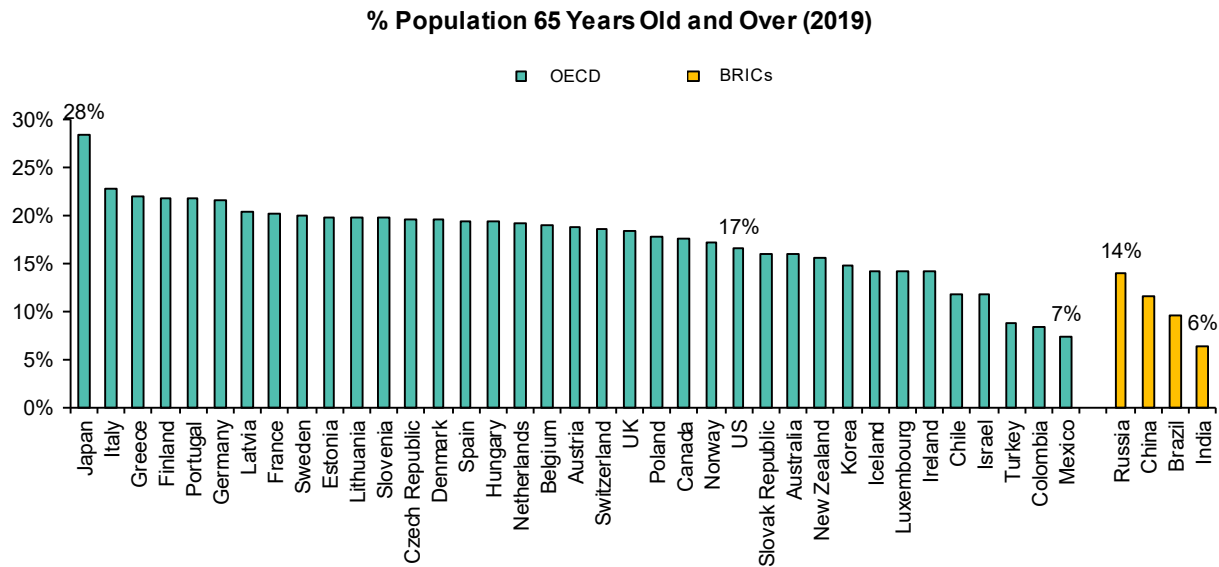
EXHIBIT 341: Despite higher healthcare spending by the US, the US average life expectancy at 78.7 as of 2018 was below the OECD average of 80.7, and 5.5 years below Japan's average life expectancy of 84.2 years



Note: Japan's average life expectancy is as of 2017

Source: OECD and Bernstein analysis

EXHIBIT 342: US population structure doesn't seem to explain its higher healthcare spending; according to the OECD, 16.5% of the US population were 65 and older as of 2019, below OECD average of 17.6%



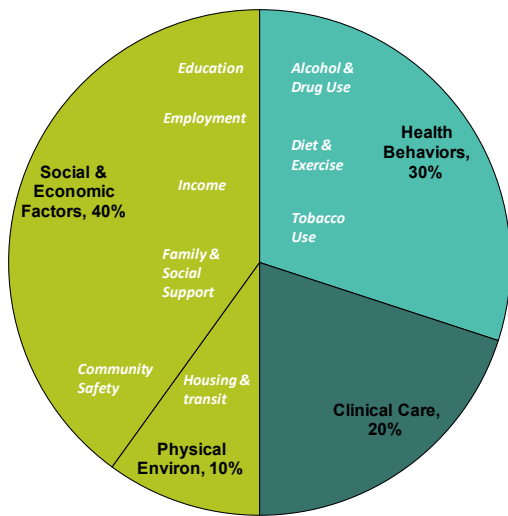
Note: Israel's population structure is as of 2018.

Source: OECD and Bernstein analysis

One explanation for the disconnect between the US' second-to-none healthcare spending and below-average life expectancy is that the US lags many other developed countries in

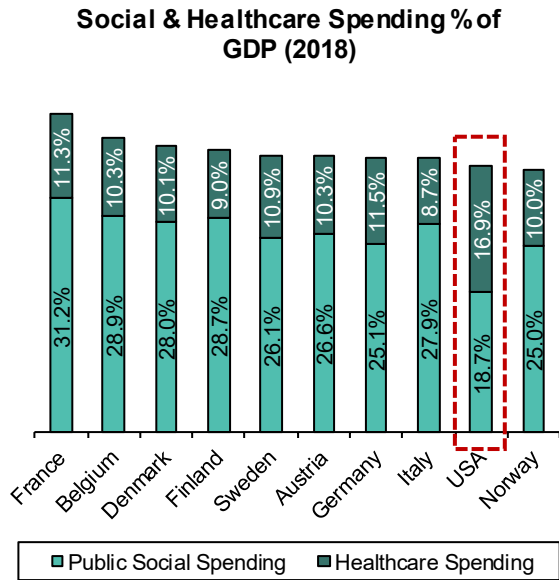
terms of public social spending. Social determinants such as education, employment, income, family & social support, and community safety drive 40-50% of health outcomes in developed countries (see Exhibit 343). Despite its high healthcare spending, US public social spending was 18.7% of GDP in 2018, which is below the OECD average of 20.1% and ranks the US #20 out of 29 OECD countries based on data updated through 2018 (see Exhibit 344). There is clearly room for improvement for the US to address these social issues, which will not only narrow socioeconomic gaps but also generate healthcare savings and better health outcomes over time.

EXHIBIT 343: **Social determinants drive 40-50% of health outcomes in developed countries**



Source: University of Wisconsin Health Rankings model, Federal Reserve Bank of Atlanta, and Bernstein analysis

EXHIBIT 344: **US lags other OECD countries in terms of public social spending despite its high healthcare spending**

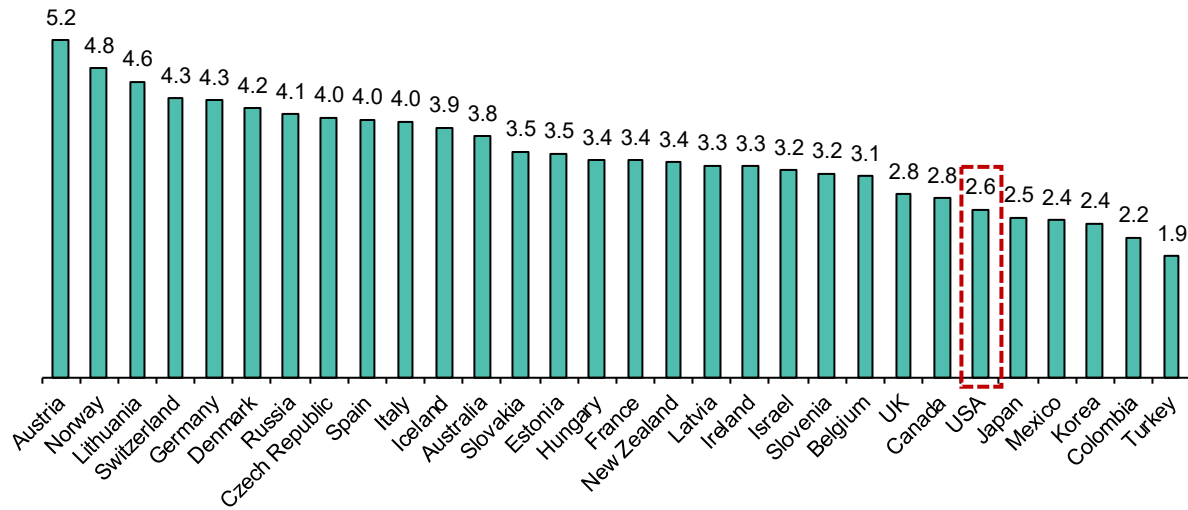


Source: OECD and Bernstein analysis

But we also cannot ignore the fact that the US compares poorly in terms of healthcare affordability versus many other developed countries. According to a study by the Committee on Ways and Means presented to the US Congress in 2019, US drug prices are 3.7x higher than average prices in 11 other developed countries included in the study.⁴⁶⁹ A poll by the KFF showed nearly one in four Americans taking prescription drugs had difficulty affording their medications.⁴⁷⁰ Meanwhile, the US has fewer doctors — 2.6 per 1,000 residents — versus the OECD average of 3.5 (see Exhibit 345), which constrains healthcare resources and increases the cost.

⁴⁶⁹ https://waysandmeans.house.gov/sites/democrats.waysandmeans.house.gov/files/documents/U.S.%20vs.%20International%20Prescription%20Drug%20Prices_0.pdf

⁴⁷⁰ <https://www.kff.org/health-costs/press-release/poll-nearly-1-in-4-americans-taking-prescription-drugs-say-its-difficult-to-afford-medicines-including-larger-shares-with-low-incomes/>

EXHIBIT 345: **The US has fewer doctors – 2.6 per 1,000 residents – versus the OECD average of 3.5****# of Doctors per 1,000 Residents by Country (2018)**

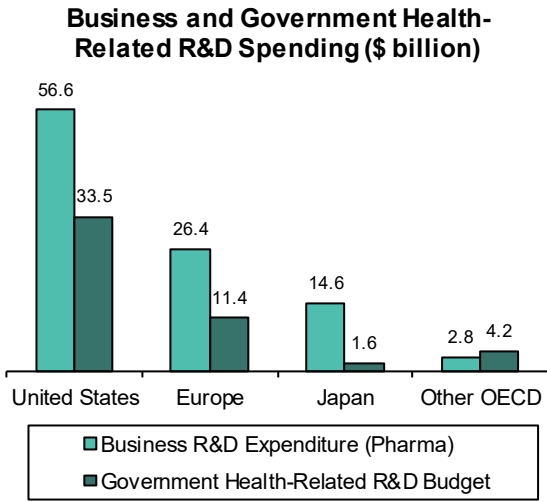
Source: OECD and Bernstein analysis

That said, the US healthcare story is not all doom and gloom. **Part of the high healthcare spending has funded a significant R&D budget in the US** (see Exhibit 346 and Exhibit 347), which helps advance new frontiers in medical innovation and benefits future generations across all countries. Although part of the high healthcare spending in the US is a result of high administrative costs and redundancies, the healthcare industry is very R&D intensive. Pharmaceutical companies spend an average of 14% of sales on R&D across OECD countries.⁴⁷¹ And it takes ~US\$2.5bn of R&D spending to generate one new drug approval.⁴⁷² Why is the US bearing a disproportional share of the cost of global medical innovation? We take a closer look at the differences across the US and other developed countries' healthcare systems in the next section.

⁴⁷¹ https://www.oecd-ilibrary.org/docserver/health_glance-2017-72-en.pdf?expires=1605288781&id=id&accname=quest&checksum=A713B5F1E39301C03602D665D5F954BF

⁴⁷² <https://www.brookings.edu/research/the-global-burden-of-medical-innovation/#footnote-3>

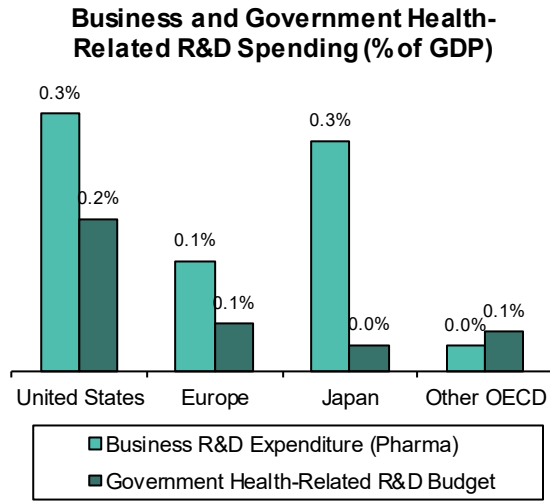
EXHIBIT 346: **US significantly outspends other OECD countries in health-related R&D, both in absolute dollar amount...**



Note: 2012 Business enterprise expenditure on R&D (BERD) data for Switzerland and 2011 government budget allocations for R&D (GBARD) data for Mexico; all other countries 2014 or 2013. Europe includes 21 EU member countries that are also members of the OECD, Iceland, Norway and Switzerland; no BERD data available for Luxembourg and no GBARD data for Latvia.

Source: OECD and Bernstein analysis

EXHIBIT 347: **...and as a percentage of GDP**



Note: 2012 BERD data for Switzerland and 2011 GBARD data for Mexico; all other countries 2014 or 2013. Europe includes 21 EU member countries that are also members of the OECD, Iceland, Norway and Switzerland; no BERD data available for Luxembourg and no GBARD data for Latvia.

OECD and Bernstein analysis

+ COMPARISON OF HEALTHCARE SYSTEMS AROUND THE WORLD

US is the only developed country that doesn't have universal healthcare coverage. According to the WHO, universal healthcare coverage means "all people and communities can use the promotive, preventative, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship."⁴⁷³

Other developed countries have systems in place with the goal of offering universal access to healthcare services that are more affordable than in the US.⁴⁷⁴ Countries/regions have adopted different systems to provide universal healthcare. For example, Canada and Taiwan have a **pure-form single payer system**, where the government is the single payer that pays for healthcare and restricts other payment mechanisms. Meanwhile, Germany, Japan, the Netherlands, and Switzerland **mandate health insurance** for all citizens from either private or public health insurers. Elsewhere, Australia, France, Singapore, Sweden,

⁴⁷³ https://www.who.int/health_financing/universal_coverage_definition/en/

⁴⁷⁴ <https://axenehp.com/international-healthcare-systems-us-versus-world/>

and the UK have a *hybrid system*, which combines elements of a single payer system with private insurance, which offers more rapid access to healthcare or other benefits.

In comparison, 9.2% of the US population, or 29.6 million people, did not have health insurance in 2019, down from 14.6% in 2008 (see Exhibit 348). **Although the US hasn't reached universal healthcare coverage, access to healthcare is less of a concern now** as the Affordable Care Act (also known as ObamaCare) mandates insurance providers cannot take into account pre-existing conditions, which eliminates the risk of over 50% of the US population who have employer-based insurance potentially not having access to insurance coverage because of a pre-existing condition.

However, affordability remains a key issue in the US. In most other developed countries, regardless of the specific type of healthcare system, governments are able to regulate and negotiate healthcare pricing by setting annual health budgets and restricting post-launch price increases.⁴⁷⁵ Conversely, **by law the US government cannot negotiate drug pricing.** The Medicare Modernization Act of 2003, the law that added drug benefits to Medicare (Medicare Part D), states the government "may not interfere with the negotiations between drug manufacturers and pharmacies and PDP sponsors,⁴⁷⁶ and may not require a particular formulary or institute a price structure for the reimbursement of covered part D drugs."⁴⁷⁷ While there have been efforts to enable Medicare to negotiate drug prices directly, such legislative change requires bipartisan support.

Meanwhile, *pharmacy benefit managers (PBMs)* that manage drug coverage for most private health insurance plans typically negotiate with manufacturers for rebates in return for preferred placement to increase a drug's market share. Rebates are kept confidential as a way to promote price competition among manufacturers. In reality, however, rebates may not be passed on in full to patients, which gives PBMs incentives to keep drug prices high and to promote more expensive/higher-rebate drugs.

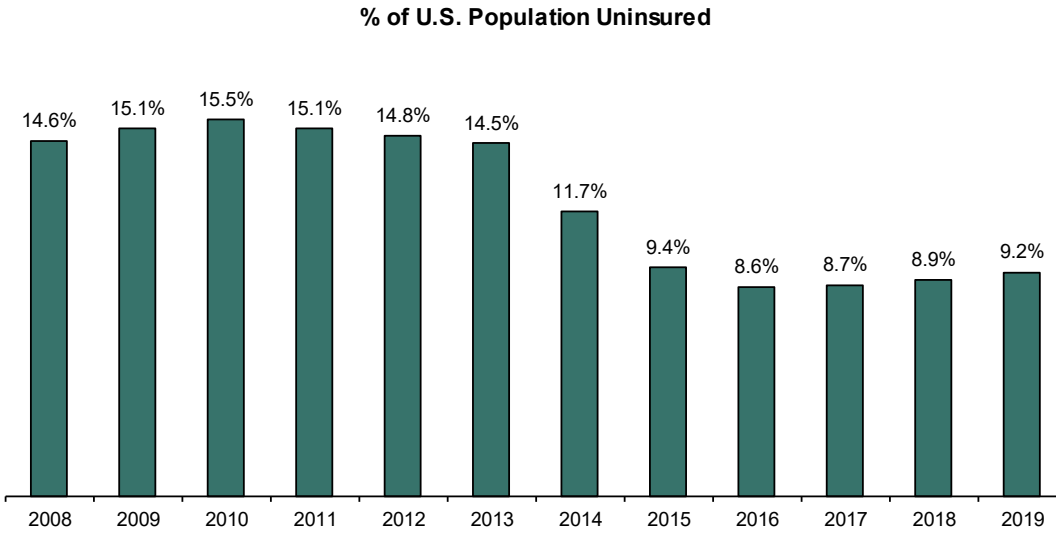
The combination of the US government's inability to regulate drug pricing and PBMs' arguably distorted incentives have contributed to a very expensive healthcare system in the US. The silver lining is the ever-increasing healthcare costs in the US have promoted medical innovations by investing a large R&D budget and by attracting the best and brightest talent to the industry. How did we get here? We will explore that in the next section.

⁴⁷⁵ <https://heatinformatics.com/sites/default/files/images-videosFileContent/Danzon-2018-PharmacoEconomics-1.pdf>

⁴⁷⁶ Prescription drug plan sponsors.

⁴⁷⁷ <https://www.kff.org/medicare/issue-brief/whats-the-latest-on-medicare-drug-price-negotiations/>

EXHIBIT 348: **9.2% of US population, or 29.6 million people, did not have health insurance in 2019, down from 14.6% in 2008**



Source: US Census Bureau, 2008 to 2019 American Community Surveys (ACS), and Bernstein analysis

+ HOW DID WE GET HERE?

It's fair to assume the US didn't intend to become the world's healthcare R&D center while bearing most of the cost in the first place. It took many twists and turns in history to get to where we are today.

The roots of the current US healthcare system can be traced back to World War II. President Franklin Roosevelt froze labor wages in 1943 in an attempt to curtail inflation, which prompted companies to start offering health and pension benefits to retain employees.⁴⁷⁸ This was the beginning of employer-sponsored health insurance.

When California Governor Earl Warren proposed to introduce mandatory health insurance in the state in 1944, he faced opposition from lobbyists claiming "political medicine is bad medicine." This slogan resonated with people's anti-German sentiment as they viewed the German healthcare system to have "socialized medicine." The same lobbyists, Campaigns, Inc., blocked President Truman's proposal of a public health plan in 1949 on the back of widespread **anti-communist sentiment** in the US.

Beyond the political sentiment, American patients may be as much to blame for the high healthcare costs and poor outcomes as the healthcare system itself. Experts say American patients are more likely to push their doctors to treat (or overtreat in some cases) rather than to watch and wait.⁴⁷⁹ American patients also have less healthy lifestyles on average, disregard routine care, and are more likely to count on expensive specialists to treat

⁴⁷⁸ <https://qz.com/1022831/why-doesnt-the-united-states-have-universal-health-care/>

⁴⁷⁹ <https://www.theatlantic.com/magazine/archive/2019/07/american-health-care-spending/590623/>

symptoms rather than to prevent diseases. While this cannot be generalized to every American, the cultural differences have contributed to a more expensive healthcare system in the US with suboptimal outcomes.

As early proposals for a universal healthcare system failed to gain momentum, in the 1960s, the federal government created health insurance programs for the elderly (Medicare) and the poor (Medicaid). Initially these programs were operated by the federal (Medicare) and state governments (Medicaid), which set rates and cut checks to pay for services. Over time, these programs expanded eligibility to cover disabled people and a wider range of lower-income individuals and families. The government began allowing managed care alternatives in the 1980s, with faster adoption in Medicaid.⁴⁸⁰

Affordable Care Act (ACA) was passed in 2010. The ACA was primarily focused on expanding coverage and providing consumer protections. The coverage expansion was accomplished through expanding Medicaid, creating a public exchange of health insurance plans with accompanying premium subsidies tied to income levels. Consumer protections were focused on ensuring access to coverage (elimination of pre-existing conditions), making all insurance policies more comprehensive (removing lifetime caps and eliminating coverage limitations), along with limiting insurance profitability (medical loss ratios). Tied to the consumer protections was a mandate for individuals to purchase health insurance, along with a mandate for employers to provide coverage. Funding for the Medicaid expansion and individual premium subsidies was from Medicare reimbursement cuts, a surtax on wealthy individuals tied to the Medicare payroll tax, and excise taxes on specific health industries (e.g., Health Insurer Fee).

- **What worked and what didn't work?** Uninsured rates dropped as 39 states expanded Medicaid, and 11 million individuals enrolled in the public exchange.⁴⁸¹ The major shortcomings were insufficient enrollment in the public exchange, which contributed to adverse selection and skyrocketing premium rates, along with ongoing cost inflation that was not contained by the ACA.

Since President Trump took office in 2017, there have been efforts to "Repeal and Replace" the ACA holistically, which has not passed in Congress. **Instead, President Trump made a series of piece-meal changes to the ACA** to: (1) effectively eliminate the mandate for insurance coverage by reducing the penalty to zero, (2) allow states to require people eligible for Medicaid to demonstrate they are working or in school, (3) terminate ACA subsidies to insurance companies offering coverage on the exchange, (4) reduce advertising and opportunities for enrollment in the ACA's public exchange, (5) allow consumers to use lower-quality insurance for up to four years (versus three months under the ACA), and (6) discourage foreign nationals legally residing in the US from enrolling in Medicaid.⁴⁸²

⁴⁸⁰ See report: [Industry Primer, Managed Care: Before the 2020 Election, a primer on how the US healthcare system works.](#)

⁴⁸¹ <https://www.healthaffairs.org/doi/10.1377/hblog20200402.109653/full/>

⁴⁸² <https://www.brookings.edu/blog/fixgov/2020/10/09/six-ways-trump-has-sabotaged-the-affordable-care-act/>;
<https://www.healthcare-management-degree.net/faq/what-changes-have-been-made-to-the-aca-under-the-trump-administration/>

These developments led to a complex healthcare system in the US with a range of public and private providers, high administrative costs, and a lack of control over healthcare pricing. There are changes on the way, however. For example, the Trump administration issued an interim final rule to implement the Most Favored Nation (MFN) model in late 2020, which would peg Medicare drug pricing to the lowest price paid by certain OECD countries. While its implementation has been temporarily blocked by several US district courts, the Biden administration has expressed support for allowing the federal government to negotiate drug pricing in Medicare Part D and for other payers.⁴⁸³

Beyond these near-term policy changes, what are the long-term options for the US healthcare system? Will efforts to improve affordability undermine medical innovation? In the next section, we explore trade-offs between cost and innovation and discuss the long-term implications.

THE COST-INNOVATION TRADE-OFF AND LONG-TERM OPTIONS

A survey by the KFF demonstrates the trade-off between healthcare cost and innovation. 89% of Americans polled said they would support the federal government negotiating for lower drug prices based on the argument that people could save money on prescription drugs. Conversely, when presented with the argument that government intervention could limit access to newer prescription drugs, 65% of respondents were against it.⁴⁸⁴

Essentially, the current US healthcare system prioritizes medical innovation over affordability. This is a result of the US government not being able to regulate drug prices, the PBMs having somewhat distorted incentives to keep prices high, and perhaps American patients preferring expensive treatment over preventative care. However, if the US significantly reduces its healthcare spending, this could have meaningful implications for medical innovation (not only drugs but also procedures and medical devices) for future generations globally.

In light of this trade-off, there is likely not a perfect solution that solves the affordability problem in US healthcare while fully preserving the innovative power it finances. Instead, we will need a delicate balance between sector collaboration to improve affordability and free market competition to incentivize future innovation. We discuss two long-term options and their pros and cons below.

COULD THE US MOVE TO A SINGLE PAYER SYSTEM?

A single payer system would allow the US government to regulate and negotiate drug pricing, which could level the playing field with its European counterparts from a pricing and affordability perspective. However, without international collaboration, this could lead

⁴⁸³ <https://www.kff.org/medicare/issue-brief/a-status-report-on-prescription-drug-policies-and-proposals-at-the-start-of-the-biden-administration/>

⁴⁸⁴ <https://www.kff.org/health-reform/poll-finding/kff-health-tracking-poll-october-2019/>

to a meaningful reduction in the global medical R&D budget, which would weigh on the innovation pipeline for future generations.

We also believe a single payer system is unlikely from a political perspective. To a certain extent, the anti-socialism sentiment that blocked the proposal of universal healthcare back in the 1940s still exists today. For example, according to a YouGov survey in 2017, 60% of respondents agreed to expand Medicare for all but only 44% agreed to introducing single payer healthcare.⁴⁸⁵ While these two options are essentially identical, people showed more aversion to the second option because of the perception that single payer involves more government intervention and taxation. We believe this is partly because people fear a move to a single payer system will lead to a loss of their private healthcare.⁴⁸⁶ As we wrote in our Weekend Pulse: [Weekend Pulse: What can the US healthcare system learn from Germany?](#), Americans who haven't had to seriously interact with their health insurance tend to like it.

From an execution perspective, some states have attempted to move forward with a single payer system but haven't been successful so far. For example, Vermont created the US' first single payer system, Green Mountain Care, in 2011. However, the state tax was not nearly enough to cover the incremental cost of a single payer system. The support for the program fell in the interim as multiple stakeholders (unions, community activists, disability rights advocates, etc.) failed to align their priorities. As a result, Green Mountain Care ended in late 2014.⁴⁸⁷ Similarly, Colorado and Massachusetts failed to move forward to a single payer system for similar reasons. More recently, California Governor Gavin Newsom brought single payer discussions back on the table, although the path to providing healthcare through a unified financing system remains unclear.

HOW ABOUT PAYING FOR OUTCOMES (VBC)?

A plausible middle ground could be for the US to pay for health outcomes in a VBC model instead of paying for the volume of health services provided. The VBC model could reduce costs by eliminating waste, increase co-ordination among providers delivering care for an episode, and reduce/eliminate rehospitalization. This model also engages in population health management to provide preventative services to keep their population healthy in the first place. Providers receive incentives, or a share of savings achieved, for delivering care at below-benchmark costs. In contrast, the traditional Fee for Service (FFS)-based care delivery model pays providers for the volume of services provided irrespective of patient health outcomes.

Shift to VBC has been underway since passage of the ACA in 2010. The ACA established the Center for Medicare & Medicaid Innovation (CMMI) to support innovative care delivery models designed to lower the cost of care.⁴⁸⁸ The ACA also created the Medicare Shared Savings Program (MSSP) to reward providers that achieve quality standards while lowering

⁴⁸⁵ <https://qz.com/1022831/why-doesnt-the-united-states-have-universal-health-care/>

⁴⁸⁶ <https://www.washingtonpost.com/opinions/2019/05/03/sorry-bernie-most-americans-like-their-health-insurance-way-it-is/>

⁴⁸⁷ <https://www.thirdway.org/report/single-payer-health-care-a-tale-of-3-states>

⁴⁸⁸ <https://www.cigna.com/assets/docs/about-cigna/thn-white-papers/928450-state-of-value-based-care-final.pdf>

expenditure growth. VBC is expected to account for 70% of total healthcare spend in the US by 2025.⁴⁸⁹

However, adoption of VBC has been slower than expected over the past decade, in many cases as healthcare providers had poorly structured incentive systems and/or lacked analytical capabilities to assess health outcomes. American patients' preference for expensive treatment over affordability might have also contributed to the slow transition to VBC. A survey of 10,000 patients in the US found only 31% consider cost very important when making a healthcare decision, whereas 85% find a doctor's compassion a key factor in their decision-making.⁴⁹⁰ Given these systemwide challenges and cultural hurdles, VBC is by no means a guaranteed success in the US. Let's take a closer look at VBC to better understand how we might be able to overcome the challenges.

In practice, VBC is not one model. It represents a range of approaches along the profit and risk-sharing spectrum that look to improve quality and lower costs (see Exhibit 349).⁴⁹¹

EXHIBIT 349: **Evolution of VBC models**

	Risk Sharing Spectrum				
	Fee-for-Service	Performance-Based Incentives	Bundled Payments	Shared Risk	Full Risk/Capitation
Providers	Providers receive payments for the volume of services provided	Providers receive performance-based incentives for quality improvement and cost savings.	Providers receive a fixed payment for a particular episode of care and benefit from savings if they keep costs below the fixed amount.	Providers realize savings if costs are below the benchmark rate and share costs if costs exceed the benchmark rate (but below the upper threshold).	Providers receive a fixed payment and assumes full clinical risk (upside and downside).
Payers	Payers pay for the volume of services provided.	Payers benefit from lower costs (net of incentives).	Payers assume the risk if costs exceed the payment amount, but benefit from lower costs and having more visibility on expenditure.	Payers share savings if costs fall below the benchmark rate (but above the lower threshold) and only bears 100% of costs if costs exceed the upper threshold.	Payers benefit from cost savings and have full visibility on medical costs.

Source: Bernstein analysis

Performance-based incentives: The move from FFS to VBC is gradual, with payers continuously evaluating the different models and improving them. Providers need to develop capabilities to be able to measure their performance and take on more risk to receive a greater share of the savings. Performance-based incentives are the first step as we move away from the FFS model. Providers are evaluated on a number of performance and cost parameters and receive incentives for achieving their targets. Historically

⁴⁸⁹ <https://www.oliverwyman.com/content/dam/oliver-wyman/global/en/images/insights/health-life-sciences/2014/October/OW%20-%20how%20to%20succeed%20in%20value-based%20healthcare.pdf>

⁴⁹⁰ <https://www.theatlantic.com/magazine/archive/2019/07/american-health-care-spending/590623/>

⁴⁹¹ See report: [US Healthcare Services: A primer on Value Based Care.](#)

performance-based incentives programs largely focused on quality performance, while newer programs have evolved to also include cost measures.⁴⁹²

- Studies have shown mixed results from performance-based incentive programs so far, with limited improvement in clinical quality and cost savings. Most studies have also found limited unintended consequences of performance-based incentive programs, although recent studies in the Veteran's Administration found overtreatment of patients with hypertension and diabetes, which is linked to absolute performance measures (e.g., blood sugar below a certain absolute threshold). Programs could disincentivize overtreatment by improving performance measures to give providers credit for taking appropriate clinical actions and to add an additional monitoring step to adjust incentives based on evidence of overtreatment.

Bundled payments: As the name suggests, bundled payment models pay providers a fixed fee for a particular episode of care. For example, for knee replacement surgery, providers will get a bundled payment for the entire procedure. That would include costs of blood work, radiology and imaging, lab tests, surgery, hospitalization, etc. Providers benefit from achieving savings by keeping costs lower than the bundled payment rate. Providers are also evaluated on quality parameters to make sure the care provided is of high quality and there are no subsequent recurrences and complexities. Providers receive bonuses for keeping costs lower than the payment rate. Payers assume the risk if the costs exceed the payment amount. Bundled payment is beneficial for providers as they can earn incentives for savings and for payers as they lower their costs and have more predictability on expenditure (bundled payment rates are established beforehand). Patients benefit from better outcomes and may benefit from lower cost sharing.

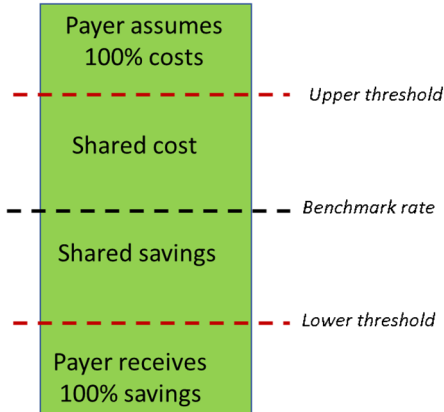
- We are still in the early stage of bundled payment development, with several studies showing a ~5-10% cost reduction under bundled payment models, but there is inconclusive evidence on the improvement in clinical quality. One study²⁹ showed a meaningful improvement in clinical quality (from 59% to 100% adherence on 40 clinical processes) under the bundled payment model, although it focused on a single integrated health system with unique characteristics that couldn't be generalized across other systems. While we don't have enough evidence on the impact on clinical quality, studies have shown a reduction in costs by ~5-10% under the bundled payment model. In terms of potential *unintended consequences*, the bundled payment model could incentivize providers to shift services from inpatient to outpatient, underdeliver appropriate care services, select low-risk patients into the program, avoid high-risk patients, and increase cost estimates to maximize bundle payments. So far there's only consistent evidence around shifting services from inpatient to outpatient, which helps save costs and does not have a major impact on the quality of services provided.

Shared risk: In a shared risk model, providers share a certain amount of risk with payers for the costs of a care delivery episode. Payer and providers establish thresholds above and below the benchmark payment rates in which they share the risk (both savings and overruns). Any savings achieved within this threshold will be shared by both the provider

⁴⁹² https://www.rand.org/content/dam/rand/pubs/research_reports/RR300/RR306/RAND_RR306.pdf

and the payer and any cost exceeding the benchmark but within the threshold is absorbed by both. Costs and savings outside these thresholds are absorbed by the payer (see Exhibit 350).

EXHIBIT 350: **Illustration of shared risk model**



Source: Bernstein analysis

Capitation/full risk models: In these models, providers or a group of providers receive a fixed payment. Providers receive all the savings if they can take care of patients within the payment received. To achieve better outcomes and lower costs, providers will need to avoid hospitalizations for patients. Providers can do so by adopting preventative care, which will encourage healthy living among its beneficiaries.

- Full risk models require a higher level of integration among all the providers and participation of other healthcare experts such as care coaches, dieticians, nutritionists, primary care physicians, and population care managers who not only try to lower cost of procedures but also try to keep members healthy and out of hospitals. Providers may also use analytics to identify high-risk members and incentivize them to undergo check-ups and screenings to address care requirements before the condition becomes critical.

How does VBC work in practice? One approach is through **Accountable Care Organizations (ACOs)**, where a group of providers (physicians, hospitals, and other providers) voluntarily come together to be held accountable for the cost and quality of care for patients enrolled in the program. Providers receive bonus payments for savings/quality beyond their target and may have to pay penalties if savings/quality fall below the target.

- **Early results from ACOs are incrementally positive.** 541 ACOs in the Medicare Shared Savings Program generated US\$1.2bn net savings for Medicare in 2019. While the savings were small relative to Medicare's total spending of US\$644bn, this represented an improvement from prior years and the third consecutive year of net

savings. In particular, ACOs that participated in downside risk sharing outperformed those that didn't.⁴⁹³

- **However, there are concerns about ACOs leading to greater industry consolidation and less price competition among providers.** Regulations that limit the growth in healthcare spending by providers and limit anti-competitive behaviors could help mitigate this risk. Culturally, there are also questions about whether American patients will want to limit their choices to providers within a specific ACO in exchange for lower costs.
- Meanwhile, there are also valuable lessons we can learn from the decline of **Health Maintenance Organizations (HMOs)** to better structure ACO programs going forward.
 - HMOs started forming in the 1970s on the back of escalating healthcare costs in the US. They were formed to deliver a lower price for employers (typically 15% lower than traditional insurance) by directly contracting with a narrow network of doctors and hospitals in exchange for receiving lower unit costs.⁴⁹⁴ The passage of the HMO Act of 1973 under the Nixon administration accelerated the growth of HMOs, which doubled in size by the 1990s. However, some HMOs began to exit the market through M&As and/or bankruptcies after sustaining losses in the mid-1990s.⁴⁹⁵ While HMOs are not, strictly speaking, VBC programs, they share similar goals with ACOs of improving the quality of care while reducing costs. And both look to achieve the goals by bringing together providers (hospitals, physicians, and others) through an integrated approach.
- **What happened last time?** Studies have shown that HMOs eventually failed for a number reasons, including: (1) prioritization of cost control and profit over patient care, which led to patient dissatisfaction, (2) poor management and growing bureaucracy after having enjoyed a period of success, (3) inability to control costs, partly due to a failure to manage admin and overhead costs, (4) resistance from physicians who were dissatisfied with incentives and preferred having autonomy over being in an employment relationship, and (5) inadequate IT infrastructure to streamline patient data and claims management across various providers.
- **We hear some similar concerns around ACOs and VBC today.** According to a recent survey, 43% of physicians believe VBC will negatively impact their relationship with patients, worrying that an increasing focus on cost control will take the attention away from patient care.⁴⁹⁶ Another survey of over 1,000 healthcare and other industry practitioners shows that a lack of IT infrastructure is the #1 hurdle for more widespread VBC adoption.⁴⁹⁷ Further, 57% of oncologists in VBC programs see the high prescription drug costs as a main challenge in managing costs and have

⁴⁹³ <https://www.healthaffairs.org/doi/10.1377/hblog20200914.598838/full/>

⁴⁹⁴ See report: [US Healthcare Services Blast - Could the decade's most valuable sequel be Value Based Care \(HMO Part II\).](#)

⁴⁹⁵ https://www.researchgate.net/publication/325855660_What_Should_ACOs_Learn_from_the_Failure_of_HMOs_What_should_accountable_care_organizations_learn_from_the_failure_of_health_maintenance_organizations_A_theory_based_systematic_review_of_the_literature

⁴⁹⁶ <https://www.thedoctors.com/about-the-doctors-company/newsroom/the-future-of-healthcare-survey/>

⁴⁹⁷ <https://revcycleintelligence.com/news/partners-patients-key-to-achieving-value-based-care-results>

advocated for more data disclosure from pharmaceutical companies to better understand the value and effectiveness of high-cost cancer treatments.⁴⁹⁸

Dialysis also provides a good example of real-world implementation of VBC. While Medicare is typically only for patients 65+, all patients with end-stage renal disease (ESRD) qualify for Medicare regardless of age. These patients comprise less than 1% of total Medicare beneficiaries, but they account for ~7% of the total Medicare budget, given the high cost of dialysis care and the high number of comorbidities typical in ESRD patients. Given its high costs, ESRD was an early area targeted by CMMI for efficiency increases.

- **In 2013, CMMI introduced the ESCO program,⁴⁹⁹ a shared savings program for participating dialysis providers.** Under the terms of the program, large dialysis players would take responsibility for all the annual healthcare costs of treating dialysis patients enrolled within the program. These costs would then be compared versus a benchmark and the dialysis providers would keep 75% of the savings while Medicare would keep 25%. As dialysis players see the patients three times a week for four hours for their weekly treatments, they are well placed to provide preventative care to the patients, and therefore hopefully reduce annual hospital visits and other complications that lead to their high cost of care. We were initially positive on the program as we thought it would both help improve patient outcomes, reduce system costs, and benefit dialysis provider margins.
- **Initial results were positive, but then CMMI appears to have moved the goalposts.** Early results from the program were positive, with dialysis providers generating and receiving savings on the patients they were serving. However, in 2019, leading dialysis provider Fresenius Medical Care had to take two write-downs on the expected savings it was generating from the programs. We understand while the programs were still generating savings on the patients served, CMMI was moving the goalposts, altering the financial payouts the providers received. For example, it decided to exclude patients who died in the year, even if significant savings were generated on the patient's care while they were alive. This was a disappointing shift in the structure, as we believe this reduces the incentive for providers to participate in future programs.
- **We still see opportunities for integrated VBC programs with private insurers.** Large dialysis players have been entering into VBC contracts with private insurers, particularly the Medicare Advantage plans. We believe the incentives of the insurers and the providers are well aligned in these contracts, and the goal posts are unlikely to be moved the way they were in the ESCO contracts. Growing integrated care should both reduce total cost of care for dialysis patients and provide margin upside for dialysis providers.

How does VBC impact healthcare providers' financials? In an oversimplified example, VBC could have a negative revenue impact on some healthcare providers (e.g., hospitals) in the near term as they receive less fee-for-service payments and reduce the volume of services they provide (e.g., physicians will be less incentivized to provide over-treatment; they will

⁴⁹⁸ <https://revcycleintelligence.com/news/prescription-drug-costs-challenge-value-based-care-in-oncology>

⁴⁹⁹ [Dialysis Services: More Clarity on Integrated Care \(ESCO\) Program. Attractive Opportunity, But Likely Slow Ramp-Up](#)

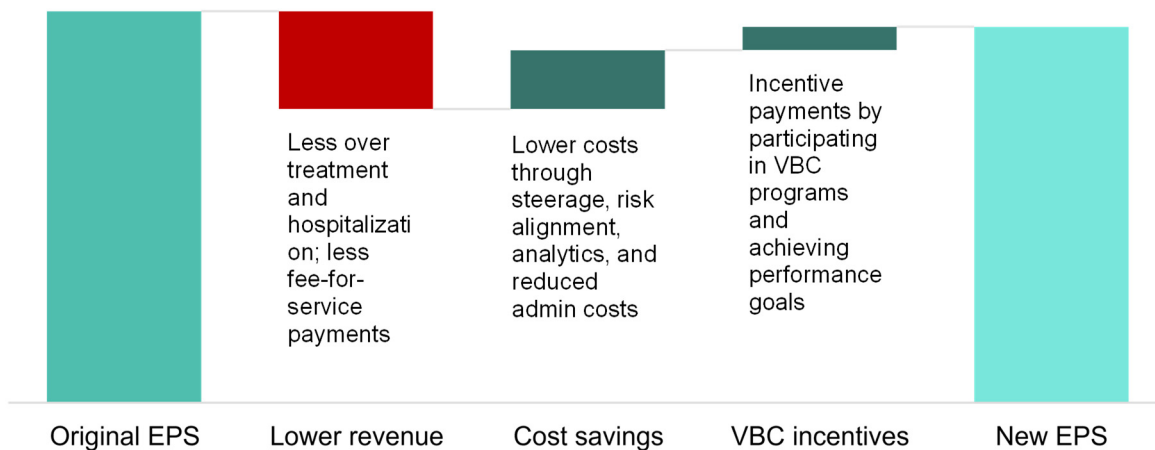
put a greater focus on preventative care than disease treatment, and will recommend less frequent, shorter hospital stays) (see Exhibit 351). However, what this analysis doesn't capture is that physicians and hospitals that provide high-quality, low-cost services could gain market share over time, which could help offset some of the immediate revenue impact.

Meanwhile, providers could unlock meaningful cost-saving opportunities. Our Healthcare Services team expects annual cost savings of US\$500-US\$750bn in the healthcare system through the shift toward VBC.⁵⁰⁰ Major cost-saving tools include steering away from high-cost providers, drugs, aligning risks to incentivize lower costs and improved outcomes, improving clinical population health through data analytics, and eliminating redundant operating costs, with an opportunity to save US\$3tn dollars in total over the next five to 10 years. In addition to cost savings, healthcare providers could generate incremental revenue from incentive payments by participating in VBC programs and achieving or exceeding performance goals.

What's the net financial impact? We expect it to vary by providers, which can help differentiate winners and losers. In particular, healthcare providers who have experience with risk sharing, have a strong leadership team to align physicians' incentives with health outcomes, and have access to data analytics and other resources have a higher chance of succeeding, while others could struggle in responding to such a long-term structural shift. We expect this potential shift to create investment opportunities, and take a closer look at the sector-by-sector implications in the following section.

EXHIBIT 351: In an oversimplified example, we expect VBC to have a negative revenue impact on healthcare providers, which can be offset by cost savings and incremental VBC incentives; net financial impact could vary between winners and losers

Illustrative EPS Impact of VBC on Healthcare Providers



Source: Bernstein analysis

⁵⁰⁰ See report: [US Healthcare Services: A primer on Value Based Care](#).

While VBC appears to be a promising solution to improve the affordability of US healthcare, it's by no means a guaranteed success, especially given the complexity of aligning multiple stakeholder interests. Learning from the failure of HMOs and mixed results from value-based pilot programs so far, we believe the following building blocks are crucial to VBC's success over the long term:

Upside and downside risk sharing. Most early-stage VBC programs started out by paying incentives to reward quality improvement and cost savings. However, we believe it is critical to enable physician groups to share both the upside and the downside risks to differentiate winners and losers and to allocate more resources to outperformers. Over time, we also expect to move in the direction of **full risk sharing** (e.g., global capitation), which gives total medical cost responsibility (including hospital costs, specialists, pharmacy, etc.) to the physician groups. In exchange for this transfer of risk, the payer would receive a guarantee of lower medical costs than what they are achieving in the current model.

Data and analytics capabilities. To enable physician groups to take the full clinical risk, we will need data and analytical capabilities for physicians, hospitals, and care givers to share claims and clinical data, to analyze patients' electronic health records (EHRs), and to leverage data analytics for pricing and health outcome analyses. We will also need to insert this level of information and analytics into the physician workflow, such that the physician can make real-time decisions to improve outcomes and lower costs. Medical devices that are Bluetooth-enabled and cloud-connected hold the potential to generate much of the data required to bridge this analytical gap. For example, new insertable cardiac monitors (from Medtronic, Abbott, and Boston Scientific) record heart rhythms and then send daily wireless transmissions to a database in the cloud. AI-enabled analytics alert care teams when arrhythmias are detected, and physicians call patients into the office for evaluation as needed. Remote patient monitoring (RPM) technologies are improving patient outcomes across a number of medtech categories, including continuous glucose monitors (CGMs) for diabetics and new ICDs (defibrillators) that can detect early signs of heart failure. From a system perspective, more widespread adoption of RPM can help control episode-of-care costs. We see this happening in two distinct ways. The first is self-evident: if critical biomarker data can be collected from the comfort of the patient's home without in-person assistance, then a substantial percentage of costly routine follow-up appointments can simply be avoided. Second, real-time RPM technology can help optimize long-term patient outcomes by catching emergent clinical issues as they emerge — that is, rather than during an in-person appointment that might occur once every 12 months (i.e., up to eleven-plus months after the first warning signs emerge). Earlier detection is obviously good for patients, but it's equally coveted by care providers and payers, given the higher rates of complication and readmission associated with more advanced disease states.

Physician incentives and buy-in. We've heard resistance from physicians that they are concerned about sacrificing patient outcomes for the sake of cost management. On this, it is important to design performance metrics to **balance cost, quality, and outcome metrics** to ensure that care is not withheld and that the physician has incentives that are consistent with improving health and outcomes. It's also important that such metrics are set up in a clear and non-conflicting way for physicians to identify the key drivers of their financial incentives. In addition, we've also heard from physicians that they prefer having autonomy over being told what to do and how to treat their patients. In this regard, it's crucial to

engage physicians in the decision-making process of introducing and designing the value-based program. For example, physician groups can involve individual physicians in developing or improving performance evaluation metrics and help physicians make more informed decisions by providing them with education, data, and ongoing support.

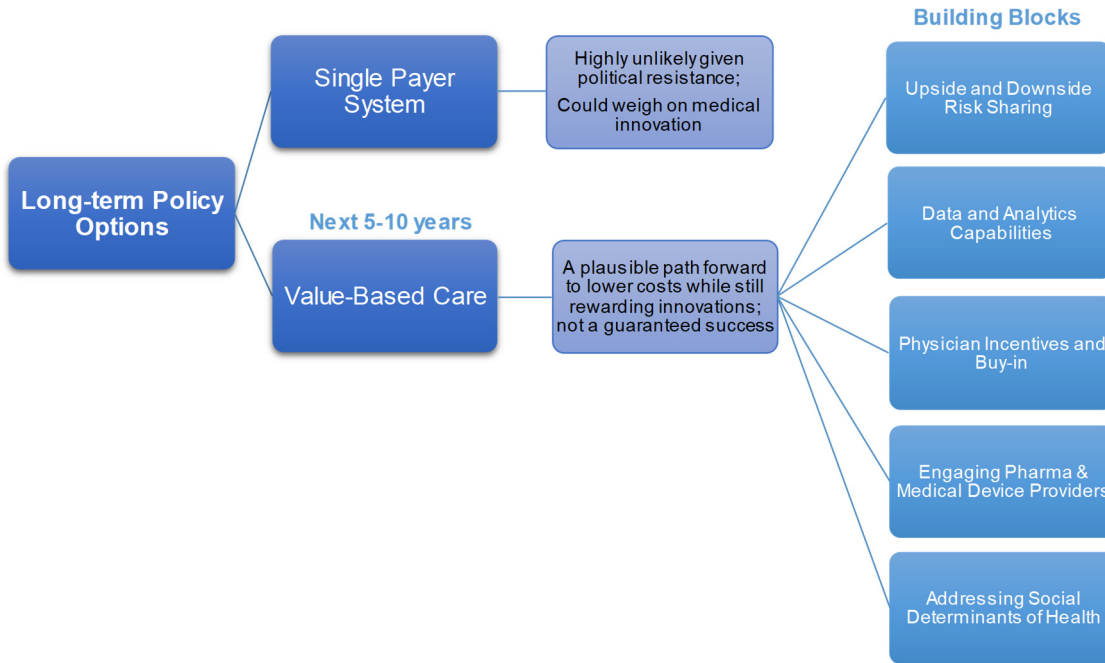
Engaging pharmaceutical companies and medical device providers. Primary care costs of physicians only account for a small proportion of total medical costs, estimated at less than 10%. While physicians have leverage over a greater portion of costs through prescribing, referring, and performing treatments in other settings, they have limited control over costs when it comes to expensive medication, procedures, or devices that are necessary to treat certain diseases. We've heard from oncologists the need for pharmaceutical companies to ***share data*** around care quality and outcomes, treatment costs on a comparable basis, and care pathways. In addition, we also expect pharma companies and medical device providers to enter into ***risk-sharing agreements*** with physician groups to be held directly accountable for treatment effectiveness and outcomes. Having said that, we do not believe medtech adoption of risk-sharing models will be either quick or linear, and we expect the industry's enthusiasm for these agreements to be highly variable at the individual company level. Medtronic was an early trailblazer in exploring risk-sharing contracts with hospitals (e.g., diabetes partnership with UnitedHealth and TRYX antibacterial envelope contracts). But more recently, Medtronic CEO Geoff Martha conceded that the company: (1) had been "too early" with its economic value strategy under his predecessor Omar Ishrak, and (2) had invested too many resources without seeing sufficient returns. Some level of focus on health economics is important, but the more sophisticated risk-sharing arrangements that Medtronic had pioneered were difficult to accomplish without more "dance partners" (partnerships with payers and providers, and with data linkages to track outcomes). Risk-sharing agreements are likely to increase with time, but these early experiences suggest that finding the winning formula may not be easy.

Addressing social determinants of health. Another missed opportunity in the current FFS model is addressing social determinants of health (e.g., access to nutritious food, housing, and education), which impact healthcare costs and outcomes beyond genetics and health behaviors. The healthcare model in the US has largely focused on treating illnesses so far. While American patients are partly responsible for their less healthy lifestyles, with the transition to VBC, healthcare providers are now more incentivized to focus on preventative measures to keep their members healthy and away from hospitals by addressing these non-medical issues that affect health outcomes. Managed care organizations have started to offer social determinants benefits (e.g., access to a dietitian and a fitness tracker, subsidized gym memberships, and ride sharing to a doctor's appointment) as part of their plan benefits to control costs and attract new customers. While these are social issues that require collaboration from many public and private stakeholders, the shift to VBC gives healthcare providers financial incentives for the first time to join forces in addressing these social issues, which will ultimately help lower the cost of healthcare in the US.

While the value-based approach has the potential to transform the US healthcare system without draining its innovative power, achieving success requires collaboration from multiple stakeholders (e.g., physicians, hospitals, pharma and medical device companies, IT infrastructure providers, and policy makers), and it could take us many more years to get to the full risk/capitation stage (see Exhibit 352). If we use history as a guide, it took HMOs

about two decades to flourish, before their ultimate demise. Although the transition to VBC has been slower than expected over the past decade, the next five to 10 years could be critical to engage all stakeholders to realize its full potential. What could this mean for the various stakeholders? We take a closer look at the financial implications in the next section.

EXHIBIT 352: We view VBC to be a plausible path forward to lower costs in the US healthcare system while still preserving its innovative power, although it's by no means a guaranteed success



Source: Bernstein analysis

+ WINNERS, LOSERS, AND KEY ENABLERS

As we pursue structural healthcare reforms such as VBC to improve the affordability of healthcare, this could separate winners and losers and create opportunities for key enablers to take advantage of structural growth.

US HEALTHCARE SERVICES (MCOS)

We expect the potential shift to VBC to be neutral to positive for MCOs as they can pass on the cost pressure to healthcare providers while the value-based system could improve member experience and their quality of life. MCOs have historically had limited incentives to control costs as the employer risk model was more focused on accurately predicting and passing along projected medical costs, and self-insurance doesn't expose MCOs to medical costs. The misalignment of interests of standalone PBMs discussed previously is consistent with this overall system misalignment. However, the growth of government MCO

is changing MCO incentives, as the government is the price taker, establishing modest rate increases and forcing MCOs to apply pressure within the system to manage costs. In this way, we see MCOs as a transmission mechanism for cost pressures from payers, applying this pressure downstream to hospitals, physicians, drug companies, and other providers.

- Within our managed care coverage, **UNH** has a strong lead in this area and should be a long-term winner. **CVS** has a strategy that we believe it can execute and position itself as a solid challenger. There is a growing list of pure-play VBC companies that are expanding and raising capital, including Iora Health, Privia/Brighton, VillageMD, Oak Street, ChenMed, and IMC Health (all private). These companies represent varied business models that typically either employ physicians or partner with physicians. We tend to prefer the employed physician model as it has greater control, which should lead to greater cost savings, although we recognize this model is more capital intensive.⁵⁰¹
- We have incorporated our expectations of disruptive growth in VBC into our UNH multiple, with a higher segment multiple applied to OptumCare (the UNH division responsible for care delivery). For most other MCOs we cover, we see their ability to contract with VBCs as not adding to their multiples. For CVS, we see long-term growth from VBC, but this currently represents a small portion of its overall multiple, given the size of the HealthHub businesses.

US HEALTHCARE SERVICES (HOSPITALS)

Hospitals could see the most amount of disruption from the shift to VBC as we shift volume from high-cost to low-cost hospitals and/or shift away from hospitals to lower-cost surgery centers. By providing more preventative health services, we could also save cost by keeping more people out of hospitals for longer.

- We believe **HCA** and all hospitals are at risk from volume and rate declines if the transition to value-based reimbursement occurs more quickly and if HCA is merely a supplier and not a partner in this effort. Based on the current pace, we believe this risk is expanding. HCA has indicated focus on capital deployment in areas of reinventing care delivery, which we believe will be supportive of VBC.

EU BIOPHARMACEUTICALS

The debate on US drug affordability has and will continue to be a vocal one. Benchmarking (MFN) and rebate reform are two examples and we are likely to see progress on both over the long term. Recent updates on US drug pricing reform further support why we see these as long-term policies. Given some of the price differentials globally, benchmarking could clearly drive a reset for the industry, but one we think will take time to implement and changes will be gradual. However, we believe the potential shift to VBC could drive the biggest change to pharma companies' current business model. Pharma companies have historically differentiated their products through R&D followed by extensive marketing and sales activities. As we shift to focus on outcomes, it will raise the innovation bar with a greater emphasis on drugs' effectiveness on patients and ultimately, relative costs.

⁵⁰¹ See report: [Pre-IPO research: Oak Street Health - overview on Value Based Care business model, key competitors and their S-1](#).

Although this is unlikely to be implemented in the US anytime soon, the National Institute for Health and Clinical Excellence (NICE) in the UK evaluates drugs with regard to their clinical impact and the total cost of treatment.⁵⁰² Although drugs can, in theory, access the UK market without NICE's approval, its recommendations have a major impact on a drug's market penetration.

In light of these potential changes, pharma companies will need to rethink their competitive advantage in terms of where they can achieve industry-leading patient outcomes by integrating value-based metrics in their R&D process. R&D teams will need to consider a range of outcomes/value metrics and work cross functionally within the organization to develop drugs that are able to effectively demonstrate value. Pharma companies may also need to share data and enter into risk-sharing agreements with hospitals/physicians /payers to enable new payment models whereby pharmacos agree to share risk in return for access (e.g., pharma companies may agree to partially reimburse a payer if their drug fails to demonstrate a certain level of efficacy, in return for more generous access/coverage). In recent years, we have seen new drug launches with a greater consideration on value, even those without a "requirement" from payors — the journey has just started.

Companies that: (i) offer a value-based pricing approach for new product launches, (ii) launch at lower price differentials US/OUS, (iii) raise the innovation bar for new products entering competitive spaces, and (iv) offer a personalized care approach will likely succeed in the long term. Within our European biopharma coverage, we view **Roche** as best placed to excel in many of those factors. Interestingly, **Novo** would normally be considered one of the more challenged but, given our view on obesity value long term, we believe it is well placed despite the continued debate on diabetes pricing (insulins).

INDIA HEALTHCARE (GENERIC PLAYERS)

The potential shift to VBC could support the growth of high-quality generics over the long term. ~40% of generic drugs in the US are produced by Indian pharmaceutical companies. Despite the value-based tailwind, the generic market in India is highly competitive, given the low barriers to entry, especially for simple generics. However, we see opportunities for companies to develop more of a moat in complex generics, which take longer to develop and could face more regulatory scrutiny but, therefore, face less competition.

US & EU MEDICAL DEVICES & SERVICES

Medical device players are likely at lower risk from a shift to VBC than other areas of healthcare, given the diagnosis-related group (DRG) system already in place helps curb pricing in medical devices. Under the DRG system, insurers will reimburse hospitals for the entire cost of the procedure (e.g., a knee surgery), for which the cost of the device (e.g., the implant) is only one part. Providers therefore are already incentivized to negotiate the price of the device as it influences their profitability. We expect medical device providers to adapt their business models if we transition to VBC to offer more services and solutions to improve the health outcomes instead of just focusing on selling devices on a standalone

⁵⁰² <https://www.bcg.com/en-us/publications/2012/biopharma-what-value-based-health-care-means-for-pharma>

basis.⁵⁰³ In a value-based system, a payer is more likely to pay for services that help improve the outcome. Therefore, medical device companies that can prove their devices improve outcomes (via clinical studies) or reduce costs (e.g., through improving process efficiency or reducing readmission rates) will benefit. This shift will likely separate winners and losers among medical device providers. In particular, we believe revenue growth strategies based on like-for-like price increases or large mix uplifts just because a product is "new" but not necessarily improving the health outcome versus older models are typically difficult to maintain in the long run. Stocks in these subsectors (e.g., hearing aids) could be at risk of a stock price derating over time.⁵⁰⁴

Within our European medical device coverage, we believe companies in the medtech sector focused on innovation around improved outcomes and efficiency in total cost of care are poised to benefit. Among our European coverage, **Coloplast** leads in innovation in the chronic care space, investing the clinical data to prove the superior outcomes of its newer products. It also works closely with payers as part of clinical trials to emphasize the reduction in total cost, allowing it to achieve higher reimbursement categories. For example, with its ostomy products it has gained new reimbursement categories by demonstrating the reduction in skin complications whose treatment can be a significant cost of a stoma patient's care.⁵⁰⁵ In the imaging space, **Philips and Siemens Healthineers** are leading the charge to incorporate more data analytics (including AI) into their products to increase the efficiency with which their machines are used (e.g., reducing scan time) and with which their scans are read (e.g., integrating data across platforms and reducing errors).⁵⁰⁶ Lastly, we think the dialysis service providers, **Fresenius Medical Care and DaVita**, could be long-term winners if integrated care can be structured in a way to ensure long-term return on investment for the providers.⁵⁰⁷

Among our US coverage, there is likewise no shortage of examples of new technologies delivering better outcomes for patients, lower episode-of-care costs for payers, or both. Despite the fact that newer-generation medical devices tend to command ASP premiums versus prior-gen predecessors, many of the most meaningful innovations ultimately pay for themselves and lower the total cost of care.

- **Edwards Lifesciences** has developed a highly differentiated portfolio of heart valve technologies that deliver dramatic improvements in patient outcomes (e.g., faster recovery, extended life expectancy, increased quality of life, etc.).⁵⁰⁸ Transcatheter Aortic Valve Replacement (TAVR) has also demonstrated competitive relative economics versus Surgical Aortic Valve Replacement (SAVR) despite TAVR's US\$20k+ price premium. In fact, economic analysis shows the average total one-year

⁵⁰³ <https://www.oliverwyman.com/content/dam/oliver-wyman/global/en/images/insights/health-life-sciences/2014/October/OW%20-%20how%20to%20succeed%20in%20value-based%20healthcare.pdf>

⁵⁰⁴ See report: [Global Medtech: Does ESG matter? What metrics are most material?](#).

⁵⁰⁵ See p. 24-25 of our December 2019 note: [Chronic Care: Recently reinitiated. Own the innovator \(Coloplast - Outperform\), not the follower \(ConvaTec - Underperform\)](#).

⁵⁰⁶ For more details see the "Artificial Intelligence in Medical Imaging" chapter starting on p.125 of our November 2020 Philips *Blackbook*: [Philips: Harnessing the Healthcare Data Revolution](#).

⁵⁰⁷ For further details on this topic, please see pp. 6-7 of our October 2020 note: [Fresenius Medical Care: CMD reiterates focus on value-based care and home dialysis. Mid-term guidance upside from potential M&A](#).

⁵⁰⁸ <https://www.tavrbyedwards.com/why-edwards-tavr/>

cost was 16% lower for TAVR than for SAVR (see Exhibit 353), driven by a lower rehospitalization rate and a >50% decline in the time spent in rehab centers.

EXHIBIT 353: **TAVR economics are favorable to SAVR despite a much higher upfront cost for the valve**



Source: Edwards Lifesciences, Cohen et al., Cost-Effectiveness of Transcatheter versus Surgical Aortic Valve Replacement in Intermediate Risk Patients Results from The PARTNER 2A and Sapien 3 Intermediate Risk Trials (2017), and Bernstein analysis

- **Johnson & Johnson's** Biosense Webster business is another example of medtech ingenuity driving better patient outcomes and meaningful long-term cost efficiencies. Patients with atrial fibrillation ("AFib") frequently fail to respond to traditional drug therapy (e.g., beta blockers, digoxin, warafin, etc.). Those who *do* respond must cope with debilitating side effects (e.g., fatigue, weight gain, depression, dizziness, fainting, major bleeding, etc.). Cardiac ablation has emerged as a viable alternative to drug therapy, offering: (1) reduced side effects (by targeting the underlying problem more directly), (2) more immediate impact (given the procedure's "one-and-done" nature), and (3) the elimination of drug adherence issues. More broadly, many medtech companies are working on additional "one and done" device solutions that could potentially replace the burden of lifetime drug therapy by more directly targeting the underlying problem (e.g., Medtronic's renal denervation therapy for hypertensive patients).
- **Intuitive Surgical** is another example of medtech innovation unlocking better, more consistent patient outcomes. Intuitive's da Vinci robot continues to democratize access to quality care by reducing the case-to-case variability in surgical outcomes. Laparoscopic surgeons who rank in the bottom quartile among peers based on technical skill have exhibited ~3x more complications and ~2x more reoperations and readmissions than top-quartile surgeons when performing certain procedures.^{509,510} Although robotic surgery is often more expensive than other surgical modalities, we are already seeing tangible evidence that the cost curve for da Vinci will gradually bend down over time.

⁵⁰⁹ <https://isrg.intuitive.com/static-files/8afb7980-4820-41ff-bfa4-b3f82ce4111a>

⁵¹⁰ <https://pubmed.ncbi.nlm.nih.gov/24106936/>

- We reflect these potential opportunities and risks in our revenue forecasts, market share gain estimates, and margins (given the different margin dynamics of greater VBC in some subsectors such as dialysis).

Cloud Computing: Cloud computing could play a major role in facilitating the management and analytics of patients' health information if we transition to a value-based system. In particular, health providers are able to access information from multiple sources (e.g., clinical and claims data from multiple providers) through cloud computing in order to form a holistic view of patients' health history and outcomes. Cloud computing also lowers the cost as healthcare providers shift from buying hardware and servers to paying only for what they use on the cloud. Meanwhile, cloud-based big data solutions could provide helpful tools to analyze health data for research and personalization purposes.

- Cloud capabilities could also support the growth of *telemedicine* (i.e., virtual doctor appointments to address non-urgent care and routine issues) to reduce the need for costly in-person visits.⁵¹¹ Before the Covid-19 pandemic, telemedicine was adopted by a very small proportion of the US population. According to a study by KFF, only 2.4% of enrollees in large employer health plans used telemedicine at least once in 2018.⁵¹² This was largely a result of a lack of clarity around insurance reimbursement, patients' varying degrees of access to technology, and concerns about the quality of telemedicine versus in-person visits. The Covid-19 pandemic, however, has provided a catalyst for the growth of telemedicine, with 23% of adults in the US reporting to have used telehealth services in light of the pandemic.⁵¹³ This is on the back of federal and state governments loosening restrictions on telemedicine through Medicaid and Medicare, and commercial insurance companies broadening coverage of telemedicine in response to the pandemic. Should some of the new regulations and policies remain in place post Covid-19, this could accelerate the growth of telemedicine in the US. We also expect cloud computing to further facilitate broader adoption of telemedicine by providing the technology, infrastructure, and solutions for physicians to access and manage patient data through a centralized database to provide more customized services.
- Despite promising growth potential, data privacy and security issues remain a big concern, especially given sensitivities around patients' private information. More robust regulations and blockchain technologies could pave the way for wider adoption of cloud computing technologies in the healthcare space.

Data Analytics/AI Solutions: Beyond cloud computing infrastructure and service providers, health data analytics tools can help physicians incorporate ever-expanding mounds of data into their workflows, increasing efficiency while reducing errors in their decision-making to improve health outcomes. One particularly exciting vector of AI-enabled innovation is the emergence of "closed loop" technology across multiple medical device markets, including diabetes and neuromodulation (e.g., spinal cord stimulation and deep brain stimulation). In

⁵¹¹ <https://www.healthitoutcomes.com/doc/ways-cloud-computing-is-impacting-healthcare-0001>

⁵¹² <https://www.kff.org/womens-health-policy/issue-brief/opportunities-and-barriers-for-telemedicine-in-the-u-s-during-the-covid-19-emergency-and-beyond/>

⁵¹³ https://morningconsult.com/wp-content/uploads/2020/05/2004100_crosstabs_CONTENT_CORONAVIRUS_Adults_v2_RG.pdf

diabetes, CGMs and insulin pumps are designed to be increasingly interoperable, and competition in the pump market is now largely determined by the relative degree of each system's CGM integration. For patients who convert to CGM/pump therapy from finger sticks/multiple daily injections (MDI), the reduction in disease burden and improvement in quality of life can be dramatic. Some of the newer "hybrid closed-loop" systems can automatically suspend insulin to prevent blood glucose from falling too low (i.e., hypoglycemia), deliver correction boluses to prevent blood glucose from spiking too high (hyperglycemia), and be adjusted for the patient's activity level (e.g., exercise or sleep). Each of these features helps stabilize blood glucose levels, maximize patients' "time in range," and minimize time below range (since hypoglycemia can be particularly dangerous and costly). Looking ahead, next-gen automated insulin dosing (AID) systems capable of real-time blousing (i.e., "full/true closed loop") may eventually come to market, further improving patient outcomes and alleviating costs at the population level (diabetes is the most expensive chronic condition in the US, with >US\$230bn spent annually on direct medical costs according to the CDC).⁵¹⁴ Meanwhile, conceptually similar closed-loop technology has emerged as an intriguing potential solution in multiple areas of neuromodulation. In the spinal cord stimulation (SCS) market, both Medtronic and Saluda Medical are now developing closed-loop systems capable of delivering customized stimulation based on the spinal cord's response to the system's electrical stimuli (as measured by evoked compound action potential, or ECAP).⁵¹⁵ And in deep brain stimulation (DBS), Medtronic recently announced ADAPT-PD, the first trial designed to evaluate "adaptive" DBS (aDBS) in patients with Parkinson's disease.⁵¹⁶ Using proprietary BrainSense technology, Medtronic hopes to capture brain signals (local field potential (LFP)) to "deliver personalized, data-driven treatment and adjust as patients' needs evolve."⁵¹⁷ All else being equal, we believe AI-enabled closed-loop technology is self-evidently superior to fixed output "open-loop" technology, and we expect to see continued proliferation into additional medical device categories going forward.

- In China, the government has partnered with Tencent and others to collect health records across the country to build an AI system which has shown some early promise in alleviating the pressure that the aging population is putting on the healthcare system.⁵¹⁸ The AI health market was about RMB20bn in 2018 (or ~US\$3bn) and has been growing exponentially in recent years on the back of policy support.⁵¹⁹ In particular, AI medical imaging is the most developed segment in China, given surging clinical demand and a lack of medical imaging doctors across the country. At the same time, China has been developing its capabilities around AI-assisted diagnosis, AI-enabled drug development, and AI health management (e.g., self health monitoring and chronic disease management).

⁵¹⁴ <https://www.cdc.gov/chronicdisease/programs-impact/pop/diabetes.htm>

⁵¹⁵ <https://pubmed.ncbi.nlm.nih.gov/31215718/#:~:text=Introduction%3A%20The%20electrically%20evoked%20compound,%2C%20electrophysiological%20response%2C%20and%20neuromodulation.>

⁵¹⁶ <https://newsroom.medtronic.com/news-releases/news-release-details/medtronic-launches-first-its-kind-adaptive-deep-brain>

⁵¹⁷ <https://www.medtronic.com/us-en/healthcare-professionals/products/neurological/deep-brain-stimulation-systems/percept-pc.html>

⁵¹⁸ <https://www.chinabusinessreview.com/the-hidden-challenges-of-chinas-booming-medical-ai-market-2/>

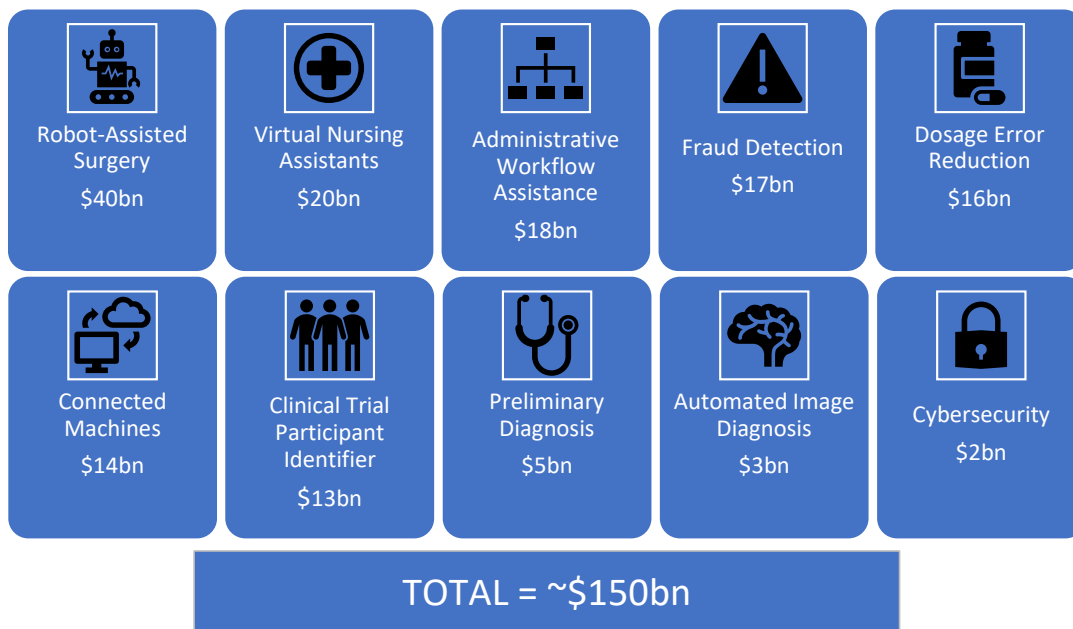
⁵¹⁹ Ministry of Foreign Affairs of Denmark: China AI Healthcare (a report by Innovation Center Denmark).

- Overall, we expect AI to become an important tool in addressing unmet demand for healthcare. With growing populations, coupled with a rise in complex chronic diseases (e.g., diabetes, kidney disease, and cardiovascular disease), emerging market governments face the challenge of increasing healthcare provision while infrastructure and budgets are limited. AI can help square this circle by improving efficiency and offering access to healthcare when infrastructure is lacking. As such, although we don't expect AI to replace current doctors in emerging markets, we do think it can increase provision where there is a shortage of trained physicians.⁵²⁰
- In developed markets, we see AI as a useful tool in helping to make doctors more efficient and also potentially better. We would not expect AI-enabled platforms to replace doctors, but the use of AI may take over many routine tasks in time. Meanwhile, human judgement is likely to be as relevant in healthcare in 50 years as it is today (although perhaps the use of that judgement will be applied more narrowly). Physicians encounter things every day that don't conform to previously known patterns, when they must consider non-medical implications in treatment path selection, and have to make judgements and decisions quickly and accurately based on a deluge of information that likely cannot ever fully be fed into a computer. But we do see three areas where AI more broadly has the potential to help improve developed world healthcare systems: (1) speeding up workflows for clinicians and increasing efficiency, (2) reducing error/improving accuracy of diagnoses, and (3) eventually being able to do things that are beyond human capabilities.
- Before we get too excited, however, there are many barriers to a wider adoption of AI solutions in healthcare. First, the inherent requirement of data analytics/AI platforms for access to large-scale, high-quality, well-structured data may ultimately limit the areas in which AI can bring benefits to healthcare in the foreseeable future. Until recently, the ability to tap into all the information available in a hospital was beyond the industry's collective technological capabilities. Although most healthcare providers in developed market health systems have now moved to EHRs, there are still technological issues around interoperability, and thus data transfer between facilities (e.g., physicians' offices, hospitals, labs, etc.) remains a challenge. At the same time, in much of the developed world, AI companies face a challenge accessing patient data due to constraints around patient privacy, ownership of medical information, and data security concerns. This can limit the ability to create new algorithms if adequate training data is not available. Further, much like in the self-driving car scenario, the adoption of AI in healthcare raises ethical and legal questions around who will be responsible for AI errors — is it the hospital, the software company, or the regulator who approved the product?
- Now, how big is the AI opportunity? Your guess is as good as ours as the pathway to commercialize AI opportunities in healthcare remains highly uncertain. However, third-party estimates have put numbers anywhere from US\$30bn to US\$100bn over

⁵²⁰ See report: [EU Medtech: A Primer on AI in medical imaging - evolution or revolution?](#)

the next five to 10 years.⁵²¹ In addition, according to a 2017 report from Accenture (*Artificial Intelligence: Healthcare's New Nervous System*), the top 10 AI applications in healthcare have the potential to generate annual benefits of US\$150bn to the economy by 2026 (see Exhibit 354). Frankly, these are no more than educated guesses today, but the figures at least show the direction of travel.

EXHIBIT 354: Top 10 AI applications in healthcare have the potential to generate annual benefits of US\$150bn to the economy by 2026, according to Accenture



Note: Robot-Assisted Surgery is orthopedic surgery specific.

Source: Accenture, "Artificial Intelligence: Healthcare's New Nervous System" (2017), and Bernstein analysis

And who are the key players/enablers of this trend? A key debate in this field has been whether developments will come from existing healthcare players or from Silicon Valley and tech players. Our view is traditional healthcare players have a key advantage in their ability to access data, which is crucial to training any AI system. We also believe proximity to the patient and strong relationships with hospitals make them better placed than traditional tech players. However, we highlight a few examples across both in the medical imaging space where AI has the potential to make an impact in the near to medium term:

- Deep Mind/Moorfields Study.** In collaboration with Moorfields Eye Hospital NHS Foundation Trust, Google⁵²² DeepMind developed AI to analyze Optical Coherence Tomography (OCT) eye scans. Based on neural networks, the technology can recognize and recommend treatment for a range of eye diseases, including age-

⁵²¹ <https://www.prnewswire.com/news-releases/ai-in-healthcare-market-worth-31-3-billion-by-2025-grand-view-research-inc-300975059.html>; <https://www.alliedmarketresearch.com/artificial-intelligence-in-healthcare-market>; <https://www.marketsandmarkets.com/Market-Reports/artificial-intelligence-healthcare-market-54679303.html>

⁵²² Covered by Bernstein's U.S. Internet analyst Mark Shmulik.

related macular degeneration, diabetic eye disease, and severe myopia. The program has demonstrated 94% accuracy, matching the success rate of Moorfields' own expert clinicians. Importantly, the program also provides clinicians with a breakdown of which disease features it has recognized in the scans, as well as an indication of confidence in its own diagnosis (via a percentage score). For the first results of the collaboration, published in the journal *Nature Medicine* in September 2018, see [Clinically applicable deep learning for diagnosis and referral in retinal disease](#).

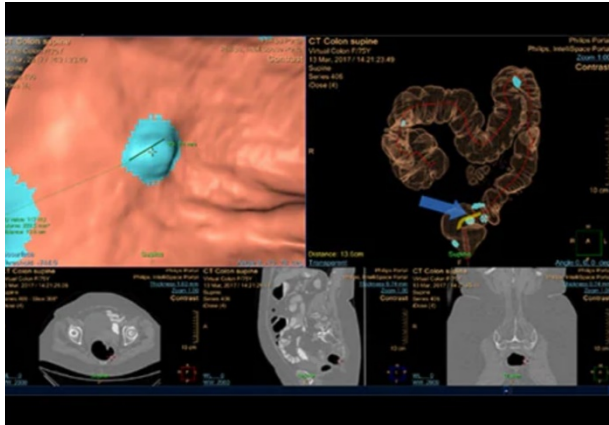
- **IBM Medical Sieve.** The IBM⁵²³ Medical Sieve is a "cognitive assistant" with analytical and reasoning capabilities and a wide range of clinical knowledge (not just oncology) designed to assist in clinical imaging-driven decision making in radiology and cardiology. IBM argues Medical Sieve can analyze clinical images as well as spot and detect problems faster and more accurately than humans, particularly in routine cases. Medical Sieve seeks to free up time for human radiologists to focus on the most complex cases by empowering machines to do some of the routine work.
- **Philips.** Philips' IntelliSpace Portal 10 platform offers a range of Advanced Visualisation applications (see Exhibit 355). Some of these are developed by Philips and others by third parties. One example would be the Philips-developed CT Lung Nodule Assessment (LNA) application, which can use image-based features to assess how likely it is that a detected lung nodule is malignant. Another example of an integrated application is VeraLook from **iCAD**, a third-party software designed to detect potential polyps in CT scans of the colon. The VeraLook algorithm was trained on a library of colonoscopy exams. In addition to offering these applications as individual purchase options, Philips offers Advanced Visualisation as a Service (Avaas), a recurring subscription model that allows hospitals to ensure they have access to the latest Philips-supported software (see Exhibit 356).
- **Intuitive Surgical** has been steadily increasing investment in big data and AI-enabled solutions. For example, Intuitive CEO Gary Guthart recently discussed the concept of a "computational observer" — a robotic copilot that can help make surgeons better and more efficient. We believe this is an extremely powerful idea. Intuitive has collected a significant amount of data over the last 20 years on surgical technique (i.e., what did the surgeon do during the procedure). When these input data are linked with data on patient outcomes, Intuitive can begin to develop predictive insights regarding which choices or surgical techniques tend to be linked with the best outcomes. Then the computer can "observe" an individual surgeon and offer: (a) specific feedback in real time during a procedure and (b) personalized coaching plans outlining what the surgeon needs to practice to generate better patient outcomes more consistently. If a robot can help surgeons get better every time they perform a procedure, imagine the benefits for patients, hospitals, and payers.
- **Alibaba⁵²⁴ Health — Doctor You.** In November 2017, Alibaba Health launched its first AI service for disease diagnosis, Doctor You, in the Chinese market. It can be used for medical image diagnosis of CT scans to identify inflammatory cells in human organs,

⁵²³ Covered by Bernstein's U.S. IT Hardware analyst Toni Sacconaghi.

⁵²⁴ Covered by Bernstein's China Internet analyst Robin Zhu.

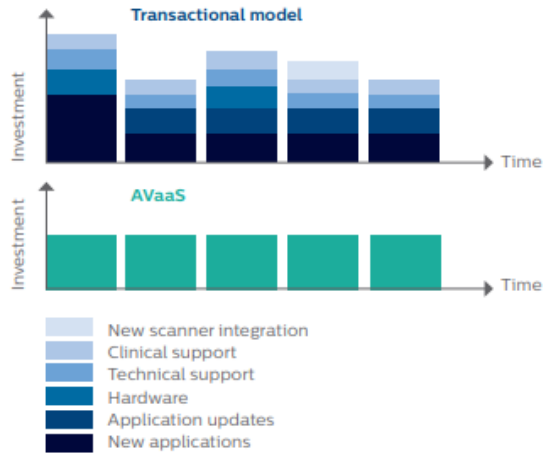
as an early risk indicator of cancer. Doctor You is designed to serve as an assistant to physicians. In a 30-minute trial test demonstration at the launch of Doctor You, it achieved a 90% accuracy rate in detecting lung sarcoidosis (a sign of early stage lung cancer that is particularly tricky to diagnose). Alibaba Health said it took four doctors nearly three hours to process the same amount of patient data using their trained human eyes.

EXHIBIT 355: **Philips' IntelliSpace Advanced Visualisation includes VeraLook CAD for polyp detection**



Source: Philips website and Bernstein analysis

EXHIBIT 356: **Cash flow comparison of a transactional model and AVaaS**

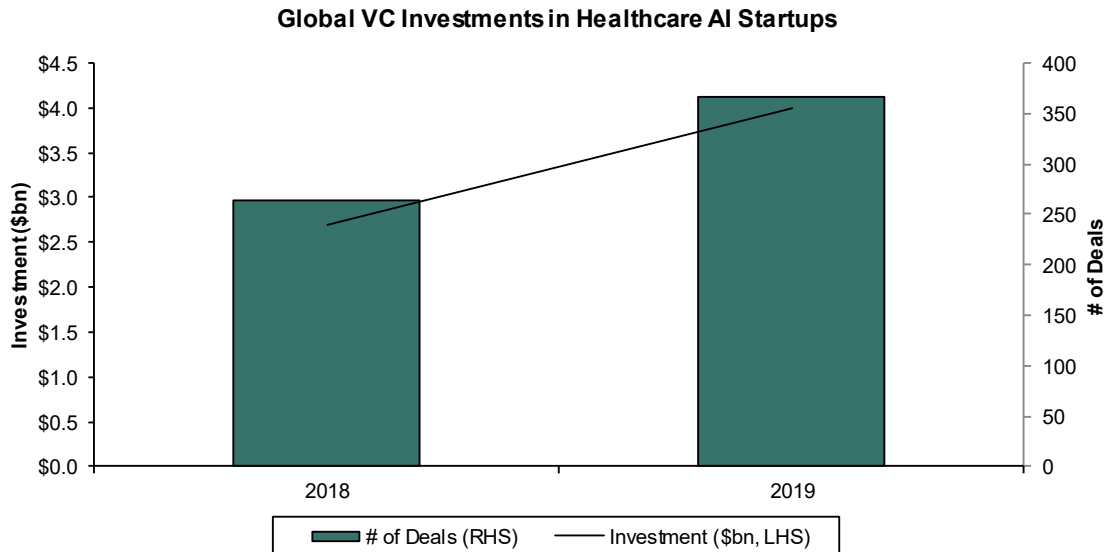


Source: Philips website and Bernstein analysis

Beyond these big tech companies and large medical device suppliers, venture capital funding has also been pouring into startups in the healthcare AI space, with US\$4bn in investments across 367 deals globally, up from US\$2.7bn in 2018 across 264 deals (see Exhibit 357).⁵²⁵ While it's difficult to tell who's ahead in the race of building out AI capabilities, our research in the industry indicates imaging equipment players are well placed due to their close relationships with hospitals, giving them better access to data. Meanwhile, as we build out the IT infrastructure and establish a more robust regulatory framework to support the development of AI in healthcare, this could unlock significant opportunities for all players over the longer term.

⁵²⁵ <https://www.fiercehealthcare.com/tech/investors-poured-4b-into-healthcare-ai-startups-2019>

EXHIBIT 357: **Venture capital funding has been pouring into startups in the healthcare AI space, with US\$4bn investments across 367 deals globally, up from US\$2.7bn in 2018 across 264 deals**



Source: CB Insights and Bernstein analysis

As we pursue structural healthcare reforms to improve the affordability of healthcare, this could separate winners and losers among healthcare providers. We expect companies that are able to adapt their business models to focus on true innovations that improve patient outcomes to be long-term winners. Further, cloud computing and data analytics tools could provide the critical infrastructure needed for healthcare providers to more holistically evaluate patients' health outcomes and to provide lower-cost services (e.g., through telemedicine and AI), although data privacy and other technological and regulatory issues remain near-term hurdles to the wider adoption of big data in healthcare.

INVESTMENT IMPLICATIONS

US Healthcare Services

We rate CVS and UnitedHealth Group Outperform; and HCA Market-Perform.

EU Biopharmaceuticals

We rate Novo Nordisk and Roche Holding Outperform.

EU Medical Devices

We rate Koninklijke Philips NV and Coloplast Outperform; and DaVita and Fresenius Medical Care Market-Perform.

US Medical Devices

We rate Johnson & Johnson and Intuitive Surgical Outperform; and Edwards Lifesciences Market-Perform.

EXHIBIT 358: **Bernstein ticker table**

Ticker	Rating	Currency	29-Nov-2021 Closing Price	Target Price
HCA	M	USD	229.92	261.00
CVS	O	USD	92.02	100.00
UNH	O	USD	452.00	508.00
NOVOB.DC	O	DKK	715.70	725.00
ROG.SW	O	CHF	357.50	400.00
CLPBY	O	USD	16.31	20.50
COLOB.DC	O	DKK	1,074.50	1,350.00
PHG	O	USD	35.88	50.50
PHIA.NA	O	EUR	31.75	45.00
SHL.GR	O	EUR	64.66	68.00
FMS	M	USD	30.22	38.00
FME.GR	M	EUR	53.54	64.00
DVA	M	USD	96.91	112.00
EW	M	USD	110.71	125.00
ISRG	O	USD	334.74	395.00
JNJ	O	USD	159.75	180.00
MSDLE15			1,856.96	
SPX			4,655.27	

Source: Bloomberg, and Bernstein estimates and analysis

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LOOKING FOR THE NEXT ESG MEGA TRENDS?

Unicorn startups might give us a clue

HIGHLIGHTS

- The future of ESG will be led by new products and technologies. From clean energy to alternative meat, from robotic surgery to digital banking, these innovations have become key enablers of ESG development. Where to find the next ESG mega trend? We tap into the venture capital world as a barometer to identify emerging technologies and business models that could define the next generation of ESG investments — classifying ~850 unicorns (valued at over US\$1bn) as a proxy for the latest and greatest trends. Among these unicorns, we identified 197 (or 23%) as ESG-oriented (or meaningfully contributing to one or more of the UN Sustainable Development Goals (SDGs)).
- **Health and Wellbeing** is the most represented SDG, especially in North America. While public equity ESG investors have mostly focused on climate-related investment opportunities so far, we expect ESG investors to turn their attention toward the health and wellbeing space as these emerging technologies mature over time.
- **Climate Action** remains a salient issue in the VC space. The majority of unicorns contributing to this goal (14 out of 27) are involved in the **EV supply chain**. We expect this to create opportunities not only for EV OEMs but also for enablers such as battery manufacturing, charging infrastructure, AI technology for EVs, and recycling players.

UNICORNS: ESG FORCE TO BE RECKONED WITH

Unicorns are the most successful startups that are valued at over US\$1bn. We've identified ~850 unicorns based on the Crunchbase Unicorn List as a proxy for the latest and greatest VC investment trends today. These unicorns collectively represent US\$2.9tn in equity valuation, with ~50% based in North America, followed by Asia and Europe (see Exhibit 359 and Exhibit 360). This is proportional to the relative size of the VC market by region.⁵²⁶

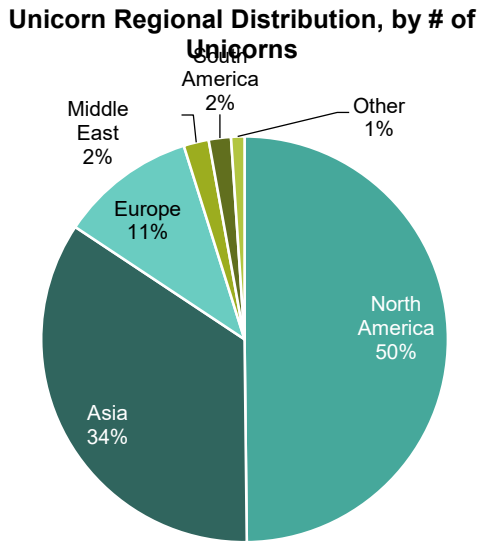
Capital deployment in the VC market has hit all-time highs. In Q3 2021, global VC investments were US\$158bn. This figure is up 105% YoY from Q3 2020. With more VC dollars available, unicorns are emerging at a rapid pace. In all of 2020, a total of 159

⁵²⁶ Unless otherwise noted, the unicorns referenced in this report are private and not covered by Bernstein analysts.

Unicorns were added to the CrunchBase Unicorn List. In Q1 2021 *alone*, the list saw an increase of 112 companies.⁵²⁷

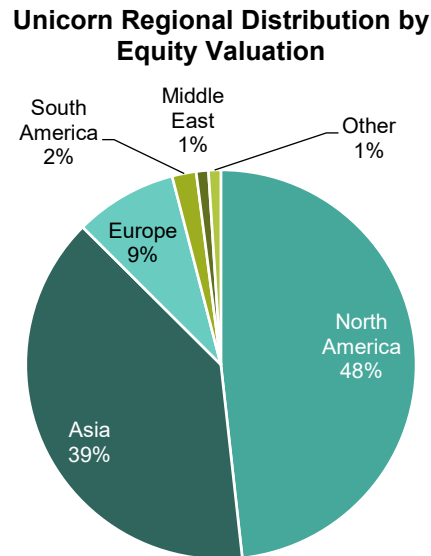
Are any of these unicorns pursuing ESG-related goals? And, as they start coming to the public equity market, what should ESG investors be looking out for? In the following section, we map these unicorns to relevant UN SDGs, where possible, to identify the next-generation ESG mega trends.

EXHIBIT 359: **Majority of unicorns are headquartered in North America and Asia, in terms of number...**



Source: Crunchbase and Bernstein analysis

EXHIBIT 360: **...as well as their equity valuations**



Source: Crunchbase and Bernstein analysis

MAPPING TO THE UN SDGS

In 2015, the UN established its 2030 agenda for sustainable development. Part of the UN's agenda lays out 17 Sustainable Development Goals supported by a total of 169 targets to measure progress. These [goals](https://sdgs.un.org/goals#:~:text=Transforming%20our%20world%3A%20the%202030,New%20York%20in%20September%202015)⁵²⁸ build on the UN's 2015 Millennium Development Goals and incorporate three dimensions of sustainable development: economic, social, and environmental. They seek to address issues including poverty, hunger, health, education, gender equality, water, energy, decent work, infrastructure, inequalities, sustainable cities, consumption, climate change, marine life, biodiversity, peace, and international partnership (see Exhibit 361).

To identify key themes and emerging opportunities, we map the ~850 unicorns to these UN SDGs, where possible. We define a company as advancing ESG practices if the *primary* business operations meaningfully contribute to one or more of the UN SDGs. Examples include an EV company helping combat carbon emissions (SDG 13) or a financial company

⁵²⁷ <https://news.crunchbase.com/news/global-venture-hits-an-all-time-high-in-q1-2021-a-record-125-billion-funding/>

⁵²⁸ <https://sdgs.un.org/goals#:~:text=Transforming%20our%20world%3A%20the%202030,New%20York%20in%20September%202015>.

reducing the friction and costs for migrant workers to send remittances back to their home countries (SDG 8).

EXHIBIT 361: **UN SDGs provide a global framework for thinking about the world's greatest challenges and opportunities**

Sustainable Development Goals		
People	#1	No poverty
	#2	Zero hunger
	#3	Good health and well-being
	#4	Quality education
	#5	Gender equality
Planet	#6	Clean water and sanitation
	#7	Affordable and clean energy
	#13	Climate Action
	#14	Life below water
	#15	Life on land
Prosperity	#8	Decent work and economic growth
	#9	Industry, innovation and infrastructure
	#12	Responsible consumption and production
Peace	#10	Reduced inequalities
	#11	Sustainable cities and communities
	#16	Peace, justice and strong institutions
Partner-ship	#17	Partnerships for the goals

Source: Harvard Law School, United Nations, and Bernstein analysis

Among the ~850 unicorns, we have identified 197 as meaningfully contributing to one or more of the SDGs, which account for 23% of unicorns and US\$626bn in equity valuation (see Exhibit 362 and Exhibit 363).

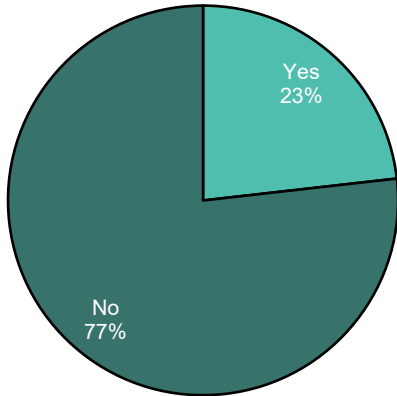
The percentage of unicorns founded in any given year that contribute to SDGs has been on the rise, from an average of 16% in the 2000s to 23% in the 2010s (see Exhibit 364). Notably, this percentage peaked at 35% for unicorns founded in 2017. We've seen a decline among unicorns founded in more recent years, although recent data is less reliable as it takes an average of seven years for the best startups to reach unicorn status.⁵²⁹ So far, we only have a small sample size of startups that were founded over the past two to three years that have reached the US\$1bn mark, of which ~10-20% contribute to SDGs. This might also suggest that it takes longer for some ESG-oriented startups to reach scale as

⁵²⁹ <https://www.valuewalk.com/2018/06/unicorn-status-valuation/>

they pursue long-term objectives and look to address complicated environmental/social problems.

EXHIBIT 362: Among ~850 unicorns, we've identified 197 as meaningfully contributing to one or more of the SDGs, accounting for 23% of unicorns...

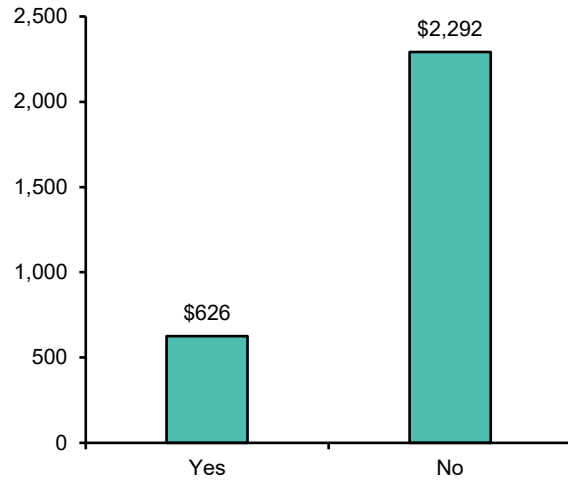
% of Unicorn Start-ups Meaningful Contributing to UN SDG



Source: Crunchbase and Bernstein analysis

EXHIBIT 363: ...and representing US\$626bn in equity valuation

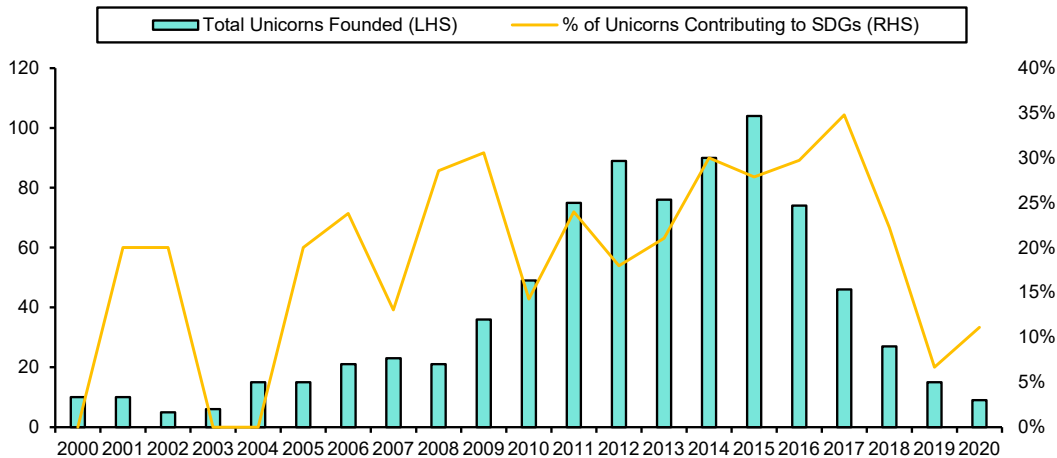
Equity Valuation Meaningfully Contributing to UN SDG Among Unicorns (\$Bn)



Source: Crunchbase and Bernstein analysis

EXHIBIT 364: Percentage of unicorns that contribute to SDGs has been on the rise, from an average of 16% in the 2000s to 23% in the 2010s; however, more recent data is less reliable as it takes an average of seven years to reach unicorn status

of Unicorns Founded and % of Unicorns Contributing to SDG by Year

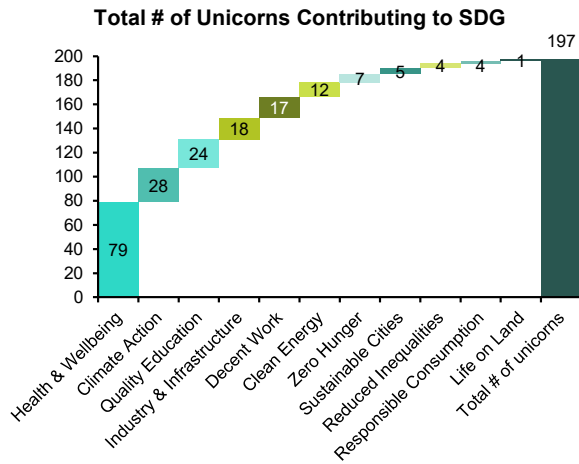


Source: Crunchbase and Bernstein analysis

UNICORNS BY SDG

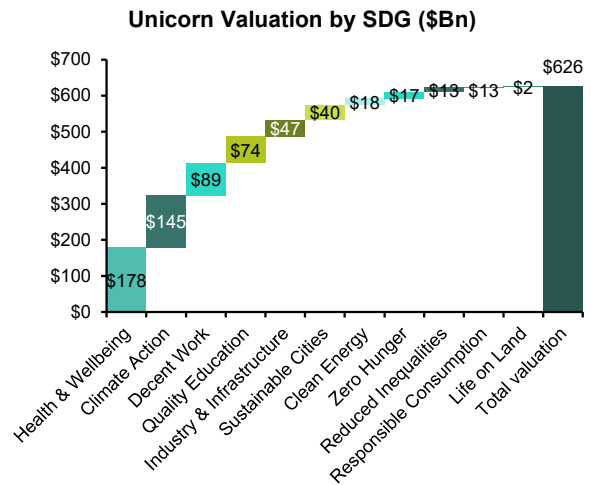
By SDG, we've identified 79 unicorns that primarily contribute to the Health and Wellbeing goal, followed by 28 that contribute to Climate Action (see Exhibit 365). On a valuation basis, unicorns that contribute to the Health and Wellbeing goal represent US\$178bn in equity valuation, followed by Climate Action (US\$145bn) (see Exhibit 366).

EXHIBIT 365: **We've identified 79 unicorns that primarily contribute to the Health and Wellbeing goal, followed by 28 that contribute to Climate Action**



Source: Crunchbase and Bernstein analysis

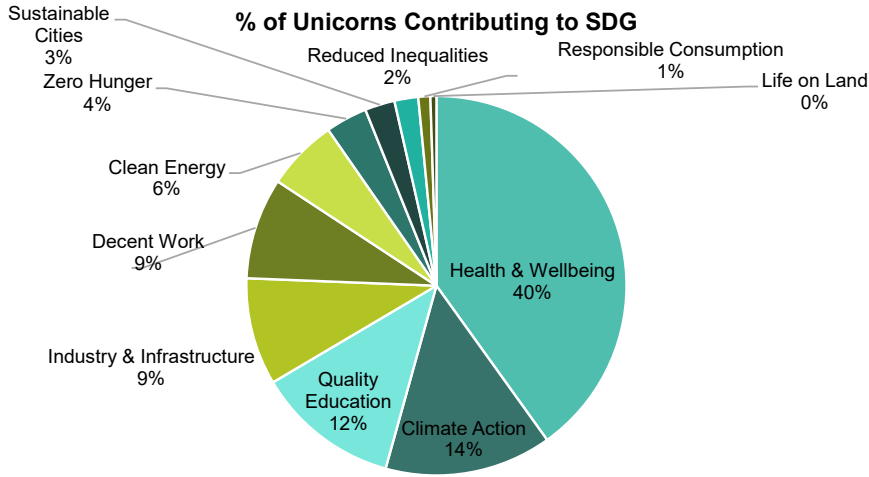
EXHIBIT 366: **Unicorns that contribute to the Health and Wellbeing goal represent US\$178bn in equity valuation, followed by Climate Action (US\$145bn)**



Source: Crunchbase and Bernstein analysis

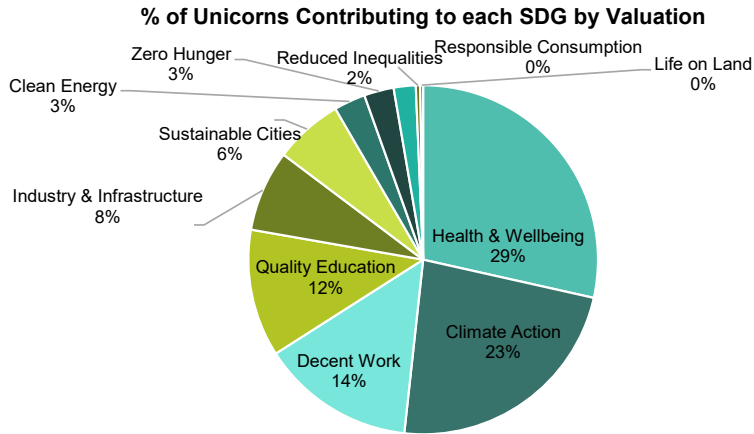
It's worth noting that 40% of ESG-oriented unicorns contribute to the Health and Wellbeing goal, but they only represent 29% of total equity valuation, which suggests these companies have a lower valuation on average. In comparison, 14% of unicorns contribute to the Climate Action goal — they have a higher average valuation and represent 23% of equity valuation in aggregate (see Exhibit 367 and Exhibit 368).

EXHIBIT 367: 40% of ESG-oriented unicorns contribute to the Health and Wellbeing goal, but they only represent 29% of total equity valuation, which suggests these companies have a lower valuation on average



Source: Crunchbase and Bernstein analysis

EXHIBIT 368: In comparison, 14% of unicorns contribute to the Climate Action goal; they have a higher average valuation and represent 23% of equity valuation in aggregate

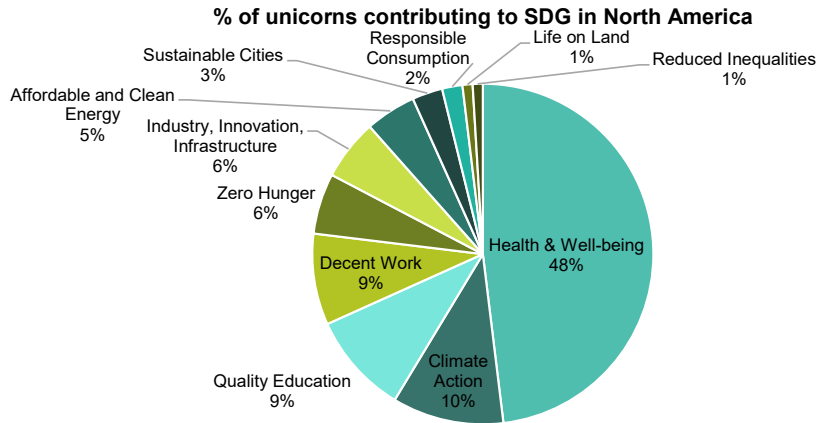


Source: Crunchbase and Bernstein analysis

SDG CONTRIBUTIONS BY REGION

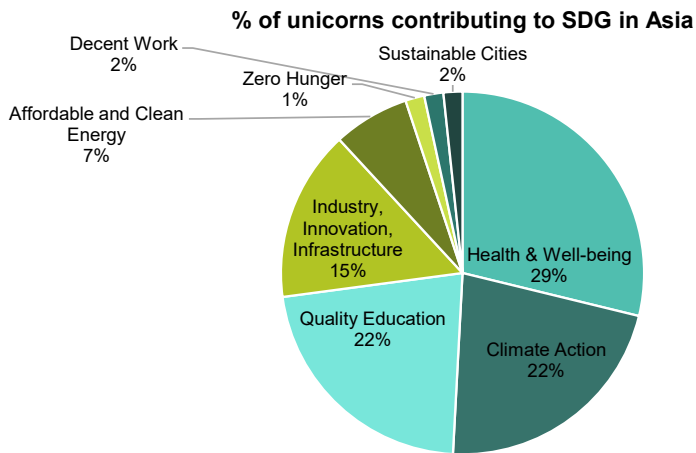
By region, Health and Wellbeing is the No. 1 objective among unicorns in North America (48%), Europe (36%), and Asia (29%) (see Exhibit 369 to Exhibit 371). Outside of Health and Wellbeing, 22% of unicorns in Asia are focused on Climate Action, and the same percentage on Quality Education, which we will discuss further in the following sections. In Europe, Decent Work takes precedence over Climate Action as the second most prevalent SDG. This is likely because European companies have already been working on climate solutions for a number of years now, such that most innovations in the VC space are focused on other emerging issues.

EXHIBIT 369: **In North America, Health and Wellbeing is by far the most prevalent SDG objective among unicorns (48%)**



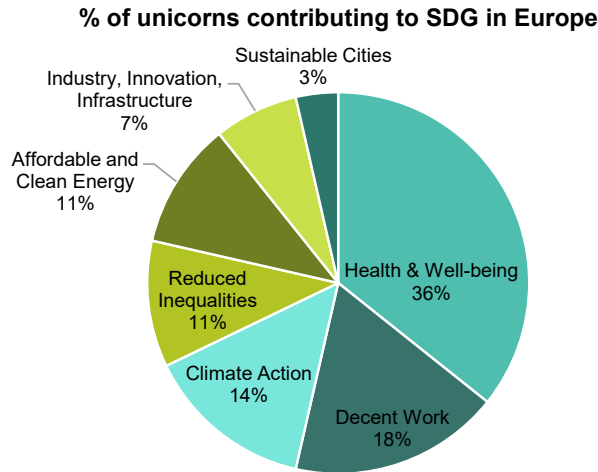
Source: Crunchbase and Bernstein analysis

EXHIBIT 370: **Beyond Health and Wellbeing, Asia has a greater percentage of unicorns contributing to Climate Action and Quality Education**



Source: Crunchbase and Bernstein analysis

EXHIBIT 371: In Europe, Health and Wellbeing and Decent Work take precedence over Climate Action as the most prevalent SDGs, likely as European companies have already been working on climate solutions for many years



Source: Crunchbase and Bernstein analysis

+ WHAT ARE THE NEXT-GENERATION ESG MEGA TRENDS?

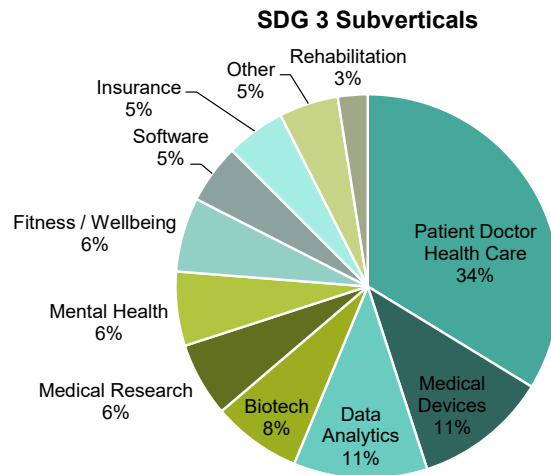
In the following section, we take a closer look at notable innovations and new business models that unicorn startups are pursuing within each of the major UN SDGs.

HEALTH AND WELLBEING: GENOME SEQUENCING, BIG DATA & AI, AND HEALTHCARE LOGISTICS

The UN's SDG 3 to "ensure healthy lives and promote wellbeing for all at all ages" (or Health and Wellbeing) is the most represented goal among unicorn startups globally. While public equity ESG investors have primarily focused on climate-related investment opportunities so far, we expect ESG investors to turn their attention toward the health and wellbeing space as these emerging technologies mature over time.

The Health and Wellbeing goal spans a number of categories. Over one-third of unicorn companies fall under the Patient-Doctor Health Care category, which covers companies that provide physician care, treatment for illness, teleconsultation, etc. This is followed by medical device manufacturing, data analytics, and biotech (see Exhibit 372).

EXHIBIT 372: The Health and Wellbeing goal spans a number of categories: over one-third of companies fall under Patient-Doctor Health Care, followed by medical devices, data analytics, and biotech



Source: Crunchbase and Bernstein analysis

We highlight a few notable unicorns and their business models here:

- **Oxford Nanopore Tech (ONT)** is a UK-based company that develops nanopore-based electronic systems for next-generation DNA and RNA sequencing. The quest to sequence our genome began with the Human Genome Project in the 1990s, using sequencing techniques based on the Sanger method that were manual and time consuming. New entrants have since revolutionized the genome sequencing space. Oxford Nanopore's first sequencing product, the MinION sequencer, was the only portable sequencing device for low-cost real-time out-of-lab analysis. The company has since developed two other sequencers, the GridION and the PromethION. As of 2019, the company holds about ~2% of the US\$4.2bn next-generation sequencing instrumentation market. Our European Medical Devices & Services team believes there is significant room for ONT to gain market share, given the platform's small size, rapid availability of results, and lower cost. The company launched commercial sales in 2015 and grew to £52mn in revenue in 2019. For further analysis, see our European Medical Devices & Services team's pre-IPO research on Oxford Nanopore Tech.⁵³⁰
- **Zipline** is a California-based company that owns a system of autonomous drones for delivering essential medical supplies. Zipline launched operations in emerging markets such as Rwanda and Ghana, where last-mile delivery is inaccessible due to poor or non-existent transportation infrastructure. Zipline's Unmanned Aerial Vehicle (UAV) design can reach ranges orders of magnitude farther than electric quadcopters, resulting in cost savings as fewer fulfillment centers are needed. Its autonomous, electric-powered UAVs also have better margins than large internal combustion vehicles. With backing from investors such as Andreessen Horowitz, Goldman Sachs, and the Bill and Melinda Gates Foundation, Zipline recently began operations in the

⁵³⁰ See report: [Oxford Nanopore: Pre-IPO Research - An introduction to the company with the potential to disrupt genomics.](#)

US. The company partnered with Novant Health to deliver essential Covid-19 supplies in the Southeast region.⁵³¹ Although federal regulations pose near- to medium-term headwinds, as the company continues to prove itself in emerging markets and as the aerial mobility industry matures, Zipline could disrupt the future of healthcare logistics.

- **Benchling** is a B2B cloud-based software platform for life science R&D. The software increases data efficiency and interconnectivity across the entire R&D lifecycle. Benchling addresses frictions of legacy technology, including altering configurations for process development, integration with lab notebooks, and cross-workflow data capture and analysis. The company is backed by Andreessen Horowitz and Y Combinator, among others. As of April 2021, it serves over 450 customers including Regeneron, Gilead, Sanofi, and Corteva Agriscience. Although no official date has been set, the founders have noted that the company is laying the groundwork for an IPO. Despite some regulatory concerns around healthcare data privacy protection, we believe big data analytics could play a major role in making quality healthcare more accessible going forward.
- **CMR Surgical** is a UK-based surgical robotics company. The robot allows surgeons to conduct procedures traditionally performed via open surgery through a minimally invasive technique. Minimally invasive surgery both improves the quality of care through the reduced likelihood of surgical complications and increases accessibility through cost reduction. Additionally, robotic surgery democratizes access to quality care by reducing case-by-case variability in surgical outcomes. For example, laparoscopic surgeons who rank in the bottom quartile among peers based on technical skill encounter ~3x more complications and ~2x more reoperations and readmissions than top-quartile surgeons when performing certain procedures. The company is also transforming digital healthcare through data analytics. The robot is a digital interface between the surgeon and patient, and accumulates data to provide learning and feedback. In the public equity space, our analysts have written extensively about robotic surgery and healthcare AI players such as Intuitive Surgical⁵³² and Philips.⁵³³

CLIMATE ACTION: EVS AND EVTOL

Beyond Health and Wellbeing, Climate Action continues to be a salient issue in the VC space. The UN's 13th SDG calls us to "take urgent action to combat climate change and its impacts." This includes a shift from fossil fuels and a reduction in GHG emissions.

The majority of unicorns contributing to the Climate Action goal (14 out of 27) are involved in the EV supply chain. Others include micro-mobility and electric vertical takeoff and landing (eVTOL) startups. 48% of unicorns contributing to SDG 13 (and 53% by equity valuation) are based in Asia (see Exhibit 373 and Exhibit 374). Conversely, European

⁵³¹ <https://techcrunch.com/2020/05/26/zipline-begins-us-medical-delivery-with-uav-program-honed-in-africa/>

⁵³² Covered by Bernstein's U.S. Medical Devices analyst Lee Hambricht; see report: [Intuitive Surgical: ESG in Action... We have a massive global shortage of surgeons. Can robots fix it?](#)

⁵³³ Covered by Bernstein's European Medical Devices & Services analyst Lisa Clive.

startups only make up a small proportion of the pie, likely as companies in Europe have been working on climate solutions for a number of years now.

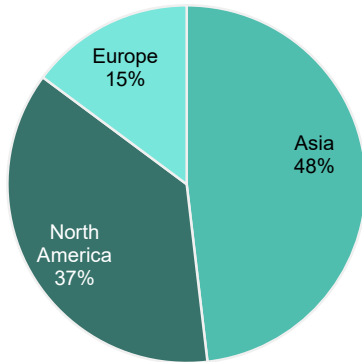
Within Asia, almost all companies contributing to SDG 13 are headquartered in China. The country has committed to carbon neutrality by 2060. EVs will likely play a major role in supporting China's green transition.

China has been a frontrunner for EV adoption. Of the 14 EV unicorns, 11 are based in China. In 2009, the government began providing subsidies for EVs to encourage demand. The country planned to phase out the subsidies in 2020, but to help automakers recover from the Covid-19 pandemic, subsidies have been extended by two more years. After phasing out subsidies, China expects to continue to grow EV sales to represent 40% of all auto sales by 2040, although this timeline may be pushed out due to Covid-19-related disruptions.⁵³⁴ Additionally, the country is supporting the necessary charging infrastructure for EVs. As of 2019, the country had over 1.2 million charging stations and is looking to add around 600,000 in 2021, supported by an infrastructure stimulus package.⁵³⁵ China is expected to continue to lead the world with the largest EV fleet (see Exhibit 375). This will create opportunities not only for EV manufacturers but also for enabling technologies such as battery manufacturing, charging infrastructure, AI technology for EVs, and recycling players.

EXHIBIT 373: 48% of unicorns contributing to SDG 13 (and 53% by equity valuation) are based in Asia...

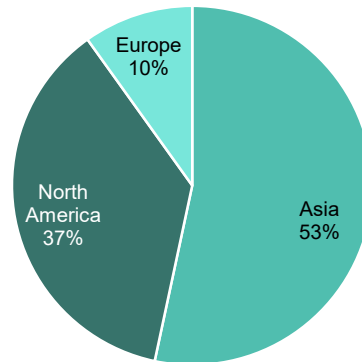
EXHIBIT 374: ...while European startups make up a small proportion this is likely because they have been working on climate solutions for a number of years

% Unicorns Regionally Contributing to Climate Action



Source: Crunchbase and Bernstein analysis

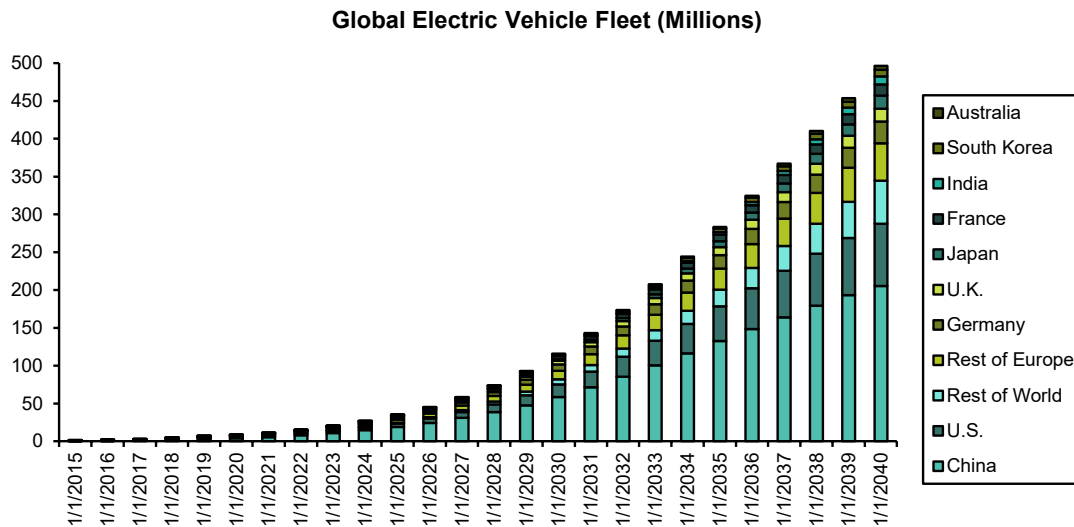
% Unicorns Regionally Contributing to Climate Action by Valuation



Source: Crunchbase and Bernstein analysis

⁵³⁴ <https://www.reuters.com/article/us-china-autos-policy-electric-exclusive/exclusive-china-may-ease-electric-car-quotas-delay-emission-rules-to-help-automakers-sources-idUSKBN21J4WP>

⁵³⁵ <https://www.greenbiz.com/article/look-inside-chinas-timely-charging-infrastructure-plan>

EXHIBIT 375: **China is expected to continue to lead the world with the largest EV fleet**

Source: BNEF and Bernstein analysis

eVTOL is another emerging trend that could contribute to the low carbon transition. Among the Crunchbase Unicorn list, there are three eVTOL companies: Joby Aviation, Lilium, and Volocopter. These companies are manufacturing aircraft for two types of urban mobility: intracity air taxis and short-haul regional transport.

While we are excited about the prospect of eVTOL companies disrupting urban mobility, our Industrials and Materials team believes there are still significant barriers to its adoption. Current battery technology does not lend itself to extended air travel due to its heavy weight and lack of energy storage. Other hurdles include building out the infrastructure, meeting safety and regulation standards, and sustaining profitable unit economics. For further analysis, see the Bernstein Industrials and Materials team's note on the eVTOL landscape.⁵³⁶

It's also worth considering the net environmental and social impact of eVTOL. For example, some studies have found eVTOLs have greater GHG emissions for the first 40km travelled compared to internal combustion engine vehicles (ICEVs), but become more efficient beyond the first 40km.⁵³⁷ We also wonder if eVTOL will grow at the expense of public transportation, which is among the most energy-efficient forms of transportation. Beyond the environmental impact, eVTOL companies have the ambition to significantly reduce the cost of air taxis as they reach scale over time to make eVTOLs affordable for the mass population. However, before we reach this moonshot goal, could eVTOL offer convenience only to those who can afford it and further widen the gap between the haves and have-nots? Despite these concerns, we believe these new technologies and products will shape

⁵³⁶ [Industrials & Materials Blast: eVTOL - Will we fly on air taxis in 2024? Nine questions before we meet George Jetson](#)

⁵³⁷ <https://transportup.com/headlines-breaking-news/flying-cars-and-the-environment-a-study-from-university-of-michigan/>

the future of transportation and could present new investment opportunities to ESG investors going forward.

DECENT WORK: FINANCIAL
INCLUSION AND DIGITAL
BANKING

The UN's 8th SDG calls to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all." This is the third most prevalent goal on a valuation basis and the fifth most prevalent on a count basis among unicorns globally.

Unicorns contributing to SDG 8 are primarily companies that promote financial inclusion, particularly digital banking. The secular trend of digital banking is an important shift in our financial system. It opens the doors for traditionally excluded groups to gain access to financial services. However, this does not come without risks. Users without financial education are left vulnerable to exploitation, and a shift to digital presents data security risks. Below are a few examples of unicorns driving financial inclusion:

- **Dave** is a challenger banking and fintech company with the goal of improving the average American's financial health. The company's three primary products are (i) overdraft protection with zero-fee advances of up to US\$200; (ii) the first financial platform for forecasting upcoming bills to help budget paychecks; and (iii) "Side Hustle," a platform to connect members to the gig economy to make extra money on the side. Additionally, the company launched Dave Banking in December 2020. As of June 2021, Dave Banking has already attracted 1.3 million members. These users primarily come from Dave's existing base of customers, which creates a low customer acquisition cost for its new banking services. Dave's TAM is the 150 million Americans living paycheck to paycheck, those who can't afford a US\$400 emergency, and frequent overdrafters. The company generated US\$122mn of revenue in 2020, of which about 10% was from Dave Banking, its fastest-growing segment. Dave is preparing to go public via a special-purpose acquisition company (SPAC) sponsored by Victory Park Capital. For more detail, see Harshita Rawat's Reinventing Banking, Fireside Chat with Co-Founder and CEO of Dave.⁵³⁸
- **Nubank** is a Brazilian fully digital bank providing financial services to the traditionally underbanked. Brazil's legacy banking system is concentrated in big institutions, and the country has a large unbanked population. The situation is similar across all of Latin America, where there are around 250 million people without access to financial services. Nubank is democratizing financial services by providing a platform for all people to save and spend money with zero fees. The company also provides insurance, personal loans, investment products, and other essential services to help promote financial inclusion. It is backed by investors such as Goldman Sachs, Tencent, and Ribbit Capital, and recently received a US\$500mn investment from Berkshire Hathaway. As of June 2021, it is the largest fintech company in Latin America with 40 million users in Brazil, Columbia, and Mexico.⁵³⁹ Notably, the company faced criticism

⁵³⁸ https://www.bernsteinresearch.com//brsvc/replay.aspx?fileinfo=evt0000000031336**bca6261405282001ak2s3

⁵³⁹ <https://www.wsj.com/articles/berkshire-hathaway-to-buy-500-million-stake-in-brazils-nubank-11623153600>

in late 2020 when its cofounder made a controversial comment in a TV interview that was viewed as racist. It has since committed to set racial inclusion goals.

OTHER EMERGING TRENDS:
GLOBAL CONNECTIVITY,
DISRUPTIVE AGRICULTURE, AND
ED TECH

Global connectivity is a major component of the UN's SDG 9 (Industry, Innovation, and Infrastructure). According to the UN, as of 2019, fewer than one in five people use the internet in the least-developed countries. Studies show internet access improves health, reduces inequality, improves educational outcomes, leads to a stronger civic society, and helps eliminate poverty.⁵⁴⁰ For remote regions, providing connectivity through fiber optic cable networks and other internet solutions is not as feasible as connecting through satellite networks. However, legacy satellite technology is incredibly expensive. We've identified multiple unicorns with innovative technology to address this problem.

- **Astranis** is a California-based satellite company focused on providing internet access to remote regions. Its satellite technology is 20x smaller in size than legacy technology, making it both simpler and cheaper to launch. The company has completed major technical testing milestones and aims to launch its first commercial satellite in 2021 to provide greater internet access to Alaska, where 39% of the population does not have reliable access to the internet. The company is backed by Andreessen Horowitz, and recently raised US\$250mn in Series C funding led by BlackRock.⁵⁴¹

Disruptive agriculture is another trend we see among unicorns. According to the UN, food insecurity has been on the rise, which is only worsened by the Covid-19 pandemic. Sustainable agricultural solutions help reduce food waste and resource use and ultimately drive down food costs. Within the Crunchbase Unicorn list, there are five companies with AgTech solutions, one of which is **Bowery Farming**, an indoor vertical farming solution provider. The company's processes use 95% less water than traditional farming, don't require pesticides, and its land is 100x more efficient than traditional farming solutions. Because of land efficiency, the company's farms are located just outside of New York City, which reduces transportation costs and the associated environmental impact. The company has grown 750% since 2019 on the back of pandemic-related tailwinds. It currently supplies 850 stores, including big names such as Walmart, Whole Foods, and Giant Foods. In May 2021, the company completed a US\$300mn Series C funding led by Fidelity, bringing its valuation to US\$2.3bn.⁵⁴²

Elsewhere, **Education Technology** (EdTech) has also seen growth accelerated by the Covid-19 pandemic, given the increased demand for remote learning. Notably, over 50% of unicorns contributing to SDG 4 (Quality Education) are headquartered in Asia, of which 84% are based in China. Asian EdTech unicorns primarily focus on augmenting K-12 education. In contrast, many North American EdTech Unicorns offer upskilling of technical skills, particularly for information technology roles. The focus on K-12 education in China could be the result of its overall more competitive education system. Although EdTech companies could make quality education more accessible, we wonder if they could also

⁵⁴⁰ <https://medium.com/@johngedmark/getting-4-billion-people-online-a5784d13abf8>

⁵⁴¹ <https://techcrunch.com/2021/04/14/astranis-raises-250m-at-a-1-4b-valuation-for-smaller-cheaper-geostationary-communications-satellites/>

⁵⁴² <https://techcrunch.com/2021/05/25/indoor-farming-company-bowery-raises-300m/>

make an already competitive system even more competitive. In fact, the sector came under regulatory scrutiny recently in China after President Xi Jinping suggested that the surge in after-school tutoring was putting immense pressure on China's students.⁵⁴³ Additionally, depending on the target audience for EdTech platforms, EdTech companies could simply be providing more resources and opportunities for those who already had access, ultimately further widening education inequality. However, with increased global connectivity and more robust regulations, EdTech could be a growing market with the opportunity to increase access to education.

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⁵⁴³ <https://www.verdict.co.uk/china-edtech-ipo-crackdown/>

BERNSTEIN

APPENDIX: VALUATION METHODOLOGY & RISKS

This section details the sector-wide valuation methodology used to arrive at our target prices, and related risks. For company-specific details on valuation methodology and risks, refer to www.bernstein.research.com.

VALUATION METHODOLOGY

European Autos

We value EU automotive companies based on one/two-year-forward multiples. Based on the point in the cycle, these can vary between PE, EV/sales, and EV/EBITDA. In some cases, we also use sum-of-the-parts (SoTP) valuation. Our EV multiples are for the industrial (autos) operations, and we value captive Financial Services operations separately with their book value. Truck makers and super sport niche makers are valued with respect to their industrials and luxury goods peer groups.

Global Metals & Mining

Our valuation framework for our coverage of Global Metals & Mining stocks varies by company, but is driven by: (a) a top-down approach using near-term future forecast EBITDA multiplied by the appropriate multiple (EV/EBITDA), and (b) a bottom-up approach using a set of life-of-asset DCFs for the most important assets in a company's portfolio modeled under our assumptions of commodity prices and asset properties.

We adjust our target multiples and discount to NPV to include the effects of growth, balance sheet strength/weakness, capital efficiency, management premium/discount, FCF yield, and risks, especially around ESG.

European Industrial & Consumer Chemicals

We value our companies using a mix of relative P/E, EV/EBIT, and DCF methodologies. We calculate an arithmetic average of these methodologies for each company, and then increase this by 4.5% (long-run market return of 7% minus a dividend yield of 2.5%) to calculate our 12-month target prices. For Croda, BASF, Evonik, Bayer, Umicore, and JMAT, we additionally use a SoTP model. For companies in a potential M&A deal, we also use probability-weighted valuation to calculate the target price.

Global Luxury Goods

Luxury goods stocks tend to trade short term on organic growth positive/negative surprises. Longer term, we believe there is value in taking a more structural stance. We have a multipronged proprietary methodology to ascertain structural appeal. We use target-relative PEs to establish our price targets, and gear those target-relative PEs to our

structural assessment scores. We make an exception for Farfetch, where we use a target EV/Sales multiple, using a correlation of EV/Sales to "take rate" with a number of other platforms.

US Food

Our primary valuation mechanism is derived from market multiples. To set our target prices, we begin with the current forward EV/EBITDA ratio for the S&P500 based on consensus estimates. We then establish a premium or discount for the US Food sector relative to the S&P based on forward EV/EBITDA ratios. For individual food companies, we apply a deserved premium/discount relative to the forward EV/Adjusted EBITDA for the food sector. Our deserved premium or discount is based on near-term and longer-term EBIT growth relative to the US packaged food group as a whole. We apply this forward EV/Adjusted EBITDA ratio to our forward adjusted EBITDA estimates beginning a year from now. This generates the Enterprise Value (EV) for each company, from which we subsequently derive equity value and ultimately a 12-month target price based on our 12-24-month adjusted EBITDA estimate.

European Food

We value the European Food sector in two steps. We use EV/EBITDA multiples as our preferred way of valuing the companies. We first value the sector in aggregate, looking at current sales growth and profitability of the sector, 10-year bond yields, and current earnings growth versus the MSCI Europe Sector. The companies are then valued on relative EV/EBITDA versus the sector. Relative EV/EBITDA multiples are based on each company's long-term sales growth, short-term sales growth, current 10-year bond yields with each company's individual sensitivity to bond yields, and earnings growth. We apply those valuation multiples against our NTM forecast of EBITDA and the 12 months beyond that, to derive our price targets.

The sector trades at a premium to the market today, which in our view is justified by superior prospects. Compared to the market, the group promises:

- Higher ROIC;
- High cash conversion, leading to a reliable income stream;
- Steady growth, keeping close track of global GDP growth;
- Inflation protection as the sector is typically able to pass on pricing similar to global CPI; and
- Resilience in times of economic downturns as the sector has a very low sales beta to economic growth.

European Beverages

We value stocks based on an analysis of relative price-to-earnings (P/E) multiples backed up by conservative discounted cash flow analysis (DCF). We believe the two most important drivers of P/E are profit growth and return on capital.

The sector trades at a premium to the market today, which in our view is justified by superior prospects. Compared to the market, the group promises:

- Faster growth
- Higher ROIC
- Earnings stability

For these reasons, we believe a 50% long-term premium to the MSCI Europe is appropriate for the sector.

Within the group, we believe stocks with higher long-term secular growth rates and higher tangible ROIC should carry the highest multiples. Slower growers long term, with lower ROIC, should carry lower multiples. We use forward EPS estimates beginning a year from now, represented by April 2022-March 2023 EPS, to set our target prices.

We value beverage stocks based on relative P/E multiples combined with conservative DCF. We believe the two most important drivers of P/E are profit growth and ROIC.

We measure stock performance relative to other consumer staples companies around the region using the MSCI Asia Consumer Staples index or the ASX Consumer Staples index as our benchmark. We apply sector premiums/discounts based on the outlook for growth and margins.

We believe stocks with higher long-term growth rates and higher ROIC should carry the highest multiples, so we apply incremental company premiums or discounts to individual stocks to reflect their outlook for growth and returns.

We use forward EPS estimates beginning a year from now to set our target prices.

Given the importance of retail investors to the A-share markets, A-share listed stocks may be relatively more volatile than their H-share listed counterparts. Upside or downside risks could come from Chinese government policies as China looks to control the rate of growth of its economy in general, or capital markets in particular. These policies may manifest in market rules that affect A- and H- shares differently.

We maintain dual A- and H-share ratings when stocks have both categories of shares listed on the relevant exchange. We derive our A-share target prices by translating the H-share target prices from HKD to RMB. As a general matter, we then assign our rating for A-share stocks by comparing this translated price to the current A-share price. Thus, there will be situations where the H-share and A-share ratings on a related security may differ from one another.

Asia-Pacific Beverages

We value beverage stocks based on relative P/E multiples combined with conservative DCF analysis. We believe the two most important drivers of P/E are profit growth and ROIC.

We measure stock performance relative to other consumer staples companies around the region using the MSCI Asia Consumer Staples index or the ASX Consumer Staples index as our benchmark. We apply sector premiums/discounts based on the outlook for growth and margins.

We believe stocks with higher long-term growth rates and higher ROIC should carry the highest multiples, so we apply incremental company premiums or discounts to individual stocks to reflect their outlook for growth and returns.

We use forward EPS estimates beginning a year from now to set our target prices.

Given the importance of retail investors to the A-share markets, A-share listed stocks may be relatively more volatile than their H-share listed counterparts. Upside or downside risks could come from Chinese government policies as China looks to control the rate of growth of its economy in general, or capital markets in particular. These policies may manifest in market rules that affect A- and H- shares differently.

We maintain dual A- and H-share ratings when stocks have both categories of shares listed on the relevant exchange. We derive our A-share target prices by translating the H-share target prices from HKD to RMB. As a general matter, we then assign our rating for A-share stocks by comparing this translated price to the current A-share price. Thus, there will be situations where the H-share and A-share ratings on a related security may differ from one another.

US Tobacco

We value US Tobacco based on a three-stage DCF analysis, which we triangulate with analysis of relative P/E and EV/EBIT multiples. Within the group, we believe the stocks with higher long-term secular growth rates and higher ROIC should carry the highest multiples. Slower growers long term with lower ROIC should carry lower multiples.

US Beverages and Snacks

We value US Beverages and Snacks based on a three-stage DCF analysis, which we triangulate with analysis of relative P/E and EV/EBIT multiples. Within the group, we believe stocks with higher long-term secular growth rates and higher ROIC should carry the highest multiples. Slower growers long term with lower ROIC should carry lower multiples.

Global Gaming

Asian Gaming: We value our Asian gaming stocks with two methodologies: (1) DCF, (2) one-year-forward EV/EBITDA multiples valuation based on long historical trading multiples for each company. We believe valuations are driven by the ability of a company to generate return on its capital base, grow its business profitably, and, if applicable, return capital to shareholders. The DCF factors in growth prospects, while the EV/EBITDA multiples valuation method adds market color to setting the target price.

US Gaming: We value our US casino coverage using the SoTP approach as they all operate in multiple different geographical regions that warrant very different growths and valuation multiples. For each part of the business, we deploy one-year-forward EV/EBITDA multiples valuation methods. As we cover the Asian subsidiaries of Wynn Resorts, LVS, and MGM Resorts, our valuation there reflects our target prices on Wynn Macau, Sands China, and MGM China. For DraftKings, we use a DCF valuation model to arrive at our target price.

European Household & Personal Care

We value the European HPC sector in two steps. We use EV/EBITDA multiples as our preferred way of valuing the companies. We first value the sector in aggregate, looking at current sales growth and profitability of the sector, 10 year bond yields and current earnings growth versus the MSCI Europe Sector. The companies are then valued on 'relative EV/EBITDA versus the sector'. Relative EV/EBITDA multiples are based on each company's long term sales growth, short term sales growth, current 10 year bond yields with each company's individual sensitivity to bond yields, and earnings growth. We apply those valuation multiples against our NTM forecast of EBITDA and the 12 months beyond that, to derive our price targets.

The sector trades at a premium to the market today, which in our view is justified by superior prospects. Compared to the market, the group promises:

- Higher ROIC;
- High cash conversion leading to reliable income stream;
- Steady growth, keeping close track of global GDP growth;
- Inflation protection as the sector is typically able to pass on pricing similar to global CPI; and
- Resilience in times of economic downturns as the sector has a very low sales beta to economic growth.

US Semiconductors

We value companies in our coverage using a combination of Enterprise Value to Sales, Enterprise Value to EBITDA, and Price to EPS multiples.

Asian Industrial Technology

We use EV/EBITDA multiple as the primary valuation method. We set the target multiple referencing previous cycles but adjust for secular or competitive trends that we believe are moving multiples higher or lower across multiple cycles. We use DCF as reference for the company's long-term intrinsic value. As we move along the different stages of a cycle, the time-dependent target price may deviate from the DCF-implied value.

US Internet

We value our coverage companies based on a one-year-out target price using a combination of valuations derived from discounted cash flow (DCF) calculations, target

NTM EBIT or EBITDA multiples, NTM revenue multiples where EBIT/EBITDA is either unavailable or immature, and SoTP where data is available and applicable.

European Media

Unless specified otherwise, we value our coverage companies based on a one-year price target. To calculate the target price, we apply a 50-50 weight to a DCF valuation and a price derived from market multiples. The multiples are determined by historical and relative trading patterns. The multiples used include price-to-earnings ratio (P/E), EBIT or EBITDA multiples, and FCF yield and are applied on NTM or a combination of NTM, NTM+1, and NTM+2 estimates. For Vivendi, we use SOTP methodology. To value group assets, we use segment-level DCFs, multiples, and market valuations where applicable.

Global Software

For Global Software, we value our companies using a mix of relative P/FE, DCF, and SOTP methodologies. We value shares based on our estimate for 12-month NOPLAT in one years' time and apply an adjusted P/FE multiple. We then add back in the net cash per share, discounted at 15% to account for potential tax costs and other "friction" to repatriate all cash, arriving at our target price.

Global Hotels & Leisure

We primarily value our companies using a combination of EV/EBITDA, relative P/E, and DCF analysis. Our target price is a subjective combination of the approaches. We benchmark our PE and EV multiples against peer companies adjusting, where appropriate, for cost of capital, relative growth, and ROIC. For our DCF, we do five years of fully detailed estimates, a further five years of estimates where we only consider changes to revenue growth, NOPAT margin, and ROIC, and then calculate a terminal value beyond that.

US Telecom & Cable

Our target prices are a blend of long-term DCFs and multiples. We adjust the ratios between the two to reflect our view of whether the market is more sensitive to long-term or short-term factors.

Having a multi-year view allows us to specifically model any slowing in penetration, take-up of new services (i.e., 3G, 4G, or 5G), new capex and spectrum expenditures, and/or the impact of changes in industry structure or regulation. It also allows us to forecast increased competition, subtle changes in market share and a general erosion of EBITDA margins — all key components of our long-term industry view. In our DCFs, we forecast five years out and then calculate a terminal value based on average performance from year 5.

However, we recognize the market tends to react more strongly to short-term signals than a DCF view would imply and use EV/EBITDA, EV/UFCF, P/FCF, Rel. P/E, and Rel. D/P multiples as a way of forecasting the near-term impact of market dynamics.

US Internet

We value our coverage companies based on a one-year out target price using a combination of valuations derived from discounted cash flow (DCF) calculations, target

NTM EBIT or EBITDA multiples, NTM revenue multiples where EBIT/EBITDA is either unavailable or immature, and SoTP where data is available and applicable.

European Food Delivery

We value European Food Delivery companies as an average of (1) an EV / Sales multiple, which is a function of sales growth and EBITDA margin — benchmarked against peers, and (2) a 15 year DCF to 2035

European Food Retail

We value European Food Retail companies (exc. OCDO & HFG) as an average of PE, EV/EBITDA and FCF yield valuations. We derive these multiples through an assessment of relative performance and growth based on our forecasts and vs. consensus expectations. For OCDO and HFG, due to their growth prospects and different business models, we use different methodologies. For HFG, we use an average of DCF, PE, EV/EBITDA. For OCDO, we use DCF and a 5 year EV/EBITDA built on the SOTP, due to the changing profit profile of the solutions business.

China Internet

We value our coverage stocks using a combination of methods, including (1) forward valuation multiples including PE, EV/sales, and P/GMV; (2) DCF; (3) SoTP analyses; and (4) top-down estimates for medium-term market share and profitability. On a relative basis we also compare our coverage stocks with US and China internet peers on the basis of forward EV/sales multiples versus the sum of forward revenue growth and free cash flow margins.

India Capital Goods

We value companies in the India Capital Goods sector using discounted cash flow as well as multiple (price to earnings, price to book) methodology depending on the business model.

While we value most of the companies using discounted cash flow, few businesses with steady earnings trajectory are valued using price to earnings. Business which are in initial phase, are loss making and have limited long term visibility are valued using price to book methodology.

Infrastructure assets are valued using discounted cash flow methodology

US Healthcare Services

For the following six companies, i.e., ANTM, CI, CNC, CVS, UNH and HUM, our preferred valuation methodology is relative (to S&P) price-to-forward-earning (P/FE) due to the predictive NTM results in quantile analysis across time periods, as well as the relatively strong and stable earnings generating capability of the companies' mature business. We base the companies' valuation on our EPS estimates 12-months forward, multiply it by the respective absolute P/FE ratio for each company to arrive at our target prices.

For OSH, our preferred valuation methodology is relative (to S&P) price-to-forward-earning (P/FE) and Relative Price /Revenues in Year 10 that is discounted back to establish a price target for 12 months out. In this approach we forecast the next 10 years of revenues for

OSH with our published model for five years (annual revenue growth rates range from 50% to 39%) and projected growth rates for years 6-10 (declining to 25%).

For HCA, our preferred valuation methodology is relative (to S&P) EV-to-forward-EBITDA (EV/FEBITDA) due to the predictive NTM results in quantile analysis across time periods, its high degree of financial leverage, as well as the relatively strong and stable earnings generating capability of the companies' mature business. We base HCA's valuation on our EBITDA estimate 12-months forward, multiply it by the absolute EV/FEBITDA ratio to arrive at our target price.

In addition to P/FE and EV/FEBITDA metrics, we also consider other valuation metrics including SoTP, PEG, FCF Yield, and discounted cash flow, when arriving at the target price across our coverage. In addition, we acknowledge that our coverage companies generate healthy amounts of cash and often maintain relatively conservative balance sheets, suggesting potential further upside through effective capital allocation over the investment horizon.

European Medical Devices & Services

Our valuation analysis is based on two primary approaches – relative valuation based on price to forward earnings (forward P/E) metrics, and a discounted cash flow (DCF) analysis. For the relative P/E valuation, we apply a sector specific growth adjusted price-to-2021E earnings multiple (P/2021E EPS), derived from the relationship between price and the forecast 2019-2022E earnings per share (EPS) growth for comparable medical device stocks.

US Medical Devices

Target prices for the US Medical Device stocks under our coverage are based on a target P/E multiple, applied to our next 12 months estimates, 12 months hence. The P/E targets are assigned based on observed absolute and relative historical multiples and our outlook for forward growth. We also use current EV/EBITDA vs. history and DCFs as secondary inputs to our valuation.

India Healthcare

We use SoTP valuation approach with DCF to value the specialty & biosimilar businesses and 1-year forward PE for the generics business

RISKS

European Autos

The risks to our views on our European auto stocks and our share price targets are mainly macroeconomic in nature. Earnings, liquidity, and equity value could be severely tested in the event of economic contractions in major end markets and a slowdown in vehicle demand. Individual companies are at risk of specific product and project failure, while the ability of financial services businesses to remain viable could also be tested if the global financial system deteriorates, restricting capital market access. Our forecasts are also sensitive to moves in the euro versus the US dollar and the UK sterling as well as Latin American and Asian currencies.

Global Metals & Mining

The primary risk to our target prices for Global Metals & Mining equities is lower/higher-than-expected commodity prices over the next few years.

Commodity prices are negatively impacted by demand weakness (which is driven by GDP trends and structural efficiency improvements), supply strength (which is driven by poor capital discipline or technology breakthroughs), and the strength of the dollar.

Operational, strategic, and capital allocation errors negatively impact company stock prices.

Additional risks fall into various ESG buckets. Mining has a significant environmental footprint that needs focus. Social issues involve host governments and large labor forces. Governance issues involve the risk of poor governance, mismanagement and even corruption.

European Industrial & Consumer Chemicals

For some of our commodity-linked companies, changes in the oil price could also have a significant effect as well as diverse foreign exchange movements. In a period of continuing consolidation, unexpectedly large dilutive acquisitions could have a downward effect on all our companies.

Consumer Chemicals: Specifically, consumer chemical stocks are disproportionately affected by changes in consumer confidence as a factor for demand as well as natural raw materials (vanilla, citrus, wool grease, and many others), affecting gross margins. In addition to translational impact, currency movements can have a large transactional impact on earnings.

Industrial Chemicals: In case of disappointing industrial production, auto production, and construction growth globally and in Europe in particular, industrial stocks volume growth and earnings would be at risk. A higher-than-expected raw material cost increase without effective pricing pass-through would also represent a risk to our earnings forecast.

Agrochemicals: A decline in agricultural commodity prices would affect farmers' agrochemical spending, as would persistent and simultaneous adverse weather conditions

in a number of regions across the globe. Long-term consumer resistance to genetic modification could hamper growth potential as well as any changes in regulation. Delay in product launches could have a similar effect.

Global Luxury Goods

Covid-19 triggers at least five of the 10 risks of luxury, precipitates a material downward correction to GDP growth, and leads to a sharp decline in consumer demand — and possibly medium-term damage to consumer confidence and propensity to spend. We are on "terra incognita" in terms of duration, impact, and effectiveness of measures, as this scenario has become worse than 2008. More uncertainty remains regarding the plummeting oil price, upheavals in Hong Kong, and the Sino-American trade confrontation. Luxury is cyclical and would suffer a triple whammy blow in a recession: slower or negative top-line growth would cause operating deleverage as luxury is a fixed-cost industry. Valuation multiples would typically contract in that environment.

Luxury sales thrive on customers feeling affluent and secure in their wealth. A higher-interest-rate environment would dampen asset prices and cause the richer to feel poorer: this would be a severe blow to luxury. Asset price trends are important to support confidence of luxury consumers. The Chinese real estate market and the US stock market are the bellwethers. Higher taxation of upper income brackets, higher property taxes, or other government actions to reduce the Gini coefficient would be a sector headwind.

Luxury thrives on people traveling and on a limited number of global cities. Terrorist attacks (e.g., 9/11), tighter custom controls (especially in China), and epidemics (e.g., SARS) would be a risk for luxury as fewer consumers would be traveling and spending money abroad. Luxury is dependent on a small number of cities: 25 of them account for more than two-thirds of luxury spend — Paris, Hong Kong, and New York being the top three. Serious problems in any of the top luxury cities would be a sector headwind, partially compensated by consumers shopping elsewhere and, increasingly, online.

FX would also be a risk for the sector. European luxury goods companies thrive on a weaker euro and stronger US dollar. American luxury goods companies are the mirror image to that. A weaker CNY causing Chinese consumers to spend more in Mainland China would be a headwind: prices in China are higher, price elasticity would reduce overall spend, all else being equal.

US Food

Risks to our industry forecast include: (1) changes in the degree of competitive activity within any key market; (2) changes in the nature of our coverage companies' relationships with their key customers and/or suppliers; (3) fluctuations in foreign exchange rates; (4) fluctuations in commodity costs; (5) changes in the companies' ability to deliver on anticipated growth and/or margin improvement opportunities due to internal and/or external causes; (6) changes in the companies' stances toward M&A; (7) changes in the government's stance towards regulation of nutritional content; (8) changes in consumer preferences; and (9) better than expected pass-through of pricing.

European Food

The major risks longer term in our sector are: (1) management prioritizing short-term profit targets to the detriment of brand equity and longer-term pricing power, (2) the opportunities provided to smaller brands (challenger & local brands) and private label from the growth in eCommerce distribution, (3) a material increase in bond yields, without a corresponding increase in economic growth expectations, and (4) lack of innovation leading to consumer expenditure shifting away from the categories covered by our sector. The upside risks to the sector come from: (1) our companies reacting positively to the Covid-19 challenges and taking stronger action to dominate in the eCommerce world, (2) a decision to focus on sales growth and brand equity without the constraint of margin targets, and (3) a focus on new innovations to stay relevant with shifts in consumer trends.

European Beverages

The following factors would represent risk to our positive long-term view on the sector:

- A breakdown in the three-tier distribution system in the US would expose producers of beverage alcohol to greater margin pressure from retailers.
- Current upward trends in US consumption of alcohol in general and spirits in particular could reverse.
- Difficulties of the beverage alcohol markets in Western Europe could be more severe than we anticipate.
- A drop in commodity prices could hit emerging market economies particularly badly, and reduce prospects for emerging market growth.
- Significant foreign exchange movements, such as a decline in the dollar, could reduce the value of non-European profits.

Asia-Pacific Beverages

Downside risks: Economic shock that could materially impair consumption expenditure leading to lower-than-expected consumption of alcoholic beverages. Material increase in excise tax could raise consumer prices resulting in lower consumption and/or lower producer profits. SOE corporate governance-related issues (i.e., abuse of cash balance) could destroy minority shareholder value.

Upside risks: Potential M&A transactions in beer markets could lead to further market consolidation and bring meaningful synergies. Managements' focus shift from market share gain/top-line growth to profit maximization would improve companies' profitability. Decrease in raw material prices could lead to margin expansion and/or volume increase as products become more affordable to consumers.

US Tobacco

Overall, we have a slightly cautious sector view. We expect cigarette volume declines to accelerate, driven by a shift to next-generation nicotine-delivery products. Against this backdrop, we also expect cigarette pricing to increasingly come under pressure. As a result, industry profit pool growth is likely to slow and sector valuations may derate.

Within our Global Tobacco & Nicotine coverage, the following macroeconomic and company-/industry-specific factors represent risks to our target prices:

- Regulatory decisions around the sale of nicotine products online;
- Potential privatization of the Chinese state-owned cigarette monopoly;
- Regulatory decisions around the capping of nicotine levels in combustible cigarettes;
- The success, or otherwise, of the Juul vaping business;
- The pace of adoption of Heated Tobacco Products, such as IQOS;
- The pace of adoption of vaping products;
- The entry into the vaping market/success of new players;
- The enforceability of patents surrounding Heated Tobacco and Vaping technologies;
- Legal challenges to the Tobacco Industry, on health or other grounds;
- Foreign exchange and commodity cost fluctuations; and
- Regulatory decisions around the introduction of new vaping/heated tobacco products.

US Beverages and Snacks

Within our US Beverages and Snacks coverage, the following macroeconomic and company-/industry-specific factors represent risks to our target prices:

- Changes in consumer preferences, consumer demand, and/or government regulation regarding nonalcoholic RTD beverages of the type produced by our coverage companies;
- Changes in the credit environment and/or broader economy;
- Changes in the degree of competitive activity within any key market;
- Changes in the nature of our coverage companies' relationships with their key customers or suppliers;
- Commodity cost and/or FX fluctuations;
- Changes in our coverage companies' ability to deliver on anticipated growth and/or margin improvement opportunities, whether due to internal or external causes;
- Extended changes in weather within any key market; and
- Changes in our companies' stances toward M&A or prioritization of cash in general.

Global Gaming

Macau Gaming: Our sector outlook for Macau gaming should be discounted by macroeconomic and sector-specific risks. Over the near to medium term, slower-than-expected ramp up of Macau gaming post the Covid-19 pandemic could pose volatility to the sector. The sector's performance is also contingent on China's economy not faltering, with the Chinese government providing strong stimulus. On the longer term, our view is based on our belief that China's GDP growth will continue in mid-single digits, the economy will continue to shift toward greater consumer spend, and the numbers of individuals achieving income levels sufficient to visit Macau will continue to grow. Thus, one of the critical risk factors to our Macau view is a deterioration of China's economic backdrop (GDP forecast erosion, loss of stock markets indexes, decline in real estate values, decrease in consumer confidence, and decrease in disposable income) or a negative liquidity event. Further sector risks include changes in Chinese consumer attitudes toward casino gaming, the level of anti-corruption activity in China (and Macau), regulatory risk surrounding junket activity and AML, restrictions on Union Pay usage, marketing curbs in China, labor union pressures, delays in infrastructure project openings, political unrest in Macau, decrease in visitation, taxation changes, and revision of the concession structure post-2022, FX (RMB vs. HKD).

Singapore Gaming: Our sector outlook for Singapore gaming should be also be discounted by macroeconomic and sector-specific risks. The macroeconomic risks stemming from China also apply to Singapore gaming. Further Singapore-specific sector risks include increased regulations surrounding Singaporean gaming customers, political instability in key feeder markets (Malaysia, Indonesia, and China), new ASEAN casino openings drawing away visitors, FX (SGD vs. feeder market currencies), and economic downturn in key feeder markets.

US Gaming: Our sector outlook for US gaming should be discounted by macroeconomic and sector-specific risks. Our view is based on our belief that US GDP growth will continue to be stable (in low-single digits) and the economy will continue to shift toward greater consumer spend. Thus, one of the critical risk factors to our view is a deterioration of economic backdrop (GDP forecast erosion, loss of stock market indices, decline in real estate values, decrease in consumer confidence, and decrease in disposable income). Further sector risks include changes in consumer attitudes toward gaming, and the risks of overdevelopment/saturation — in that new properties that come online simply cannibalize old properties' shares. For Las Vegas specifically, competition has become increasingly intensified from regional markets. Significant changes in fuel costs (for both ground and air transportation), share shifts in the convention market (further convention space expansions/pricing strategy changes in New York, Chicago, Orlando and San Francisco), and the potential legalization of sports betting in neighboring states present further risks to our estimates. Further, in sports betting and iGaming, risks to take into account include slower-than-expected ramp up of regional markets that have already legalized sports betting and/or slower-than-expected legalization process for online sports betting in the US (or states not moving forward on legalization), higher-than-expected tax structures in the states that are yet to legalize sports betting, reducing economics for operators and intensified/irrational competition in the market, which will lead to higher-than-expected marketing spend and create headwinds for the company to achieve better profitability.

European Household & Personal Care

The major risks longer term in our sector are: (1) management prioritizing short-term profit targets to the detriment of brand equity and longer-term pricing power, (2) opportunities provided to smaller brands (challenger and local brands) and private label from the growth in eCommerce distribution, (3) a material increase in bond yields, without a corresponding increase in economic growth expectations, (4) lack of innovation leading to consumer expenditure shifting away from the categories covered by our sector.

The upside risks to the sector come from (1) our companies reacting positively to the Covid-19 challenges and taking stronger action to dominate in the eCommerce world, (2) a decision to focus on sales growth and brand equity without the constraint of margin targets, (3) a focus on new innovations to stay relevant with shifts in consumer trends.

US Semiconductors

The greatest sector-wide risk that could affect all the stocks in our coverage is the macroeconomic environment and resulting impact on revenues and sentiment. Upside risk to our targets exist if global GDP growth is quicker than we currently anticipate, which would result in stronger semiconductor/semicap industry growth than we currently forecast. Conversely, if GDP growth is slower than expected, this would result in slower growth for the industry and semiconductor/semicap companies. Recent increasingly negative rhetoric around trade and tariffs, and of course the coronavirus pandemic, represent further potential risks to our broad coverage.

Beyond the broader macroeconomic environment, several company-specific risks may influence the stocks in our coverage:

Asian Industrial Technology

The risks to our coverage names are mainly associated with the global macroeconomy, including industrial capex cycles, trade frictions, and currency. US companies' share prices are sensitive to their quarterly results relative to management guidance and consensus forecasts. Japanese and Chinese companies are much less so.

For IPGP and Harmonic Drive, as they have >50% of global share in their respective industries, potential change in the competitive landscape would be a bigger risk to them than to other companies.

US Internet

Global macroeconomic conditions: Our sector's revenues are primarily generated from advertising dollars and consumer spend. Any sustained decline in economic conditions, economic outlook, or burdens from a potential trade war can have a material negative impact on revenue growth potential across the sector.

Anti-trust regulations & litigation: Most of our sector is currently being investigated by the DOJ, FTC, or international regulatory bodies for anti-competitive, anti-trust behavior. Regulating big tech has become a bi-partisan initiative in the US with reasonable expectations that some type of new regulation will prevail. Outsized risk remains if new regulations result in compounding cost of compliance, severely limiting revenue growth, and full or partial break-up of the companies altogether.

Privacy regulations: Almost every company in our coverage sector is involved in ongoing litigious lawsuits surrounding the capturing and usage of personal data. Any negative outcomes can set challenging precedents, resulting in materially different data collection and usage practices. Most exposed are ad supported businesses where data collection is the primary value contributor to providing desired ad targeting and attribution capabilities to advertisers.

Cyberattacks: Similarly, almost all of our companies have recently experienced some type of cyberattack. Continued cyberattacks and/or a major attack can severely impact the trust and engagement of platform users, resulting in a significant impact to stock price.

Global competition: The internet, more than any other industry, is susceptible to new and emerging competitive threats that seemingly disrupt entire ecosystems and value pools. With emerging fast-growing tech companies domestically and abroad, it stands to reason that new competitors will emerge that could reduce short-term revenue growth and destroy entire revenue pools long-term.

European Media

General risks to the companies in our coverage vary by subsector.

All consumer media companies are affected by changes in media consumption patterns and the distribution environments for content. Failure to respond to changes in consumer expectations and/or to invest in new product development and distribution channels can put growth at risk.

In content media, in particular film and video games, individual content releases face creative, production, and commercial risk, which makes the timing and scale of returns uncertain.

Marketing communications groups and ad-funded media owners like free-to-air broadcasters are exposed to the economic cycle, with ad revenues fluctuating with GDP and consumer spend.

Professional publishers and marketing communication groups are dependent on the growth of their client industries, being able to maintain and grow prices for their products and services, and keeping them relevant in the face of competition.

The ability to hire, retain, and train talent in a competitive environment is important for companies in our coverage; loss of key talent is a shared risk to growth across the sector.

Global Software

Our price targets for ADBE, CRM, CTXS, MSFT, ORCL, SABR, SAP, SPLK, VMW, and WDAY are subject to a number of macroeconomic and company specific risks that include:

The potential of a recession

Changes in the degree of competitive activity within any key market

Foreign exchange fluctuations

Changes in the nature of our covered companies' relationships with their key customers, partners and/or suppliers

Changes in our covered companies' ability to deliver on anticipated growth and/or margin improvement opportunities, whether due to internal or external causes (including the unsuccessful integration of acquired companies)

Changes in our companies' stances toward M&A or the prioritization of cash in general

Adverse situations in one of its key markets

Global Hotels & Leisure

The leisure sector is reliant on consumer spending and therefore is susceptible to changes in consumer spending and the broader macroeconomic environment. Any slowdown in these trends will affect revenues and earnings and market sentiment towards our coverage. For the Hotel and Travel stocks particularly, there is a risk of terrorism or other geo-political events changing the demand for international and domestic travel. There are a wide range of disruptors who pose a potential risk (Airbnb, Expedia, Uber Eats) to our coverage and any increase in their inroads into our segments could result in market share losses and revenue/earnings declines.

US Telecom & Cable

Telecommunications companies are subject to a number of key risks which investors should consider:

Regulatory risks — Telecommunications is a highly regulated industry and as a result the financial performance and long-term value of individual companies can be highly impacted by regulation. Key risk areas include industry specific taxes, spectrum licenses or renewals, regulated rates of interconnect or leasing of key assets, and structural separation of key assets.

Technology obsolescence risk — The underlying technologies which enable both fixed and mobile networks are constantly being updated. Data access speeds that were state of the art one-year can be uncompetitive a few years later. Operators must continue to maintain and upgrade their networks in order to remain competitive

Service disruption risk — Telecommunications is a service industry and revenues are dependent on being able to continue to provide a high-quality service to end customers. Frequent network outages, network congestion, dropped calls and/or poor data speeds can result in customer dissatisfaction leading to customer churn and falling revenues. Power failures, cable cuts and/or damage to key infrastructure can have substantial impacts on revenues

US Internet

- **Global macro conditions:** Our sector's revenues are primarily generated from advertising dollars and consumer spend. Any sustained decline in economic conditions, economic outlook, or burdens from a potential trade war can have a material negative impact on revenue growth potential across the sector.

- **Anti-trust regulations & litigation:** Most of our sector is currently being investigated by the DOJ, FTC, or international regulatory bodies for anti-competitive, anti-trust behavior. Regulating big tech has become a bi-partisan initiative in the United States with reasonable expectations that some type of new regulation will prevail. Outsized risk remains if new regulations result in compounding cost of compliance, severely limiting revenue growth, and full or partial break-up of the companies all together.
- **Privacy regulations:** Almost every company in our coverage sector is involved in ongoing litigious lawsuits surrounding the capturing and usage of personal data. Any negative outcomes can set challenging precedents resulting in a materially different data collection and usage practices. Most exposed are ad supported businesses where data collection is the primary value contributor to providing desired ad targeting and attribution capabilities to advertisers.
- **Cyber attacks:** similarly, almost all of our companies have recently experienced some type of cyber attack. Continued cyber attacks and/or a major attack can severely impact the trust and engagement of platform users, resulting in a significant impact to stock price.
- **Global competition:** The Internet, more than any other industry, is susceptible to new and emerging competitive threats that seemingly disrupt entire ecosystems and value pools. With emerging fast-growing tech companies domestically and abroad, it stands the reason that new competitors will emerge that could reduce short-term revenue growth and destroy entire revenue pools long-term.

European Food Delivery

There are certain risks common across all the companies in our coverage: (1) economics conditions - in each of the markets that our coverage companies operate in, spending on food (particularly discretionary is correlated with prevailing economic conditions therefore any unexpected deterioration or improvement in the macroeconomic conditions in these countries will impact the growth assumptions applied to those operations; (2) new entrants & competition - all companies in our coverage are at risk from new entrants or other competitive disruption either at a local / regional / national level. The industry is well-funded with significant amounts of cash, which enables high marketing spend, high levels of discounting and continued disruption as we outline in our state of war thesis; (3) pandemic recovery - there is a significant amount of uncertainty related to the pandemic recovery at the moment, which will affect consumer demand, and the network effects. Dependent on the shape of food delivery spend as the world unlocks, this could materially affect spending and cost profiles of food delivery companies. (4) Gig economy - the introduction of labour regulations on the 'gig economy' or informal worker model would materially affect these companies and require a change in operating model.

European Food Retail

There are certain risks common across all the companies in our coverage: (1) economics conditions - in each of the markets that our coverage companies operate in, spending on food is correlated with prevailing economic conditions therefore any unexpected deterioration or improvement in the macroeconomic conditions in these countries will impact the growth assumptions applied to those operations; (2) new entrants – all

companies in our coverage are at risk from new entrants or other competitive disruption either at a local/regional level. Currently this disruption is driven by premium and value players as well as the challenge of online. (3) pandemic recovery — there is a significant amount of uncertainty related to the pandemic recovery at the moment, which will affect consumer demand, supply and operational costs. Dependent on the shape of food retail spend as the world unlocks, this could materially affect spending and cost profiles of food retailers.

China Internet

The risks to our views on our China internet stocks and our price targets include (1) macroeconomic risks, including liquidity in the Chinese economy, and retail consumption trends; (2) changes in consumer preferences and engagement with specific brands and online platforms; (3) competition — both between other internet companies and offline peers; and (4) regulatory risk, for example related to China's anti-monopoly regulations. Tensions between the US and China could create political risks which may affect our coverage companies.

India Autos

After weak auto sales for last two years, we are taking a view that PV and two-wheeler growth rates will resume from 2H FY21 as demand normalizes post CoVID impact. There could be risk of continued weakness if the macro deteriorates further and consumers postpone decisions. A faster than expected regulatory pressure and stiff targets for EVs, which is currently not the case, could also present risks. Conversely, for CV, a further delay in recovery could be a risk as we are taking a cautious view on the cycle while tractor upcycle could have challenge from ongoing farmer protest.

India Capital Goods

Slower than expected recovery: We expect current cycle to be low beta with recovery expectation in certain specific end market. Slower than expected reforms as well as ordering could lead to overall delay in recovery in these end markets.

US Healthcare Services

Price targets for all our covered companies are subject to full range of domestic US macro-economic risks, such as GDP growth, unemployment rate, the pace of population aging, inflation and interest rate dynamics to fiscal spending, especially on healthcare, on both federal and state levels. As some of our covered companies continue to increase international presence outside of the US, currency fluctuations will become a more substantial risk. A number of industry specific factors will have significant impacts on the companies' future earnings, including medical cost trends, premium rate trends for government businesses and public exchange, industry-wide health insure tax, government spending on healthcare, and government regulations on healthcare costs, such as pharmaceuticals. That said, in most cases, the key drivers to outperformance against industry peers and attractive shareholder return is each company's ability to generate organic growth, achieve market share gains, execute on margin expansion plans (and integration initiatives post mergers for covered companies), and allocate capital efficiently and effectively. Finally, the valuation of the broader market has recovered but is subject to higher growth expectations and market volatilities. The valuation of the broader market

might contract if we don't see quality growth meeting market expectations and this would also impact the valuation of our covered companies.

European Medical Devices & Services

The risks to the European medical device stocks in our coverage include: the impact of healthcare reform, tax code reform, or other policy initiatives which could negatively impact product utilization, pricing, and competitiveness. The risk of deteriorating macro-economic conditions that may impact spending on healthcare which could cause an unexpected drop in product sales or demand for healthcare services. Companies could be subject to product recalls, FDA warning letters, or government enforced actions which could negatively impact sales and operations. Unexpected fluctuations in foreign currency could impact earnings in a positive or negative manner.

US Medical Devices

Upside risks to target prices on the US Medical Device stocks under our coverage include, but are not limited to: stronger than expected earnings growth, based on better than expected market conditions (e.g., market-wide improvements in healthcare utilization, volume, or pricing), major disruptions to competitors (e.g., recalls, supply interruptions), or earlier than expected approvals / introductions of key pipeline products.

Downside risks to our target prices include recalls of major products, FDA warning letters or supply interruptions at major production facilities, accelerated pricing pressure or reimbursement changes in key categories, other policy initiatives or physician guideline changes that may negatively impact product utilization, or a rapid deterioration in the global economic environment which could weaken discretionary healthcare spending. As our companies have significant overseas operations, unexpected fluctuations in foreign currency could impact earnings in a positive or negative manner.

EU Biopharmaceuticals

Risks to the pharmaceutical industry include, but are not limited to: (i) the failure of late-stage pipeline products to make it to market, (ii) the possibility that key patent cases are lost because of patent challenges or greater / faster than expected erosion of sales post loss of exclusivity, (iii) greater than anticipated pricing pressure in markets both inside and outside of the US, (iv) softening of demand, including that due to changing physician guidelines that negatively impact upon utilisation and competition from existing or key pipeline products, (v) major disruptions to manufacturing / supply (e.g. product recalls, FDA warnings on manufacturing facilities), (vi) issues relating to marketed product safety and (v) the long-term financial impact from US healthcare reform.

India Healthcare

Risks to the pharmaceutical industry include a) risk of pipeline products failing or getting delayed due to FDA actions, b) possibility of adverse litigation outcomes delaying key generic launches, c) cGMP non-compliance in manufacturing facilities leading to FDA actions like Warning Letters or Import Alerts to plants, d) product recalls or other product safety issues, e) pricing pressure from market factors or price control regulations, f) supply and logistics disruptions and f) healthcare regulations and reforms.

VALUATION METHODOLOGY

See the Appendix to this *Blackbook* for the sector-wide valuation methodology used to arrive at our target prices, and related risks. For company-specific details on valuation methodology, refer to www.bernstein.research.com.

RISKS

See the Appendix to this *Blackbook* for the sector-wide valuation methodology used to arrive at our target prices, and related risks. For company-specific details on risks, refer to www.bernstein.research.com.

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- On and as of April 1, 2019, AllianceBernstein L.P. acquired Autonomous Research. As a result of the acquisition, the research activities formerly conducted by Autonomous Research US LP were assumed by Sanford C. Bernstein & Co., LLC, which continues to publish research under the Autonomous Research US brand and the research activities formerly conducted by Autonomous Research Asia Limited were assumed by Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, which continues to publish research under the Autonomous Research Asia brand.
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- Please note that all price targets, recommendations and historical price charts are unaffected by the transfer of the business from Sanford C. Bernstein Limited and have been carried forward unchanged to Bernstein Autonomous LLP. You can continue to find this information on the Bernstein website at www.bernsteinresearch.com.
- References to “Bernstein” or the “Firm” in these disclosures relate to the following entities: Sanford C. Bernstein & Co., LLC, Bernstein Autonomous LLP, Sanford C. Bernstein Limited (for dates prior to January, 1, 2021), Autonomous Research LLP (for dates between April 1, 2019 and December 31, 2020), Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Sanford C. Bernstein (Canada) Limited, Sanford C. Bernstein (India) Private Limited (SEBI registration no. INH000006378) and Sanford C. Bernstein (business registration number 53193989L), a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C.
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- The Bernstein brand rates stocks based on forecasts of relative performance for the next 6-12 months versus the S&P 500 for stocks listed on the U.S. and Canadian exchanges, versus the MSCI Europe Index (MSDLE15) for stocks listed on the European exchanges (except for Russian companies), versus the MSCI Emerging Markets Index for Russian companies and stocks listed on emerging markets exchanges outside of the Asia Pacific region, versus the MSCI Japan (MXJP) for stocks listed on the Japanese exchanges, and versus the MSCI Asia

Pacific ex-Japan Index for stocks listed on the Asian (ex-Japan) exchanges - unless otherwise specified. The Bernstein brand has three categories of ratings:

Outperform: Stock will outpace the market index by more than 15 pp in the year ahead.

Market-Perform: Stock will perform in line with the market index to within +/- 15 pp in the year ahead.

Underperform: Stock will trail the performance of the market index by more than 15 pp in the year ahead.

Not Rated: The stock Rating, Target Price and/or estimates (if any) have been suspended temporarily.

- For purposes of the Market Abuse Regulation (MAR) and the FINRA Rule 2241, 'Outperform' is classified as a Buy, 'Market-Perform' is classified as a Hold, and 'Underperform' is classified as a Sell
- As of 12/02/2021, Bernstein branded ratings were distributed as follows: 327 Outperform - 53.6% (0.0% banking clients) ; 231 Market-Perform - 37.9% (0.0% banking clients); 52 Underperform - 8.5% (0.0% banking clients); 0 Not Rated - 0.0% (0.0% banking clients). The numbers in parentheses represent the percentage of companies in each category to whom Bernstein provided investment banking services. All figures are updated quarterly and represent the cumulative ratings over the previous 12 months. These ratings relate solely to the investment research ratings for companies covered under the Bernstein brand and do not include the investment research ratings for companies covered under the Autonomous brand. This information is provided in order to comply with Article 6 of the Commission Delegated Regulation (EU) 2016/958.
- Arndt Ellinghorst has accepted a role at QuantCo, an enterprise software services company and will be leaving Bernstein in December 2021. During this interim period, Mr. Ellinghorst will continue to provide Bernstein Research in relation to his covered companies whilst also providing limited strategic support to QuantCo's management team.
- Wimal Kapadia maintains long equity position in Sarepta. Sarepta entered into a licensing agreement with Roche granting Roche the exclusive commercial rights to Sarepta's investigational gene therapy for Duchenne muscular dystrophy outside of the United States.
- All statements in this report attributable to Gartner represent Bernstein's interpretation of data, research opinion or viewpoints published as part of a syndicated subscription service by Gartner, Inc., and have not been reviewed by Gartner. Each Gartner publication speaks as of its original publication date (and not as of the date of this report). The opinions expressed in Gartner publications are not representations of fact, and are subject to change without notice.
- Richard J Clarke, FCA maintains a long position in Danone (BN.FP).
- Trevor Stirling maintains a long position in Nestle SA (NESN.SW).
- Trevor Stirling maintains a long position in Bayerische Motoren Werke AG (BMW.GR).
- Trevor Stirling maintains a long position in Koninklijke Philips NV (PHIA.NA).
- Stacy A. Rasgon, Ph.D. maintains a long position in Amazon.Com Inc (AMZN).
- Stacy A. Rasgon, Ph.D. maintains a long position in Microsoft Corp (MSFT).
- Stacy A. Rasgon, Ph.D. maintains a long position in DISH Network Corp (DISH).
- Robin Zhu maintains a long position in Microsoft Corp (MSFT).
- Bruno Monteyne maintains a long position in Daimler AG (DAI.GR).
- Bruno Monteyne maintains a long position in Microsoft Corp (MSFT).
- Bruno Monteyne maintains a long position in Koninklijke Philips NV (PHIA.NA).
- Bruno Monteyne maintains a long position in Novo Nordisk A/S (NOVOB.DC).
- Richard J Clarke, FCA maintains a long position in Nestle SA (NESN.SW).
- Richard J Clarke, FCA maintains a long position in Daimler AG (DAI.GR).
- Richard J Clarke, FCA maintains a long position in Koninklijke Philips NV (PHIA.NA).
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- Vitaly Umansky maintains a long position in Amazon.Com Inc (AMZN).
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- Bruno Monteyne maintains a long position in Keyence Corp (6861.JP).
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- Vitaly Umansky maintains a long position in Alphabet Inc (GOOGL).
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- Callum Elliott, CFA, ACA maintains a long position in InterContinental Hotels Group PLC (IHG.LN).
- Eunice Lee, CFA maintains a long position in Wynn Resorts Ltd (WYNN).
- Eunice Lee, CFA maintains a long position in Wynn Macau Ltd (1128.HK).
- Eunice Lee, CFA maintains a long position in Sands China Ltd (1928.HK).
- Eunice Lee, CFA maintains a long position in Facebook Inc (FB).
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- Eunice Lee, CFA maintains a long position in Alibaba Group Holding Ltd (BABA).
- Eunice Lee, CFA maintains a long position in Wuliangye Yibin Co Ltd (000858.CH).
- Eunice Lee, CFA maintains a long position in Meituan (3690.HK).
- Peter Supino maintains a long position in Facebook Inc (FB).
- Peter Supino maintains a long position in Twitter Inc (TWTR).
- Peter Supino maintains a long position in The Boston Beer Company (SAM).
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12-Month Bernstein Rating History as of 12/01/2021

Company	Rating Changes
Luzhou Laojiao Co Ltd (000568.CH)	M (RC) 04/01/21 U (IC) 02/08/21
Wuliangye Yibin Co Ltd (000858.CH)	O (RC) 01/06/21 M (RC) 07/14/20
Jiangsu Yanghe Brewery Joint-Stock Co Ltd (002304.CH)	O (IC) 02/08/21
Wynn Macau Ltd (1128.HK)	O (RC) 08/22/18
Tsingtao Brewery Co Ltd (168.HK)	O (RC) 08/09/21 U (RC) 11/02/16
Budweiser Brewing Co APAC Ltd (1876.HK)	O (RC) 02/18/20
Prada SpA (1913.HK)	O (RC) 03/12/20
Sands China Ltd (1928.HK)	O (RC) 01/18/19
Great Wall Motor Co Ltd (2333.HK)	O (RC) 12/04/20 M (RC) 02/22/19
Asahi Group Holdings Ltd (2502.JP)	O (RC) 01/10/19
Kirin Holdings Co Ltd (2503.JP)	M (RC) 08/08/19
Galaxy Entertainment Group Ltd (27.HK)	O (RC) 01/18/19
China Resources Beer Holdings Co Ltd (291.HK)	U (IC) 09/07/16
Meituan (3690.HK)	O (IC) 01/25/21 O (DC) 08/31/20
SAIC Motor Corp Ltd (600104.CH)	M (RC) 12/04/20 O (RC) 05/19/17
Kweichow Moutai Co Ltd (600519.CH)	O (RC) 01/06/21 U (RC) 07/14/20
Tsingtao Brewery Co Ltd (600600.CH)	U (IC) 09/07/16
Shanxi Xinghuaacun Fen Wine Factory Co., Ltd. (600809.CH)	U (IC) 02/08/21
Keyence Corp (6861.JP)	O (IC) 06/06/16
Alibaba Group Holding Ltd (9988.HK)	M (IC) 01/25/21
Anheuser-Busch InBev NV (ABI.BB)	O (RC) 03/12/18
Accor SA (AC.FP)	O (RC) 06/18/19
Adobe Inc (ADBE)	O (IC) 08/17/11
Amazon.Com Inc (AMZN)	O (RC) 09/22/20
Altice USA Inc (ATUS)	O (RC) 10/05/20
Alibaba Group Holding Ltd (BABA)	M (IC) 01/25/21 O (DC) 08/31/20
BASF SE (BAS.GR)	O (RC) 01/12/21 M (IC) 09/24/18
Bayer AG (BAYN.GR)	O (DC) 06/29/18
Booking Holdings Inc (BKNG)	U (IC) 11/30/20
Bayerische Motoren Werke AG (BMW.GR)	O (IC) 09/08/20
Danone (BN.FP)	M (RC) 11/01/21 U (IC) 10/12/20
Burberry Group PLC (BRBY.LN)	M (RC) 03/12/20
Anheuser-Busch InBev NV (BUD)	O (RC) 03/12/18
Beyond Meat Inc (BYND)	M (RC) 11/11/21 O (RC) 05/24/21 U (RC) 10/13/20
Conagra Brands Inc (CAG)	M (RC) 03/18/20
Carlsberg A/S (CARLB.DC)	O (RC) 04/15/20
Charter Communications Inc (CHTR)	M (RC) 07/11/21 O (IC) 10/15/19
Coloplast A/S (CLPBY)	O (IC) 05/13/20
Comcast Corp (CMCSA)	O (RC) 06/30/20
Coloplast A/S (COLOB.DC)	O (IC) 03/10/20
Davide Campari-Milano NV (CPR.IM)	M (RC) 06/14/21 O (RC) 06/08/20
Salesforce.com Inc (CRM)	M (RC) 05/03/18
CVS Health Corp (CVS)	O (IC) 03/12/19
Daimler AG (DAI.GR)	O (IC) 09/08/20
Diageo PLC (DEO)	M (RC) 06/14/21 O (RC) 04/15/20
Diageo PLC (DGE.LN)	M (RC) 06/14/21 O (RC) 04/15/20
DISH Network Corp (DISH)	M (RC) 03/06/20
DraftKings Inc (DKNG)	O (IC) 01/26/21
Koninklijke DSM NV (DSM.NA)	U (RC) 01/12/21 M (RC) 03/30/20
DaVita Inc (DVA)	M (IC) 03/10/20
Embracer Group AB (EMBRACB.SS)	O (IC) 07/07/20
Evonik Industries AG (EVK.GR)	O (IC) 09/19/16
Edwards Lifesciences Corp (EW)	M (IC) 06/26/18
Expedia Group Inc (EXPE)	M (IC) 11/30/20

Facebook Inc (FB)	O (IC) 01/09/20
Fresenius Medical Care AG & Co KGaA (FME.GR)	M (IC) 03/10/20
Fresenius Medical Care AG & Co KGaA (FMS)	M (IC) 03/10/20
Fresenius SE & Co KGaA (FRE.GR)	O (RC) 03/24/20
Fresenius SE & Co KGaA (FSNUY)	O (RC) 03/24/20
Farfetch Ltd (FTCH)	M (RC) 09/08/20
Genting Singapore Ltd (GENS.SP)	O (RC) 06/09/21 M (RC) 06/09/20
Givaudan SA (GIVN.SW)	U (RC) 01/08/18
Alphabet Inc (GOOGL)	O (IC) 01/09/20
HCA Healthcare Inc (HCA)	M (IC) 06/15/16
Heineken NV (HEIA.NA)	O (RC) 10/21/16
Heineken Holding NV (HEIO.NA)	O (RC) 10/21/16
Hilton Worldwide Holdings Inc (HLT)	O (IC) 09/10/19
Hershey Co (HSY)	M (RC) 09/12/19
International Flavors & Fragrances Inc (IFF)	O (IC) 09/19/16
InterContinental Hotels Group PLC (IHG.LN)	M (RC) 06/01/20
Intel Corp (INTC)	U (RC) 07/24/20
Intuitive Surgical Inc (ISRG)	O (IC) 06/26/18
ITV PLC (ITV.LN)	M (RC) 11/15/21 U (RC) 11/16/20
Johnson Matthey PLC (JMAT.LN)	O (IC) 09/24/18
Johnson & Johnson (JNJ)	O (RC) 10/11/19
Kellogg Co (K)	U (RC) 06/11/20
Kering SA (KER.FP)	O (RC) 04/30/21 M (RC) 01/08/20
Lindt & Sprüngli (LISN.SW)	M (RC) 07/06/21 O (IC) 10/12/20
Lindt & Sprüngli (LISP.SW)	M (RC) 07/06/21 O (IC) 10/12/20
Las Vegas Sands Corp (LVS)	O (IC) 11/14/18
Lyft Inc (LYFT)	M (IC) 01/09/20
Marriott International Inc (MAR)	M (IC) 09/10/19
LVMH Moët Hennessy Louis Vuitton SE (MC.FP)	O (RC) 08/06/19
Mondelez International Inc (MDLZ)	O (IC) 08/02/06
MGM Resorts International (MGM)	O (RC) 09/13/21 M (IC) 11/14/18
Melco Resorts & Entertainment Ltd (MLCO)	O (IC) 03/23/15
Altria Group Inc (MO)	O (IC) 01/19/21 M (DC) 04/09/20
Moncler SpA (MONC.IM)	O (RC) 08/06/19
Microsoft Corp (MSFT)	O (IC) 08/17/11
Nestle SA (NESN.SW)	O (IC) 10/12/20
Novo Nordisk A/S (NOVOB.DC)	O (RC) 07/02/18
Novozymes A/S (NZYMB.DC)	O (RC) 01/05/17
Oracle Corp (ORCL)	O (RC) 05/05/14
Orkla (ORK.NO)	M (IC) 10/12/20
Koninklijke Philips NV (PHG)	O (IC) 03/10/20
Koninklijke Philips NV (PHIA.NA)	O (IC) 03/10/20
Pinterest Inc (PINS)	M (IC) 01/09/20
Philip Morris International Inc (PM)	M (IC) 01/19/21 O (DC) 04/09/20
Publicis Groupe SA (PUB.FP)	M (IC) 07/07/20
Rémy Cointreau SA (RCO.FP)	U (RC) 06/14/21 M (RC) 04/15/20
RELX PLC (RELLN)	M (IC) 07/07/20
RELX PLC (REN.NA)	M (IC) 07/07/20
Pernod Ricard SA (RI.FP)	M (RC) 06/14/21 O (RC) 07/29/20
Hermès International (RMS.FP)	M (RC) 12/11/20 O (RC) 03/12/20
Renault SA (RNO.FP)	O (IC) 09/08/20
Roche Holding AG (ROG.SW)	O (IC) 07/13/20
The Boston Beer Company (SAM)	O (IC) 05/24/21
Sea Ltd (SE)	O (IC) 06/16/21 M (DC) 02/27/17
JM Smucker Co (SJM)	U (RC) 06/11/20
Snap Inc (SNAP)	O (IC) 01/09/20
Constellation Brands Inc (STZ)	O (IC) 05/24/21 M (DC) 01/31/08
Symrise AG (SY1.GR)	M (RC) 08/10/17
AT&T Inc (T)	M (IC) 10/15/19

Molson Coors Brewing Co (TAP)	O (IC) 05/24/21 M (DC) 01/31/08
Thai Beverage PCL (THBEV.SF)	M (RC) 02/10/21 O (RC) 01/08/21 M (RC) 08/31/18
T-Mobile US Inc (TMUS)	O (IC) 10/15/19
TripAdvisor Inc (TRIP)	O (IC) 11/30/20
Treasury Wine Estates Ltd (TWE.AU)	M (RC) 02/03/21 O (RC) 11/30/20
Twitter Inc (TWTR)	M (RC) 04/08/20
Uber Technologies Inc (UBER)	O (IC) 01/09/20
Unilever (ULVR.LN)	M (RC) 11/01/21 U (IC) 10/12/20
Universal Music Group (UMG.NA)	M (IC) 09/27/21
Umicore SA (UMI.BB)	U (IC) 09/24/18
Unilever (UNA.NA)	M (RC) 11/01/21 U (IC) 10/12/20
UnitedHealth Group Inc (UNH)	O (IC) 06/15/16
Volvo AB (VOLVB.SS)	O (IC) 09/08/20
Volkswagen AG (VOW.GR)	M (RC) 12/15/20 U (IC) 09/08/20
Verizon Communications Inc (VZ)	M (IC) 10/15/19
Wolters Kluwer NV (WKL.NA)	O (IC) 07/07/20
WPP PLC (WPP)	M (RC) 11/03/21 U (IC) 07/07/20
WPP PLC (WPP.LN)	M (RC) 11/03/21 U (IC) 07/07/20
Wynn Resorts Ltd (WYNN)	O (IC) 11/14/18

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