HARVARD | BUSINESS | SCHOOL

Impact Accounting for Product Use: A Framework and Industry-specific Models

George Serafeim
Katie Trinh

Working Paper 21-141

Impact Accounting for Product Use: A Framework and Industry-specific Models

George Serafeim
Harvard Business School

Katie Trinh
Harvard Business School

Working Paper 21-141

Funding for this research was provided in part by Harvard Business School.

Impact Accounting for Product Use:
A Framework and Industry-specific Models

George Serafeim and Katie Trinh*

Harvard Business School

Impact-Weighted Accounts Project Research Report

Abstract

This handbook provides the first systematic attempt to generate a framework and industry-specific models for the measurement of impacts on customers and the environment from use of products and services, in monetary terms, that can then be reflected in financial statements with the purpose of creating impact-weighted financial accounts. Chapter 1 introduces product impact measurement. Chapter 2 outlines efforts to measure product impact. Chapter 3 describes our product impact measurement framework with an emphasis on the choice of design principles, process for building the framework, identification of relevant dimensions, range of measurement bases and the use of relative versus absolute benchmarks. Chapters 4 to 12 outline models for impact measurement in nine industries of the economy. Chapter 13 describes an analysis of an initial dataset of companies across the nine industries that we applied our models and constructed product impact measurements. Chapter 14 provides a preliminary discussion of the accounting treatment of product impact estimates within impact-weighted accounts. Our overall conclusion is that the measurement of product impact is feasible, scalable and generates important insights for the competitive positioning and strategy of organizations.

Keywords: impact measurement; product impact; customer welfare; environment; ESG; accounting; financial statement analysis

* George Serafeim is the Charles M. Williams Professor of Business Administration at Harvard Business School and the Faculty Chair of the Impact Weighted Accounts Project at Harvard Business School. Katie Trinh is a research associate at the Impact-Weighted Accounts Project at Harvard Business School. The Impact-Weighted Accounts Initiative is a joint initiative between the Global Steering Group for Impact Investment and the Impact Management Project incubated as a project at Harvard Business School. This handbook represents the synthesis of individuals reports issued by the Impact-Weighted Accounts Initiative. We are grateful to the Division of Faculty Research and Development of the Harvard Business School for financial support. We thank Nolan Hellickson, Charles Hua, Winnie Lu, and Natalie Uhr for their invaluable contributions to the construction of the product impact dataset. We thank Divya Chandra, Thomas Cobti, Sir Ronald Cohen, Kate Collins, Daniel Concessi, Daniel Dorman, Michael Etzel, David Freiberg, Sonja Haut, Sakis Kotsantonis, Abigail McGuckin, Eileen McNeely, John Miller, Leah Moehlig, Dariush Mozaffarian, Jeremy Nicholls, the Impact Management Project, Katie Panella, DG (Dong Gi) Park, Amanda Mary Rischbieth, Ethan Rouen, Susanne Stormer, Matthew Watkins, Cheryl Wilson, and Rob Zochowski for many useful comments. We thank Thomas Cobti, Sakis Kotsantonis, and Niklas Pape for providing us with access to the Richmond Global Sciences data. George Serafeim is a co-founder and has an equity stake in the technology firm Richmond Global Sciences.

Table of Contents

CHAPTER 1
INTRODUCTION

Given that all companies have impacts on employees, customers and the natural environment, efforts to measure environmental and social impact are crucial. Effective resource management depends upon an accurate understanding of the current baseline and the anticipated path forward. These allow for benchmarking, quantification of under- or out-performance, and the possibility for course correction. Metrics also allow for allocation of resources in markets and the development of price signals. Furthermore, they allow for the design of contracts, such as compensation or lending contracts, which incentivize certain actions. For example, recent efforts include the incorporation of environmental and social metrics in both executive compensation plans and in bank loan contracts. Similarly, they can be included in the design of regulatory incentives, such as tax or subsidy incentives.

The importance of measuring the impacts of companies is highlighted by the significant growth in efforts to understand, measure and improve environmental and social impact. More companies are disclosing environmental, social and governance (ESG) data as customers, employees, investors, and regulators are seeking to incorporate ESG considerations in their decisions. As of 2017, 75% of the largest 100 companies in each of 49 countries (75% of 4,900 companies) were issuing sustainability reports with ESG data, a significant increase from the 12% in 1993.[1] With over $30 trillion in assets under management labeled as ESG and more than $80 trillion publicly committed to integrate ESG data in investment decisions, asset owners and managers have demonstrated a commitment to integrate ESG information in their investment process.[2]

However, research has indicated that currently most environmental and social metrics disclosed by companies and prescribed by reporting standards pertain to a company's operations, defined as activities that happen within the company's own organizational control or in some cases, in their upstream supply chains.[3] Examples of operational impacts include water consumption, waste generation, carbon emissions, employee health and safety records or diversity and inclusion efforts. While great progress has been made in measuring such operational impacts and more

[1] The KPMG Survey of Corporate Sustainability Reporting, 2017. Available here.
[2] Global Sustainable Investment Alliance 2018. Available here.
[3] Serafeim, Zochowski and Downing 2019. Available here.

disclosure now exists around them, the progress on measuring the far-ranging impacts that products have on consumers and society has been less impressive.

We define product impact as the impact that occurs once a company has transferred control of goods or services, which is consistent with traditional accounting recognition of a sale. Measurement efforts for product impact are still coarse, relegated to broad categorizations such as businesses with large negative externalities, traditionally tobacco and more recently coal, versus all else. However, different products can have fundamentally different impacts due to their effectiveness and affordability among other factors.

Moreover, while significant progress has been made in the development of environmental and social metrics, these are not embedded in a financial statements' framework enabling managers and investors to understand trade-offs and relative performance evaluation that considers impact along with risk and return. To embed these metrics into a financial statements' framework, impacts need to be measured and monetized based on available data. Monetization based on available data translates impact into a language that is familiar to decision-makers. Therefore, creating impact-weighted financial accounts is a scalable solution for the incorporation of impact in business decision-making.

For companies that do measure their product impact, impact evaluation is highly specific, limiting comparability and scalability. Moreover, the number of companies that have managed to measure product impact in monetary terms is limited. Of the 56 companies that have experimented with monetary impact valuation, only twenty percent estimate product impact.[4] For example, NS Rail applies a monetary value to the mobility trains provide, whereas Safaricom measures the value of secure financial connectivity created by M-Pesa. Moreover, the dimensions on which these companies measure product impact are highly specific to individual products. Therein lies the difficulty with measuring product impact: such impacts, in contrast to employment or environmental impacts from operations, tend to be highly idiosyncratic limiting the ability to generalize and scale such measurements.

An accounting framework in which product impacts can be measured and monetized is needed. First, creating a framework to measure the impacts of products introduces a systematic and repeatable methodology that can capture product impacts across industries. This allows for transparency, comparability, and scalability of product impacts. Second, a framework enables

[4] Serafeim, Zochowski and Downing 2019. Available here.

more nuanced measurement of product impact. Rather than categorizing certain products, such as cigarettes or coal, as unequivocally negative, a framework allows measurement of the level of positive or negative impact that all types of products can create, including many that have large negative externalities but are not traditionally classified as 'sin' businesses (e.g. high trans-fat or sodium food). Measuring positive impacts allows for differentiation across products and companies and derivation of a more balanced assessment of a company's impact. Finally, the introduction of a product framework encourages a holistic approach of measuring and reflecting impact in financial statements by broadening the scope of impacts beyond operations. Ultimately, the aspiration is to provide investors and managers with the ability to make more informed decisions that account for the impact of a company's product using impact-weighted financial statement analysis.

In this paper, we provide a framework for systematic measurement of product impact and the rationale for each of its elements. Moreover, we apply the framework in the context of nine industries across nine different sectors per the Global Industry Classification Standard (GICS) to show the feasibility of measuring product impact and actionability of the framework. Specifically, we examine applications to the following industries (sectors): automobile manufacturing (consumer discretionary), packaged foods (consumer staples), consumer finance (financial), aviation (transportation), telecommunications (communications), water utilities (utilities), interactive media and services (technology[5]), pharmaceuticals (healthcare), and oil and gas (energy). Finally, we provide analysis of information that can be derived from impact-weighted financial accounts using the dataset we created in applying the framework. We see our results as a first step, rather than a definitive answer, towards more systematic measurement of product impact in monetary terms that can then be reflected in financial statements with the purpose of creating impact-weighed financial accounts.

[5] We examine the interactive media and services industry since some of the most prominent and widely recognized "Big Tech" companies are categorized within this industry. We note the interactive media and services industry has since been reclassified to the communications sector.

CHAPTER 2
PRODUCT IMPACT MEASUREMENT EFFORTS

There has been a significant level of market experimentation attempting to measure product impact. These efforts have moved the field forward and allowed for a more sophisticated treatment of product impact. In examining the different methodologies used to measure product impact by organizations such as companies, investors, reporting standards, and data providers, a few patterns arise. The metrics often are input or process oriented and are highly specific to single products, investments, or industries. Where monetary impacts are estimated, there is a lack of transparency around the specific assumptions used to monetize outcomes. In addition, the current state of product impact measurement has comparability and accountability limitations. Below, the current measurement efforts of different companies, investors, reporting standards, and data providers is examined.

2.1. Companies

Companies have made significant progress in identifying a consistent methodology with which to measure product impact. For example, the Handbook for Product Social Impact has created a consensus-based methodology to inform companies on how they can assess the impacts of products (Goedkoop, Indrane, and de Beer 2018). Given the highly idiosyncratic nature of product impacts, a consistent methodology can still produce a wide range of reported impacts that vary between companies. Even within a single company with a range of different products, there is no consistent set of metrics used to estimate product impacts. Yet, companies can compare their products to alternatives in the market when identifying the impact their product generates. These product impact comparisons indicate a feasibility for using similar metrics to compare the product impact of two different products and suggests there is some set of relevant metrics across products that should be identified and standardized.

TABLE 1

Sample of Companies Measuring Product Impact

Company	Example products	Measurement	Example metrics or impacts
ABN·AMRO	Fee and interest-based payment and account services, mortgages, corporate loans and advice[6]	Monetary ranges	Client value of money storage and management, value of time, data and privacy breaches, decrease in cash related crime, financial distress due to repayment difficulties of loans[7]
AkzoNobel	Decorative paints, automotive and specialty coatings, industrial coatings,	Descriptive and numeric and descriptive	Revenue from products with sustainability benefits that outperform the market, standard of reducing hazardous substances and volatile organic compounds in products, percent of timely deliveries[8]
BASF We create chemistry	Petrochemicals, nutrition and care chemicals, coatings, crop care[9]	Monetary	Reduction of fat in the liver from product consumption, percent improvement in crop yield, customer emissions from the use of end products
NOVARTIS	Pharmaceutical drugs, oncology drugs	Numeric	Number of patients reached, health gains per patient year in Quality-adjusted life years [10]
	Rail transportation	Monetary and numeric	Percent customer satisfaction, percent punctuality, seat availability, monetary values for mobility created and journey time[11]
Safaricom	Mobile services and mobile payments	Monetary	Increase in personal savings due to theft reduction, increase in personal savings due to convenience and reduced transaction costs[12]
vodafone	Mobile services, Internet of Things connectivity, cloud services, carrier services[13]	Monetary	End of life waste production, avoided emissions through reduced commuting and office utilities, improved modem efficiency[14]
VOLVO	Vehicles, excavators, trucks, haulers, wheel loaders	Numeric	Emission levels, external sound levels, recyclability[15]
YorkshireWater	Water utility services	Monetary	Water quality compliance, water supply interruptions, customer service satisfaction, customer bills[16]

[6] ABN AMRO Group N.V., "Impact Report 2018", page 18. Accessed September 11, 2019.
[7] ABN AMRO Group N.V., "Impact Report 2018", page 23. Accessed September 11, 2019.
[8] AkzoNobel, "AkzoNobel Report 2018", pages 155 – 157. Accessed September 16, 2019.
[9] BASF, "BASF 2018 Report", pages 68 – 106. Accessed September 10, 2019.
[10] A.H. Seddik, J. Branner, R. Helmy, D.A. Ostwald, S. Haut, *The Social Impact of Novartis Products: Two Case Studies from South Africa and Kenya.* Basel/Berlin/Darmstadt, August 2018.
[11] NS, "NS Annual Report 2018", pages 7 and 127. Accessed September 13, 2019.
[12] KPMG International Cooperative, "KPMG True Value Case Study Safaricom Limited". Accessed September 17, 2019.
[13] Vodafone Group Plc, "Annual Report 2019", page 6. Accessed September 17, 2019.
[14] Vodafone Netherlands, "Environmental Profit and Loss Methodology and Results 2014/15". Accessed September 17, 2019.
[15] Volvo Construction Equipment, "Environmental Declaration Volvo Articulated Haulers". Accessed September 12, 2019.
[16] Yorkshire Water, "Our Annual Performance Report 2018/2019." Published July 2019. Accessed September 16, 2019.

2.2. Investors

As more investment managers incorporate ESG issues into their decision-making, a few of them have made either their methodology or examples of metrics used publicly available. Similar to companies that report their product impact, investors rely on metrics that are specific to each investment. Interestingly, all four investment firms that have made some progress towards measuring product impact are investing in private markets, having relatively concentrated portfolios in a small number of investee organizations. This reflects the difficulty in producing product impact measurements for thousands of organizations that would be required for investors holding broadly diversified portfolios in public markets. Ultimately, given the nature of investment decisions, these methodologies tend to produce a prospective estimation of potential financial, social, and environmental gains, rather than an estimate of the impacts that have occurred.

TABLE 2

Sample of Investors Measuring Product Impact

Company	Public information	Measurement	Sample case or methodology	Sample product metrics
BainCapital	Case study examples	Numeric	Skills-focused education company	Number of programs completed, number of sponsored students, percent of learners reporting pay increase, percent of learners reporting career improvement, net promoter score[17]
The Carlyle Group	Case study examples	Numeric	Manufacturer of powertrain components	Number of electric vehicle patents filed, percent reduction in efficiency losses, miles traveled on a single charge[18]
KKR	Case study examples	Numeric	Medical transportation company	Communities served, vehicles in fleet, frequency of critical interventions, patients transported, natural disasters responses[19]
RISE	Methodology	Monetary	Impact multiple of money on online alcohol abuse course	Students (scale), reduction in alcohol incidents following course completion (desired social outcome), value of fatality reduction (economic value of social outcome), probability of impact (risk adjustment), probability of

[17] Bain Capital Double Impact, "Year in Review." Published May 2019. Accessed September 18, 2019.
[18] The Carlyle Group, "Corporate Sustainability Report 2019." Accessed September 18, 2019.
[19] KKR, "2018 ESG, Impact, and Citizenship Report." Accessed September 18, 2019.

	ongoing value creation (terminal value calculation)[20]

2.3. Reporting standards

Given the interest in ESG data, many global reporting frameworks have begun to help companies with measurement and reporting of sustainability information. Two of the global leading standard setters, the Sustainable Accounting Standards Board (SASB) and the Global Reporting Initiative (GRI), have identified hundreds of sustainability metrics. One key difference between SASB and GRI is that the SASB standards are industry-specific. SASB's identification of industry-specific metrics translates to the larger number of identified product related outcomes and impacts. This reflects the idiosyncratic nature of product impact. Given that product impacts differ significantly across industries, one would need an industry lens to capture product outcome metrics.

TABLE 3

Sample of Reporting Standards and Product Metrics

Standard	Industry Metrics	Number of Industries	Measurement	Input or Outputs	Outcomes or Impacts
GRI	N	-	Descriptive and numeric	4	2
SASB	Y	47	Descriptive, monetary, and numeric	70	117

2.4. Data providers

With standard-setting efforts for ESG disclosure underway, complementary efforts to provide ESG data are also ongoing. For two of the main data providers sharing ESG data, neither provides impact or monetary metrics. For example, one product metric Bloomberg examines in the telecom space is the number of phones recycled rather than the monetary value of the emissions saved from recycling. Similarly, Thomson Reuters has a metric on product recalls rather than the monetary value from injuries or illnesses associated with the recall. Although product recall count provides color to the health and safety of a company's products, monetary figures associated with

[20] Chris Addy, Maya Chorengel, Mariah Collins, and Michael Etzel, "Calculating the Value of Impact Investing". *Harvard Business Review* January-February 2019 Issue pp. 102 – 109.

the recall provide a metric that can be seamlessly integrated into financial statements and decision-making.

TABLE 4

Sample of Data Providers and Product Metrics

Standard	Industry Metrics	Number of Industries	Measurement	Input or Outputs	Outcomes or Impacts
Bloomberg	Y	3	Numeric	33	4
THOMSON REUTERS	N	-	Numeric and rating	25	18

While highly idiosyncratic, the metrics of these reporting standards and data providers can be categorized into recurring themes. Although the underlying metrics themselves may vary, most of these organizations make some effort to capture the accessibility or recyclability of a product. In summarizing these recurrent themes of measurement, it appears some common ones include access, environment, health and safety, information, quality, and satisfaction. The metrics from reporting standards and data providers are distributed across the product impact categories with a focus on environmental, health and safety, and access related impacts.

TABLE 5

Number of Product Metrics by Theme

Product impact theme	Number of metrics
Access	49
Environment	108
Health and safety	87
Information	17
Quality	3
Satisfaction	9

CHAPTER 3
PRODUCT IMPACT FRAMEWORK DESIGN METHODOLOGY

A few key considerations are important in framework development. A framework for measuring product impacts should build on existing measurement efforts and leverage public data. The framework should also be applicable to multiple industries or products to allow for comparability and scalability. Finally, the framework should aim to adhere to certain guiding principles.

3.1. Framework design principles

The conceptual framework of the International Financial Reporting Standards (IFRS), which are used for measurement and disclosure of corporate financial accounts across 144 jurisdictions around the world, outlines key characteristics of what makes information useful. Relevance and faithful representation are the key qualitative characteristics. Information is relevant if it can make a difference in decision making, which happens if the information has predictive or confirmatory value. Information faithfully represents the substance of what is purports to represent if to the maximum extent possible is complete, neutral, and error-free. Higher measurement error is recognized as inhibiting faithful representation. Enhancing qualitative characteristics include comparability, verifiability, timeliness, and understandability.

In designing a standard product impact measurement framework, we adopt guiding principles that are likely to generate more useful product impact-weighted financial accounts. *Consistency* ensures the framework has consistent units, scale, and approach. As such, the framework estimates monetary impact values. This likely increases the relevance of the information increasing understandability for business decision makers and the comparability of information. *Incentive alignment* encourages consideration of the behavior that is incentivized by the framework to ensure it is aligned with positive social and environmental impact thereby making the information relevant. *Best-in-class* benchmarking mitigates the probability that the impact of a product or industry is benchmarked to a very low threshold thereby safeguarding the relevance of the information. *Conservatism* bases the framework in conservative assumptions and comparisons and increases the likelihood of faithful representation mitigating the probability of positive bias through "cheap talk" and "impact-washing." Finally, the scope of impacts considered is limited to *first-order* effects from usage of the product or service. We recognize this excludes impacts to both broader stakeholders in the value chain and higher-order impacts to the direct

stakeholder, but it likely decreases measurement error thereby making the information more likely to faithfully represent substance.

3.2. Building the framework

To identify the relevant dimensions of product impact, a thought experiment was conducted in which the product impact of two products with identical features and qualities are compared. All else equal, the product with greater reach would have greater impact. Therefore, *reach* must be a dimension of product impact, composed of a product's quantity and duration. However, products do not have identical features and therefore, greater reach does not mean greater impact. Holding reach constant in simplified examples allows identification of the other dimensions of product impact.

To identify these other dimensions of product impact, additional thought experiments can be conducted to explore the elements of a customer's interaction with a product. Consider the impact of designer handbags and water where both products have the same reach. Water would be viewed as more impactful because of the inherent goodness of the product. While water is a basic need that provides sanitation and prevents dehydration, a designer handbag is a luxury item with lower inherent utility. This example illustrates that *quality* is a dimension of a product's impact. To specify, quality as a dimension of impact therefore captures the extent to which a product provides a basic need of inherent goodness and the effectiveness of a product which can be measured by customer satisfaction, rather than the level of craftsmanship or leather that might be used in a designer bag.

Next, consider the impact of a generic and prescription drug where both products have the same reach and quality, but the generic has a lower price. The lower priced generic would be viewed as more impactful since its pricing makes it more accessible to consumers. Therefore, another dimension of a product's customer usage impact is access.

Holding price, reach, and quality constant, consider the example of cigarettes. Cigarettes have accessible pricing (especially in the absence of taxes), broad reach, and high customer satisfaction but are generally accepted as a product that is unequivocally bad. Regardless of the negative impacts of cigarettes, the product maintains broad reach due to its addictive nature. Therefore, a dimension that product impact should capture is consumer *optionality* (i.e. if the consumer has the freedom to make choices). In cases of addictive products or monopolies this

optionality is limited. Together, access, quality, and optionality compose of the customer usage dimensions.

Finally, consider various products that produce energy, such as coal and solar. If the two products had the same price, reach, quality, and optionality, solar energy would have greater positive impact than coal because solar energy produces fewer emissions than coal when used. A product's environmental impact through usage *efficiency* and end of life *recyclability* is a dimension of capturing a product's overall impacts.

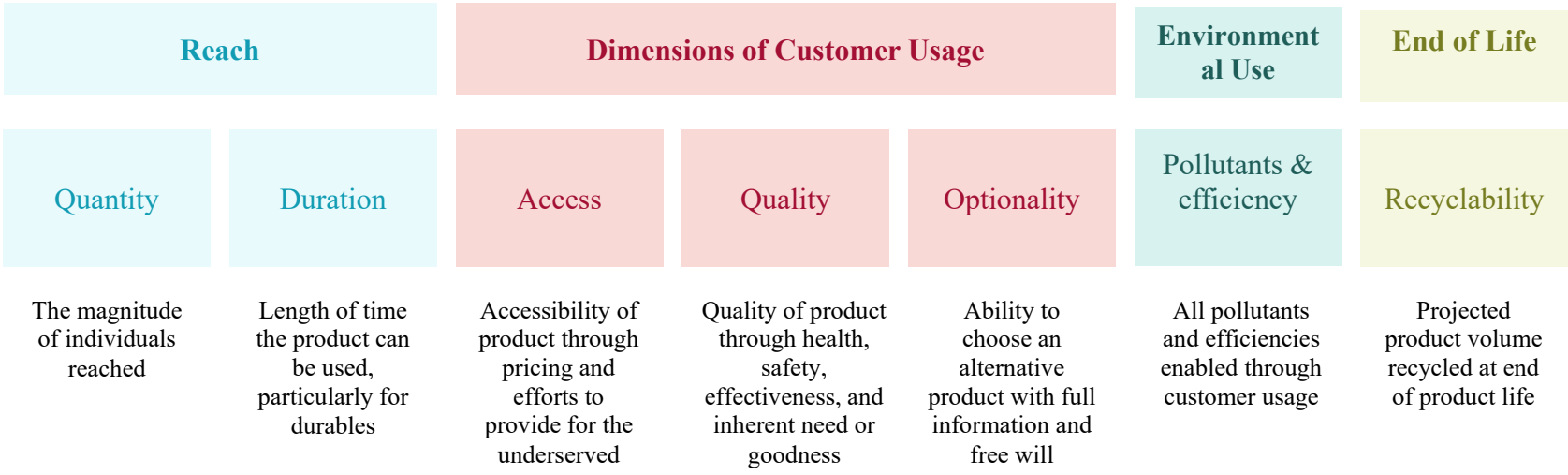
Referring to the recurrent themes of existing disclosure data in Table 5, the dimensions identified as relevant to product impact fully encompass the themes that appear in existing measurement and disclosure efforts. The pricing and underserved themes are components to the access dimension. The health and safety, data privacy, and innovation themes are attributes of the quality dimension. The information theme is one of the components within the optionality dimension. Finally, emissions, energy and recyclability contribute to a product's environmental impact. This indicates that the dimensions identified as relevant to product impact have empirical grounding in the common themes that corporations, investors, standard setters, and data providers use to assess product-related impact.

3.3. Dimensions of the framework

The dimensions of product impacts can be aggregated into a cohesive framework for use across products and industries as indicated in Figure 1. Table 6 provides general formulas for calculating product impact across the dimensions identified in Figure 1.

FIGURE 1

Product Impact Framework Dimensions



Reach

Reach examines how many individuals are reached by the product and the length of time for which the product can be used. Some sample metrics that can be used to estimate a product's reach are sales volume or number of customers. Duration can be estimated with metrics such as average or expected product life. For example, the quantity component of reach for a pharmaceutical company where a discrete number of customers might be unavailable can be estimated through sales data by pharmaceutical drug divided by dose pricing and doses in a treatment to identify the number of individuals treated. For the duration component of reach, most pharmaceutical drugs will have a duration of 0 with implants having a duration equivalent to average product life.

Access

Access is how available a product is to consumers. This can be measured through product pricing and efforts to make the product available for underserved populations. The affordability dimension aims to capture the benefit from provision of a more affordable product or service. Table 6 provides a general formula for calculating the affordability impact of access. Affordability can be estimated by calculating the difference between a product's price and average pricing in the market with a floor at zero. This difference is then multiplied by the units of product sold. For example, a consumer-packaged goods company could compare the price per calorie of their own products to the average price per calorie of all alternatives in the relevant product categories as identified by a standard research or reporting firm such as Nielsen. Products that are priced below the relevant benchmark are deemed affordable and have a positive impact. Products that are priced above the relevant benchmark and luxury products are not deemed affordable and therefore do not have an affordability impact. The accessibility of a product to the general population can be estimated through affordability.

For particularly vulnerable populations, access to various products often allows for the realization of large, critical impacts at a scale far beyond that of the general population. Given the significance and importance of these impacts, product impacts to the underserved are estimated separately in addition to general access. For a product to qualify as accessible to the underserved, the product must address a UN Sustainable Development Goal in a market that would usually not have access to the product. For example, cigarettes do not address a sustainable development goal but are sold in developing markets. They would not be viewed as products that address an

underserved population even though they are serving a developing market because they make no contributions to development. On the other hand, a pharmaceutical company could estimate the averted medical and mortality costs and productivity gains of providing qualified drugs to underserved markets. Table 6 provides a general formula for calculating the underserved impact. A binary product designation is applied to identify products which address a UN Sustainable Development Goal. This binary product designation is then multiplied by the relevant number of underserved customers and the additional benefit created from access.

Quality

Quality of a product can be measured by the health and safety, effectiveness, and inherent goodness of the product. The health and safety of a product examines whether the product performs to expected health, safety, and privacy standards. The health and safety impact can be calculated by multiplying the number of customers affected by the health, safety, or privacy incident and the associated per person cost of the incident as shown in Table 6. For a packaged food product, its health and safety would not be captured by how healthy the food product is, but by the costs associated with food-borne illnesses from product recalls. Other metrics that can capture the health and safety of a product include controversies or data leaks associated with the product.

The effectiveness of a product is whether the product works as it should. For packaged food products, effectiveness would be where the nutritional value of the product is captured. For example, the whole grains, fiber, added sugar, sodium, and trans-fat content of a product can be translated to costs associated with changes in risk of coronary heart disease or diabetes. Where effectiveness cannot be readily observed, customer satisfaction can be used as a proxy measure. As detailed in Table 6, effectiveness can be calculated by multiplying the difference of industry intended performance and actual product performance against the cost or benefit associated with the performance difference. This difference in performance is then multiplied by the number of units sold to estimate the total effectiveness impact where characteristics of product performance can be clearly observed. Where characteristics cannot be readily observed, the customer satisfaction proxy can be applied to estimate the effectiveness impact by multiplying the difference in customer satisfaction by the overall price for the product or service and the units sold. The overall price represents the value lost or averted value loss from above or below industry customer satisfaction.

Lastly, the necessity dimension of the product examines whether the product provides some basic need to the population. Elasticity can be used to identify products that are basic needs. While products that are basic needs generally exhibit inelastic demand, there are some exceptions to this generalization. For example, luxury goods often exhibit highly inelastic demand but do not meet a basic need. Individual judgement can be applied to the initial elasticity-based product designation to identify these exceptions. Table 6 provides a general formula for estimating the basic need impact, which multiplies the basic need product designation by the total number of customers and the averted cost associated with the basic need met. This averted cost can be estimated by identifying the global economic losses avoided using the product or service. For example, the basic need component of a utilities company providing water would be captured through the averted economic losses from sanitation. Similarly, the basic need component of certain food products would be the averted economic losses of starvation.

Optionality

Optionality of a product is the extent to which consumers have free will and full information in their purchasing choices. The optionality in product choice is composed by information availability, monopolistic nature of the industry, and decision altering characteristics. Table 6 provides a general formula for estimating the optionality impact which multiplies the number of customers coerced due to lack of optionality in product choice with the cost associated from making a coerced choice. In the case of information availability, sample metrics would include labeling and marketing controversies. For example, a water utilities company could use warning letters and fines around improper marketing to estimate the costs of inaccurate information to consumers. In the case of limited optionality due to monopolies, , the Herfindahl-Hirschman Index (HHI) or four-firm concentration ration (CR4) can be used to identify products and services provided in a monopoly. Monopolistic industries such as the pharmaceutical industry can estimate extractive rents to consumers by using the excess of costs associated with marketing to research and development. For decision altering products, sample metrics include how addictive a product is. A tobacco company could estimate the productivity and treatment costs associated with addiction itself.

Environmental use

Environmental impacts from product usage include emissions and other pollutants to the environment and efficiencies enabled through product use. Table 6 provides a general formula for

estimating environmental use impacts which multiplies the equivalent volume of emissions by the cost of the relevant emissions. Some sample metrics that capture the efficiency of a product are carbon or particulate emissions from use or energy required from use. A consumer-packaged goods company could identify the carbon cost of emissions that would be used for cooking and storage of the product. The averted emissions and efficiencies enabled through product use should already be accounted for by the total equivalent volume of emissions.

End of life treatment

End of life environmental impacts are based on the end of life treatment of the product. The end of life impact can be estimated by multiplying the volume of product for each end of life treatment and the associated cost or value of the treatment as illustrated in Table 6. Sample metrics could include volume or percentage recyclability and recoverability. A pharmaceutical company could identify the associated carbon costs with the end of life treatment of products sold.

3.4. Measurement bases

There are different measurement bases for financial information as they are for environmental and social impacts. In the context of financial accounts, the IFRS conceptual framework identifies both historical cost and current value measurement bases. Historical cost provides information derived, at least in part, from the price of the transaction or other event that gave rise to the item being measured. Current value measurement bases include fair value, value in use or fulfilment value, and current cost. Fair value is the price that would be received to sell an asset, or paid to transfer a liability, in an orderly transaction between market participants at the measurement date. Value in use for assets and fulfilment value for liabilities reflects entity-specific current expectations about the amount, timing, and uncertainty of future cash flows. Current cost reflects the current amount that would be paid to acquire an equivalent asset or received to take on an equivalent liability. The measurement basis is selected based on the relevance and faithful representation criteria, outlined before.

In our work, we have identified relevant measurement bases that are applicable to different dimensions. First, market prices are directly applicable when measuring impact from affordability since it is the market price that a participant needs to pay to get access to the product. This measurement base is conceptually aligned with fair value. Second, estimated benefits, including averted costs, and estimated costs from using the product are directly applicable when measuring

impact from effectiveness or environmental usage, for example. This measurement base is conceptually aligned with the value in use and fulfilment value. Third, willingness-to-pay estimates can be applied in the absence of estimated benefits and costs for health and safety, for example. This measurement base is conceptually aligned with current cost.

3.5. Benchmarking

The discussion above also illustrates the use of benchmarks in measuring product impact. No benchmark is used other than for affordability and effectiveness. The presence of benchmark for those two categories is warranted given that companies will not provide the product for zero price and that most products will likely have some level of effectiveness that differs from zero. Benchmarks in both cases is set the observed average price or performance in the industry.

TABLE 6

Impact Estimate Methodology by Product Impact Framework Dimension

$Reach$
The reach dimension is used as a multiplier to estimate the impact in the following dimensions. Values identified in the reach dimension often include unit sales, customers and, product life.
$Affordability = \max\{0\ , (price_{industry} - price_{firm}) \times units\ sold\}$
The total difference in overall price for use of a product or a service is estimated by multiplying the total relevant units sold by the difference in the industry average overall price for use of the unit sold and the firm overall price for use of the unit sold during the period of accounting with a floor at zero.
$Underserved = product_{SDG} \times customers_{underserved} \times additional\ access\ benefit$
Products that meet a United Nations Sustainable Development Goal are designated with a 1 in $product_{SDG.}$ Other products are designated with a 0 in this variable. The binary product designation is multiplied by the number of customers who are underserved. Some example methods for identifying underserved customers include income and geography. This is then multiplied by the additional positive benefit from provision of access to an underserved population.
$Health\ \&\ Safety = customers_{affected\ by\ health\ \&\ safety\ incident} \times cost_{health\ \&\ safety\ incident}$
The health and safety impact is calculated by multiplying the number of customers affected by a health and safety incident with the associated cost of the incident to the customer.
$Effectiveness = (product\ performance_{industry\ intent} - product\ performance_{firm\ actual}) \times cost_{\ performance\ difference} \times units\ sold$
Where the product performance can be clearly defined or measured, the effectiveness impact takes the difference between the industry average product performance and a firm's actual product performance. This difference in performance is then multiplied by the relevant associated cost to differential performance and multiplied by all units sold.
$Effectiveness = (satisfaction_{industry} - satisfaction_{firm}) \times price_{firm} \times units\ sold$
Otherwise, the effectiveness dimension can be supplemented with an estimate rooted in customer satisfaction. This estimate multiplies the difference in satisfaction by the firm overall price for use of the unit sold during the period of accounting. The price for use of the unit represents the value loss or averted value loss from above or below industry customer satisfaction. This value loss is multiplied by all units sold.
$Need = product_{basic\ need} \times customers_{total} \times averted\ cost_{unmet\ need}$
Products that are a basic need are designated with a 1 while other products are designated with a 0. Generally, products with highly inelastic demand are basic needs. There are exceptions to this generalization; for example, luxury goods are often highly inelastic and are not a basic need. We note that individual judgment and elasticity together should be applied to designate basic need products. To estimate the basic need impact, the basic need product designation is multiplied by the number of customers and the averted cost associated with an unmet basic need.
$Optionality = customers_{coerced} \times cost_{coerced\ choice}$
The optionality impact is estimated by multiplying the number of coerced customers by the cost these customers face due to lack of freedom of choice.
$Env.Usage = volume_{emissions} \times cost_{emissions}$
Given environmental usage data is often converted to emissions, the impact is estimated by multiplying the equivalent volume of emissions created during use of the product with the cost of emissions as defined in the environmental framework of the Impact-Weighted Accounts Project.
$End\ of\ Life = (volume_{waste} \times cost_{waste}) + (volume_{recycled} \times value_{recycled}) + (volume_{treatment_i} \times value_{treatment_i})$

The end of life impact is estimated by multiplying the volume and cost associated with each end of life treatment relevant to the product, such as waste, recycling and recovering.

APPLICATIONS OF THE FRAMEWORK

We provide applications of the product impact framework to an industry within the consumer discretionary, consumer staples, financial, transportation, communications, utilities, technology, healthcare, and energy sectors to demonstrate and ensure feasibility, scalability, and comparability across different sectors. We examine the automobile manufacturing industry within the consumer discretionary sector, the packaged foods industry within the consumer staples sector, the consumer finance industry within the financial sector, the aviation industry within the transportation sector, the telecommunications industry within the communications sector, the water utilities industry within the utilities sector, the interactive media and services industry within the technology sector[21], the pharmaceuticals industry within the healthcare sector, and the oil and gas industry within the energy sector. These applications highlight that the dimensions on which product impact occur are consistent across these nine varied industries, with nuances to how the impact manifests by industry and dimension.

The applications are based on publicly disclosed data and industry-wide assumptions. Company datapoints reflect information found in the most recent annual financial statements such as the company's Form 10-K and annual sustainability reports which often disclose SASB and GRI metrics. These applications aim to make use of existing data and metrics from the perspective of incorporating publicly available data. Industry-wide assumptions reflect industry-specific literature, government and regulatory bodies, and industry groups. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

[21]As noted in the introduction, we examine the interactive media and services industry since some of the most prominent and widely recognized "Big Tech" companies are categorized within this industry. We note the interactive media and services industry has since been reclassified to the communications sector.

CHAPTER 4

CONSUMER DISCRETIONARY SECTOR: AUTOMOBILE MANUFACTURERS[22]

We review a deep-dive of two competitor companies within a single industry, automobile manufacturing, to provide a cohesive example that examines the impacts of automobiles across all the product impact dimensions. We focus our impact estimates on those of passenger fleet vehicles. The companies will be referred to as Company A and B given the purpose of this exercise is to examine feasibility and is not to assess the performance of individual companies. However, we note that all the data are actual data from two of the largest automobile manufacturers in the world.

TABLE 7

Product Impacts of Company A and B

				Reach		Dimensions of Customer Usage			Env Use	End of Life
Company	Revenue	Positive Product Impact	Negative Product Impact	Quantity	Duration	Access	Quality	Optionality	Emissions	Recyclability
A	$160bn	$6,710m	-$3,342m	5,982,000 vehicles sold	14.72 years	$353m	$4,806m	-	-$3,161m	$1,369m
B	$147bn	$10,242m	-$3,910m	8,384,000 vehicles sold	14.26 years	$1,085m	$7,745m	-	-$3,569m	$1,072m

**Total positive and negative product impact differ from sum of dimension-level impacts provided given the access, quality, and recyclability dimensions aggregate positive and negative impacts. Variances from totals below due to rounding.*

4.1. Automobile manufacturing: Reach

TABLE 8

Product Sales and Duration of Company A and B

Data			Estimation	
SASB Disclosure	**A**	**B**	**A**	**B**

[22] Serafeim, George, and Katie Trinh. "A Framework for Product Impact-Weighted Accounts." Harvard Business School Working Paper, No. 20-076, January 2020. (Revised October 2020.)

TR-AU-000.A	Number of vehicles manufactured	6,000,000	8,459,236
TR-AU-000.B	Number of vehicles sold	5,982,000	8,384,000
Secondary Data		**A**	**B**
Forbes	Maximum[23] mileage	198,409	192,169
Forbes	Maximum mileage	198,409	192,169
		÷	
FHWA	Average annual mileage[24]	13,476	
		=	
	Average product life	**14.72**	**14.26**

To estimate the relevant quantity and duration for reach, a combination of publicly disclosed data and secondary assumptions were used. The maximum mileage of the manufacturer's vehicle and average annual mileage in the United States are used to estimate average product life. Although annual mileage is specific to the United States, this does not indicate that the framework itself is only applicable in the United States. Instead, this is indicative of how an estimate can be influenced by data availability. If a company were to apply this framework, internal data on product life could be applied instead of calculating duration from a localized assumption. Furthermore, these estimates can be rooted in other underlying data points, such as powertrain warranties for average product life. It is possible that as companies apply and refine their estimates, different underlying measures may prevail.

The importance of accounting for average product life is highlighted with durable products. The impact of a vehicle on the consumer is not limited to point of sale, but throughout its useful life. For example, a vehicle has affordability and efficiency impacts throughout use and maintenance and environmental impact at end of life. Therefore, average product life is needed to determine how long and when to recognize usage and end of life impacts.

4.2. Automobile manufacturing: Access - affordability

TABLE 9

Affordability of Vehicles Sold by Company A and B

Data	Estimation

[23] Henry, Jim. "Toyota Leads Top 10 Longest Lasting Brands". Forbes Media LLC. Accessed October 23, 2019.
[24] Office of Highway Policy Information. "Average Annual Miles per Driver per Age Group". US Department of Transportation Federal Highway Administration. Accessed October 23, 2019.

SASB Disclosure		A	B
TR-AU-410a.1	Sales-weighted avg passenger fleet fuel economy (mpg)	28.90	23.00

Secondary Data		A	B
Kelley Blue Book	Average cost of company vehicle	$42,234	$41,621
Repair Pal	Average annual maintenance cost for company vehicle	$775	$649

Industry assumptions		
Kelley Blue Book	Avg. cost of non-luxury vehicle	$33,642
	Avg. cost of luxury vehicle	$67,649
EPA	Average fuel economy	39.4
AAA	Average annual maintenance cost	$792

Applied industry assumptions for operating cost		
Blue Book	(Industry non-luxury vehicle[25]	$33,642
		÷
BTS	Industry car product life[26])	11.60
	Industry vehicle price	$2,900
		+
FWHA	(Average miles driven	13,476
		÷
EPA	Industry mileage in MPGe[27])	39.4
		x
EPA	Price of gallon of fuel[28]	$2.64
	Industry fuel cost	$903
		+
AAA	Industry maintenance[29]	$792
Industry annual operating cost		**$4,595**

		A	B
Blue Book	(Avg cost of company vehicle	$42,234	$41,621
		÷	
	Avg product life of company vehicle)	14.72	14.26
		=	
	Avg annual vehicle price	$2,869	$2,919
		+	
FWHA	(Average miles driven	13,476	
		÷	
SASB	Vehicle mileage)	28.9	23
		=	
	Avg fuel cost	$1,231	$1,547
		+	
Repair Pal	(Avg maintenance for company vehicle	$775	$649
		=	
	Vehicle annual operating cost	**$4,875**	**$5,115**

		A	B
	Industry annual operating cost	$4,595	
		-	
	Vehicle annual operating cost	$4,875	$5,115
		x	
SASB	Vehicles sold	5,982,000	8,384,000
Affordability impact		-	-

The affordability dimension accounts for the impact created by a company through provision of a more affordable product. Given vehicle ownership costs go beyond the initial sale

[25] Kelley Blue Book. "Average New-Car Prices Up 2 Percent Year-Over-Year for April 2019". *PR Newswire*. Published May 2019.
[26] Bureau of Transportation Statistics. "Average Age of Automobiles and Trucks in Operation in the United States". US Department of Transportation. Accessed October 23, 2019.
[27] Office of Energy Efficiency & Renewable Energy. "Most Efficient Cars by EPA Size Class". US Department of Energy.
[28] US Energy Information Administration. "Gasoline and Fuel Update". Accessed October 23, 2019.
[29] AAA Automobile. "What Does it Cost to Own and Operate a Car". *AAA.* Accessed October 2020.

price, the affordability of a vehicle should consider the complete price for ownership. Therefore, the estimated affordability impact compares the annual cost for operating a vehicle to an average in the market. This consists of annualized sale price, fuel costs, and maintenance costs. An important nuance to note around affordability and luxury products is that less affordable and luxury vehicles do not have an affordability impact. While provision of a more affordable product creates positive impacts, a consumer's decision to purchase a more expensive or luxury vehicle and a vehicle manufacturer's luxury pricing strategy does not have any inherent negative impact or any additional positive impact to affordability. Therefore, the affordability impact of luxury vehicles or any vehicle more expensive than the industry benchmark is floored at zero.

Estimating industry operating cost

The data section of Table 9 provides the assumptions and methodology applied to estimate the annual industry average cost to own and operate a non-luxury vehicle. To estimate the annualized sale price, the appropriate vehicle price benchmark needs to be selected. We use the non-luxury industry average price as the relevant benchmark given the overall industry average would include more expensive luxury vehicles. The sales price is divided by the average product life to estimate an annualized sales price difference that should be recognized until end of product life. The average product life is a key factor in determining affordability because even though a certain car might have a very low sales price, it could also have an extremely short product life and require more frequent car purchases. Furthermore, this recognition timing matches the common mode of payment for vehicles through long-term leases.

To estimate the cost of fuel, the average annual mileage driven is divided by the industry average fuel economy and multiplied by fuel price. An important nuance to note is the benchmark selected for fuel economy is limited to vehicles rather than other modes of transportation given the first-order principle to ensure there is not an intractable comparison. In practice, a manufacturer with more detailed fuel economy data could make the comparison by car type rather than across car type.

The estimated industry average annual vehicle price and fuel cost are summed with the industry average maintenance cost to estimate the annual cost of operating a vehicle.

Estimating the affordability impact

The affordability impact is estimated by comparing the annual industry cost to operate a vehicle to the cost for the company. Since Company A and B have a higher operating cost than the industry average, their affordability impact is floored at zero. Even with manufacturer data, these estimates are reliant on industry-wide assumptions around fuel price and average miles driven in a year. Industry input is therefore crucial in refining these assumptions to improve accuracy and ensure alignment over time.

4.3. Automobile manufacturing: Access - underserved

TABLE 10

Underserved Access to Vehicles Sold by Company A and B

Data

Secondary Data		**A**	**B**
Statista	% sales to developing countries	26%	57%

Estimation

		A	**B**
UN	Addresses SDG	1	
		x	
ANTP	(Avg travel time with car	.42 hours	
		-	
ANTP	Avg travel time without car)	.63 hours	
		x	
World Bank	Average global net national income (per capita)[30]	$8,826	
		÷	
	Annual working hours	2,080	
		x	
Statista	Percent of sales to developing countries	26%	57%
		x	
SASB	Vehicles sold	5,982,000	8,384,000
	Underserved impact	**$353m**	**$1,086m**

Sales of vehicles in underserved markets qualify as providing a positive impact to the underserved since vehicles address the ninth sustainable development goal on industry, innovation, and infrastructure. In this example, sales to underserved markets is approximated by the percentage

[30] The World Bank Data. "Adjusted net national income per capita (current US$). Accessed November 11, 2019.

of sales to a developing country. A manufacturer with more detailed data could apply a more nuanced approach to identifying sales that qualify as underserved.

The impact of these sales can be estimated using industry assumptions on time savings when relying on private vehicles for transportation compared to other modes of transportation. These time savings can be estimated for a local population or with a global constant. For illustrative purposes, this example relies on a global time savings constant. Again, this constant could be refined through industry debate and recommendations.

To identify the monetary value of these time savings, the average global hourly wage is applied. A global wage is preferred to a local wage to ensure perverse incentives are not created for manufacturers to avoid countries with the lowest wages, and likely the most underserved. Although the monetary value of time saved could have also been estimated using willingness to pay for time, global wage is preferred given the willingness to pay for time varies by congestion (free flow, slowed down, stop and start) and timeliness (early arrival, minimized lateness, reduced mean travel time)[31]. As with the affordability impact, the underserved impact can be recognized until end of product life.

4.4. Automobile manufacturing: Quality – health & safety

TABLE 11

Safety Impact of Vehicles Sold by Company A and B

Data

SASB Disclosure		**A**	**B**
TR-AU-250a.1	Percentage of vehicle models rated by NCAP programs with an overall 5-star safety rating, by region - US	59%	73%
TR-AU-250a.3	Number of vehicles recalled	5,940,000	4,230,000

Estimation

		A	**B**
AAA	Crash / 100 million miles	519	
		÷	
FWHA	Average miles driven	13,476	
		x	
Statista	% of 5-star safety cars	59%	73%
		x	
NCBI	% of reduction in crashes[32]	14%	
		x	

[31]Zheng Li, David A. Hensher, John M. Rose. "Willingness to pay for travel time reliability in passenger transport: A review and some new empirical evidence". *Transportation Research* Volume 46, Issue 3, May 2010. Accessed October 23, 2019.

[32] Metzger KB, Gruschow S, Durbin DR, Curry AE. "Association between NCAP Ratings and Real-World Rear Seat Occupant Risk of Injury". *Traffic Injury Prevention 2015.* Accessed October 23, 2019.

SASB	Vehicles sold	5,982,000	8,384,000
		x	
Tavss	Average cost of crash[33]	$69,100	
	Safety impact	**$2,387m**	**$4,141m**

		A	**B**
SASB	Recalled vehicles	5,940,000	4,230,000
		÷	
BTS	Number of vehicles in US[34]	272.4m	
		x	
NHTSA	# vehicle caused crashes[35]	44,000	
		x	
Tavss	Average cost of crash	$69,100	
	Recall impact	**-$66.2m**	**-$47.2m**

Safety impact

The safety of a vehicle is estimated using the US-based NCAP rating program. This safety rating is associated with a reduction rate in injury for frontal crashes. The monetary value of the reduced injuries attributable to the manufacturer can be estimated with average costs associated with a crash. For illustrative purposes, this example applies a US safety rating to all vehicles sold. A manufacturer would be able to apply this methodology on data that is disaggregated to use safety ratings from different geographies. Furthermore, this estimate is reliant on industry ratings and assumptions that can be continually adjusted as new safety and injury information becomes available. For example, the injury reduction assumption applied is limited to frontal crashes. Yet, there is a known association between safety ratings and reduced injury for two additional crash types. Industry debate can identify an estimate that can be generalized to all crashes. Finally, as the industry innovates and more data is available, it is possible that the safety impact will transition from capturing only crash performance to also include preventative measures such as driver assistance technology.

[33] Tavvs Fletcher. "The Price Paid for Automobile Accidents and Injuries". Accessed October 23, 2019.
[34] Bureau of Transportation Statistics. "Number of US Aircraft, Vehicles, Vessels, and Other Conveyances. Accessed October 23, 2019.
[35] National Highway Traffic Safety Administration. "Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey". *Traffic Safety Facts.* Accessed October 23, 2019.

Recall impact

The recall impact is based on manufacturer disclosed data on recall car volume and public reports of vehicle caused crash rates. The attribution of these recalled cars to the pool of crashes can be approximated by applying the percentage of cars on the road that are recalled by the manufacturer. This estimate implicitly assumes that only recalled cars are capable of a vehicle caused crash and that all recalled cars can produce a crash given the time frame required to fix a recalled car. For a manufacturer with data on the rate at which their recalled cars are fixed, the attribution percentage can be lowered by using the number of unfixed recalled cars remaining on the road rather than the total number of recalled cars. Given ongoing changes and advances in the industry, it is possible to imagine a future in which extended warranties can also factor into the health and safety impacts.

4.5. Automobile manufacturing: Quality - effectiveness

TABLE 12

Customer Satisfaction Impact of Company A and B

Data

Secondary Data		**A**	**B**
ASCI	Customer satisfaction rate	80%	80%

Estimation

		A	**B**
ASCI	Satisfaction rate	79.5%	80%
		-	
ASCI	Average satisfaction rate[36]	79%	
		x	
Carfax	% loss in car value (initial year)[37]	20%	
		x	
Blue Book	Avg cost of company vehicle	$42,234	$41,621
		x	
SASB	Vehicles sold	5,982,000	8,384,000
	Satisfaction impact	**$253m**	**$523m**

[36] American Customer Satisfaction Index. "ACSI Automobile Report 2018 – 2019". Accessed October 23, 2019.
[37] Carfax. "Car Depreciation: How Much Value Will a New Car Lose?". Accessed October 23, 2019.

Since the effectiveness of a vehicle is not directly measurable, it is approximated through customer satisfaction rate. The value associated with customer satisfaction is estimated by applying the loss in car value after ownership in the initial year. This implicitly assumes that a customer can realize their dissatisfaction in the initial year of ownership and has the optionality to change to another vehicle. Given the assumption is tied to the initial year of ownership, the satisfaction impact should be recognized only in year of sale. The customer satisfaction and car value loss assumptions are again, based on industry estimates that can be refined with additional information. Furthermore, as new technology is introduced, it is possible that effectiveness can be more directly measured in this industry. For example, one could imagine a future in which vehicles influence congestion, reduce commute time or avert accidents differently by make and model through recorded innovations such as driver assisted technology. These innovations would then reflect differences in the ability for different vehicles to effectively transport the user.

4.6. Automobile manufacturing: Quality – necessity

TABLE 13

Basic Needs Met by Company A and B

Data			Estimation			
Secondary Data				**A**		**B**
Harvard	Long-run price elasticity of vehicle	1.2		Necessity (elasticity < 1)	1	
Harvard	Price elasticity of vehicle (rural)[38]	0.2			÷	
			Illustrative	Percent of rural sales	50%	50%
					X	
				Average daily commute[39]	.45 hours	
					X	
				Commute days	260	
					X	
			Ho, Chinh	WTP for mobility as a service[40]	$6.40	

[38] Patrick L. Anderson, Richard D. McLellan, Joseph P. Overton, Dr. Gary L. Wolfram. "Price Elasticity of Demand". Accessed October 23, 2019.
[39] Sinclair, Liz. "Commute Times in Every State, Ranked." Accessed October 23, 2019.
[40] Chinh Ho, David Hensher, Corinne Mulley, Yale Wong. "Potential uptake and willingness-to-pay for Mobility as a Service (MaaS): A stated choice study". *Transportation Research,* volume 117, pages 302-318. Accessed October 23, 2019.

SASB	Vehicles sold	5,982,000	8,384,000
	Necessity impact	**$2,231m**	**$3,127m**

The final component to quality examines whether a vehicle meets a basic need. The elasticity of a vehicle demonstrates that vehicles are a basic need in rural areas. This makes logical sense as urban areas have alternative modes of transportation and vehicles could contribute to congestion. For illustrative purposes since detailed sales data is not available by geography, this example simply assumes that 50% of sales are rural. To estimate the impact created by rural vehicle provision, the time spent commuting annually is valued with willingness to pay for mobility. Given the impact is realized in all years of ownership, the necessity impact can be recognized throughout the expected product life. In practice, the manufacturer could apply the actual percentage of non-urban sales and industry input could identify precise estimates on the value of mobility.

4.7. Automobile manufacturing: Optionality

TABLE 14

Optionality Impact for Company A and B

Data		**Estimation**	
Secondary Data		Monopoly (HHI > 1500)	0
HHI for vehicle manufacturers[41]	650	**Optionality impact**	**-**

For the monopolistic component of optionality, the vehicle manufacturing industry is not a monopoly. Therefore, no impact related to monopolistic behavior exists to be estimated. Similarly, vehicles do not have decision-altering capabilities. Finally, neither company has reported marketing or information penalties for the year of 2018.

4.8. Automobile manufacturing: Environmental use

To estimate the costs associated with disclosed tail-pipe emissions per mile, assumptions need to be made around customer usage of the vehicle which can be captured through average annual mileage and the carbon cost associated with the emissions. The carbon cost applied assumes

[41] Korus, Sam. "The Automotive Industry is on the Threshold of Massive Consolidation". *Ark Invest*. Accessed October 23, 2019.

3% discounting of costs over time and is expected to be continually refined to reflect the latest data. Similarly, the average annual mileage should also be refined as new information is available. This example demonstrates the monetization of the carbon emissions impact associated with a single year of vehicle use and should be recognized for the entirety of expected product life. Although this example focuses on carbon given the data provided by SASB and the Environmental Protection Agency, it is possible to apply this methodology to other non-carbon emissions and pollutants with the respective social cost. This is particularly relevant for companies and regulatory tests where non-carbon emissions are disclosed, such as the Worldwide Harmonised Light Vehicle Test Procedure conducted by the European Automobile Manufacturers Association.

TABLE 15

Costs of Emissions Produced by Vehicles Sold by Company A and B

Data

SASB Disclosure		A	B
TR-AU-410a.1	Sales-weighted average passenger fleet fuel economy, by region - tail pipe emissions per vehicle (grams / mile)	312	251.41

Monetization

		A	B
SASB	Emissions (grams / mile)	312	251.41
		x	
FWHA	Average miles driven	13,476	
		÷	
	Grams per ton	907,184	
		x	
EPS	Social cost of carbon[42]	$114	
		X	
SASB	Vehicles sold	5,982,000	8,384,000
	Emissions impact	**-$3,160m**	**-$3,569m**

4.9. Automobile manufacturing: End of life recyclability

As is standard in the automobile manufacturing industry, both companies disclose the recyclability and recoverability of vehicles sold. For illustrative purposes, average curb weight is estimated from industry aggregate assumptions. In practice, a manufacturer could use actual curb weight of sales. The assumptions around recycling rates and associated value of recycled,

[42] Assuming a 3% discount rate. Source: David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information." Harvard Business School Working Paper, No. 20-098, March 2020.

recovered or wasted volume can be refined with additional information. Given the recycling and recovering occurs at the end of product life, the associated impacts should be recognized at the expected end of product life. As with previous dimensions, innovation and increasing data disclosure is expected to influence how recyclability is monetized. For example, as electric vehicles are beginning to reach their end-of-life, companies are starting to invest in battery collection and recycling, efforts that could make sense to include in monetization as they become more widespread.

TABLE 16

Recyclability and Recoverability Vehicles Sold by Company A and B

Data

SASB Disclosure		A	B
TR-AU-440b.3	Average recyclability of vehicles sold	85%	85%
	Average recoverability of vehicles sold	95%	95%

Monetization

		A	B
ANL	Cars recycled in operating markets	79.15%	57.5%
		x	
SASB	Recyclability	85%	85%
		x	
	Curb weight (pounds)	4,506	4,071
		x	
	Value per pound[43]	$0.08	
		x	
SASB	Vehicles sold	5,982,000	8,384,000
	Recycling impact	**$1,450m**	**$1,334m**

		A	B
ANL	Cars recycled in operating markets	79.15%	57.5%
		x	
SASB	Recoverability delta	15%	15%
		x	
SASB	Recoverability rate	95%	95%
		x	

[43] B.J. Jody and E.J. Daniels. "End-of-Life Vehicle Recycling: The State of the Art of Resource Recovery from Shredder Residue." Energy Systems Division, Argonne National Library. Accessed October 23, 2019.

	Curb weight (pounds)	4,506	4,071
		x	
	Value per pound[44]	$0.01	
		x	
SASB	Vehicles sold	5,982,000	8,384,000
	Recovered impact	**$33m**	**$31m**

		A	**B**
ANL	(Cars recycled in operating markets	79.15%	57.5%
		x	
SASB	Waste from recycling	0.75%	0.75%
		x	
	Curb weight)	4,506	4,071
		+	
	Cars not recycled	20.85%	42.5%
		x	
SASB	Vehicles sold	5,982,000	8,384,000
		x	
	Cost per pound of waste[45]	$0.02	
	Waste impact	**-$115m**	**-$293m**

[44] B.J. Jody and E.J. Daniels. "End-of-Life Vehicle Recycling: The State of the Art of Resource Recovery from Shredder Residue." Energy Systems Division, Argonne National Library. Accessed October 23, 2019.
[45] B.J. Jody and E.J. Daniels. "End-of-Life Vehicle Recycling: The State of the Art of Resource Recovery from Shredder Residue." Energy Systems Division, Argonne National Library. Accessed October 23, 2019.

CHAPTER 5

CONSUMER STAPLES SECTOR: PACKAGED FOODS[46]

We apply the product impact framework of the Impact-Weighted Accounts Initiative within the consumer-packaged foods industry to ensure the framework is feasible, scalable, and comparable in the space. Through a detailed analysis of two competitor companies, we provide a cohesive example that examines the impacts of packaged foods across the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating monetary values. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility and is not to assess the performance of individual companies. We do note that the data is from two of the largest global packaged food manufacturers.

This application is based on publicly available data from company disclosures and industry-wide assumptions informed by regulatory bodies and established research firms. Self-disclosed company datapoints reflect information found in the company's disclosures from 2018 such as the Form 10-K or annual sustainability reports which often disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Because these disclosed metrics are often input metrics rather than impact metrics, this dataset is supplemented with metrics from industry research firms and regulatory bodies, including Nielsen and the United States Department of Agriculture. This allows us to translate these inputs into estimated impacts.

Product categories and pricing data comes from the Nielsen Homescan Panel which tracks purchases of over 40,000 US households by UPC code with associated pricing, method of payment, and volume sold. Nutritional information comes from the United States Department of Agriculture Food Data Central database which provides nutrient content by product UPC code for over 250,000 branded products. Industry-wide assumptions on product pricing, nutrition associated health outcomes, and associated costs for various health outcomes come from the Nielsen Consumer Panel, health outcome specific non-profit organizations such as the American Heart Association, and meta-analyses of nutrition and health-focused studies. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

[46] Rischbieth, Amanda, George Serafeim, and Katie Trinh. "Accounting for Product Impact in the Consumer-Packaged Foods Industry." (pdf) Harvard Business School Working Paper, No. 21-051, October 2020. (Revised November 2020.)

TABLE 17

Product Impacts of Company A and B

						Dimensions of Customer Usage										
				Reach		Access		Quality				Optionality	Env Use	End of Life		
Company	Revenue	Positive Product Impact	Negative Product Impact	Quantity		Affordability	Underserved	Health & Safety	Positive Effectiveness Impact	Negative Effectiveness Impact	Need	Information, Addiction, or Monopoly	Emissions	Recyclability		
				Revenue (%) by category:												
				Cereal	36.4%											
				Breakfast	18.3%											
A	$13.5bn	$2.0bn	-$3.2bn	Crackers	14.9%	$1,323m	$3m	-$341m	$655m	-$2,215m	-	-	-$470m	-$153m		
				Snacks	11.2%											
				Breakfast (frozen)	10.9%											
				Ready to serve	4.1%											
				Yogurt	37.9%											
				Ice cream	15.8%											
				Snacks	12.2%											
B	$15.7bn	$3.2bn	-$1.1bn	Cereal	8.8%	$3,079m	$73m	-$61m	$464m	-$792m	-	-	-$150m	-$49m		
				Produce	7.2%											
				Vegetables (frozen)	6.6%											
				Breakfast	2.4%											

For the consumer packaged foods industry, the affordability dimension captures pricing below industry average of different product categories, estimates of food stamp sales proxy for underserved impact, recalls are monetized in the health and safety dimension, the nutritional profile of products are captured in the effectiveness dimension, sales of staple foods are reflected in the basic need dimension, emissions from cooking and storage are captured in environmental usage, and the emissions from waste are captured in the end of life recyclability dimension. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

5.1. Packaged foods: Reach

TABLE 18

Implied Product Category Sales of Company A and B

Data						Estimation				
		A		B			A		B	
10K	Revenue	$13.5bn		$15.7bn		Revenue	$13.5bn		$15.7bn	
Nielsen	Sales by product category	Cereal	36.4%	Yogurt	37.9%			x		
		Breakfast	18.3%	Ice cream	15.8%	% category		2.4% to 37.9%		
		Crackers	14.9%	Snacks	12.2%			=		
		Snacks	11.2%	Cereal	8.8%	Category revenue	Cereal	$4.9bn	Yogurt	$6.0bn
		Brkfst (frzn)	10.9%	Produce	7.2%		Breakfast	$2.5bn	Ice cream	$2.5bn
		Rdy to serve	4.1%	Veg (frozen)	6.6%		Crackers	$2.0bn	Snacks	$1.9bn
				Breakfast	2.4%		Snacks	$1.5bn	Cereal	$1.4bn
							Brkfst (frzn)	$1.5bn	Produce	$1.1bn
							Rdy to serve	$0.6bn	Veg (frozen)	$1.0bn
									Breakfast	$0.4bn

*Note: Product categories and percentages are based on Nielsen rather than company defined categories. Also, only product categories that represent over 2% of sales are displayed

The customer

The goal of the reach category is to identify the number of individuals reached by the company. For consumer-packaged foods, we identify the customer as the end consumer rather than the retailer because the consumer is the one using the product. Furthermore, this decision is supported by the fact that manufacturers market their products to the end consumer rather than the retailer.

Categorization of products

Given the vast number of products that consumer packaged food manufacturers sell, it would be unwieldy to report on and quantify the impact at the Universal Product Code (UPC) level. Instead, there needs to be a taxonomy of products according to a generally accepted set of categories. Looking at company disclosures for guidance, we found that although companies do categorize their revenue into certain product lines, the level of granularity and product categories differs across companies. Rather than using company-provided product categories, we use the groupings provided by a reputable and established consumer packaged foods data provider to ensure comprehensive comparability. In this example, we use the Nielsen Product Groups, but other data providers that track consumer and retailer behavior, such as IRI, could also have product groupings of relevance.

Unit of measurement

To determine the appropriate unit for reporting consumer packaged foods sales in reach, we considered unit volume, revenue, calories, and servings. We use monetary revenue as the unit of measurement given it can be translated to implied calories, implied servings, or implied nutrients sold as required for monetization in the other dimensions.

The impact estimate

Since companies do not report revenue by Nielsen Product Group, we extrapolate the percentage of sales by product group and manufacturer from the Nielsen HomeScan panel to company A and B's reported revenue for demonstrative purposes. Companies that perform this analysis could report actual revenue by Nielsen Product Group or another widely accepted taxonomy.

5.2. Packaged foods: Access - affordability

Product affordability in consumer-packaged foods

To calculate affordability, we compare the average pricing within each product category for both companies to the overall industry average price. We choose to use average price per calorie over other price metrics, which include price per unit, price per serving, or price per ounce. Tying price back to calories allows us to directly estimate the impact of pricing on accessibility since every individual must consume a certain number of calories to survive.

TABLE 19

Product Category Affordability of Company A and B

Data						**Estimation**		
Company datapoints		**A**		**B**			**A**	**B**
Nielsen, USDA	Avg company price per calorie	Cereal	$0.0023	Yogurt	$0.0069	Snacks revenue	$1.5bn	$1.9bn
		Breakfast	$0.0019	Ice cream	$0.0073			÷
		Crackers	$0.0019	Snacks	$0.0056	Snack price per calorie	$0.0025	$0.0056
		Snacks	$0.0025	Cereal	$0.0020			=
		Brkfst (frzn)	$0.0033	Produce	$0.0035	Implied snack calories sold	601.7bn	340.9bn
		Rdy to serve	$0.0093	Veg (frozen)	$0.0102			x
				Breakfast	$0.0063	(Industry snack price		$0.0027
								-
Industry assumptions						Snack price per calorie)	$0.0025	$0.0056
		Breakfast	$0.0026	Produce	$0.0053			=

Nielsen, USDA	Avg industry price per calorie	Brkfst (frzn)	$0.0039	Rdy to serve	$0.0062	**Snack affordability impact**	**$88.1m**	**-**
		Cereal	$0.0019	Snacks	$0.0027	**Affordability impact**	**$1,323m**	**$3,079m**
		Crackers	$0.0019	Veg (frozen)	$0.0045			
		Ice cream	$0.0027	Yogurt	$0.0098			

*Note: Slight differences in affordability impact and calculation methodology are due to rounding.

Pricing per calorie data

Since companies do not publicly report price per calorie, we rely on pricing information from the Nielsen Homescan Panel and caloric information from USDA FoodData Central database. We merge calories per 100g of each product to every purchase made in the Nielsen panel on UPC code. We individually create a brand identifier for each manufacturer which allows us to sum the total number of calories sold and associated cost for each manufacturer and product category. We repeat this estimate for each product category across manufacturer to get to an industry-wide assumption on the average product category price per calorie.

The impact estimate

We use the average price per calorie and estimated product category revenue to determine the number of calories sold within each product category. We then estimate the price differential from the industry average pricing within each product category to identify product categories in which the company provides a more affordable product than the industry. For the more affordable categories, we multiply the calories sold against the price differential to estimate the affordability impact. In Table 19, we show an example calculation for a single product category for company A and B. Repeating and summing this calculation for the other more affordable categories measures the total affordability impact. For Company A, the categories included in the total affordability impact are snacks, breakfast, and frozen breakfast. For Company B, the categories included in the total affordability impact are yogurt and produce. A packaged foods manufacturer looking to estimate their own affordability impact could use actual calories sold and internal price per calorie for each product category.

Since price per calorie affordability is volume-based, it is possible for companies to seem more affordable than they are in practice if they sell in bulk. A company that sells bulk-sized products will likely have lower than average price per calorie while remaining inaccessible to certain consumers who cannot afford to pay the higher lump sum price. Given this is an issue that

persists for all volume-based comparisons, the internal company comparison should be based on the highest internal price per calorie across different packaging sizes, if there is significant variance in price between different sizes.

5.3. Packaged foods: Access - underserved

TABLE 20

Underserved Accessibility of Company A and B

Data				**Estimation**		
Company datapoints		**A**	**B**		**A**	**B**
Company marketing	Total products	1,800		Revenue	$13.5bn	$15.7bn
Company WIC guide	WIC products	13			x	
CSR report	% WIC products	0.7%	16%	% of WIC products	0.72%	16%
Nielsen	% WIC purchases	1.07%	1.02%		x	
				% food stamp purchases	1.07%	1.02%
Industry assumptions					÷	
USDA	Annual meal cost per person	$491.52		Meal cost per person	$491.52	
					x	
NAIC	Food assistance health savings	$1,400		Health savings	$1,400	
				Underserved impact	**$2.99m**	**$72.89m**

The underserved consumer

In the consumer-packaged foods space, we estimate the underserved impact by identifying the food insecure customers[47] reached across all markets. We use estimates of supplemental nutrition assistance program[48] sales to identify consumers who are food insecure. We believe the sales from this program can identify products that address hunger in a nutritious and efficient manner. Although food stamp programs tend to be common in the United States over other geographies, we make the simplifying assumption that the rate of purchases by the food insecure is consistent globally given data constraints. We recognize this fails to capture the fact that different countries might exhibit different poverty rates, government support programs and eating habits. For manufacturers that believe this estimate excludes a significant part of their impact to

[47] As defined by the Food and Agriculture Organization of the United Nations, food insecurity is "a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life".

[48] In the United States, households making less than 130% of the poverty line in gross monthly income given household size are eligible for the Supplemental Nutrition Assistance Program. This program provides an average monthly benefit of $448 for a household of 4 to be used at retail food stores for purchase of fruits and vegetables; meat, poultry, and fish; dairy products; breads and cereals; and other foods such as snack foods and non-alcoholic beverages.

reducing food insecurity in emerging markets, this estimate can be supplemented to include the sales of staple products in emerging markets. The intent is to capture sales of staple foods, such as flour or grains rather than premium ice creams.

Food stamp data

To identify the revenue that is coming from food stamp programs, we use a mix of company self-reporting on qualified products and Nielsen data on purchase methodology. For company A, the identification of assistance qualified products is limited to confirmed cereals qualifying for the Special Supplemental Nutrition Assistance Program for Women, Infants, and Children (WIC)[49], which likely underestimates the full extent of products that meet food sustenance requirements. On the other hand, company B discloses the actual percent of their products that are WIC-qualified. We then use Nielsen data to identify the percent of sales that are paid for using a supplemental food assistance program since WIC-qualified products are not necessarily only purchased by WIC households. Given data availability, we are limited to estimating supplemental food assistance sales only through the WIC program using a representative sample. A company performing this analysis could use actual revenue from all food stamp programs.

The impact estimate

We divide the revenue from food stamp programs by industry assumptions on annual per person meal cost to identify the number of food insecure individuals reached. We then multiply the number of food insecure individuals reached with the averted health costs associated with food stamp program access[50] to estimate the underserved impact.

5.4. Packaged foods: Quality – health and safety

TABLE 21

Recall Impact of Company A and B

Data				**Estimation**		
Company datapoints		**A**	**B**		**A**	**B**
FDA	Recalls conducted	1	2	Cereal unit volume	19.15	231.7
FDA	Product recalled	Cereal	Cereal		x	

[49] As described by the United States Department of Agriculture, "The Special Supplemental Nutrition Program for Women, Children, and Infants provides federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women, and to infants and children up to age five who are found to be at nutritional risk".

[50] Mozaffarian, Dariush. "Food is Medicine: Why Healthier Eating Should be a Priority for Health Care Providers, Insurers and Government", National Association of Insurance Commissioners & The Center for Insurance Policy and Research. Published December 2018. Accessed July 2020.

			Snackbar
FDA	Unit volume	Box (15.3 or 23 oz)	14-box case (14.1, 19 oz)
			1 bar
FDA	Units recalled	1,145,030	16,308
			735
Industry assumptions			
	Consumption of recalled product (per person)		229.28
			1
USDA	Salmonella cost		$3,568

Cereal units recalled	1,145,030	16,308
	=	
Volume recalled (ounces)	21,927,325	3,778,564
	÷	
Per person consumption	229.28	
	x	
Health savings	$3,568	
	=	
Cereal recall impact	**-$341.23m**	**-$58.80m**
Recall impact	**-$341.23m**	**-$61.42m**

Packaged foods health and safety

In the consumer-packaged foods space, it is necessary to make the distinction between the healthiness and the health and safety of a product. In the health and safety dimension, we look at whether there have been any breaches of health and safety related to the product rather than the inherent healthiness of the product, which is instead captured in the effectiveness dimension. For consumer-packaged goods, the health and safety breaches can be examined by looking at product recalls. Although a high volume of recalls is usually indicative of a manufacturer that has produced many products of questionable quality, high recall volume could also be the result of a manufacturer that is very conscious of the health and safety of their product and therefore is voluntarily and preemptively recalling products. For demonstrative purposes, this example does not distinguish between mandatory and voluntary recalls when estimating the health and safety impact given all three recalls were voluntary. A manufacturer estimating its own impact could exclude voluntarily issued recall volumes from their analysis.

Data on product recalls

Consumer packaged foods manufacturers that disclose metrics on food safety in their corporate sustainability reports per SASB metric CN0103-09[51] tend to share only the number of recalls issued without the associated product volume. Therefore, we use Food & Drug Administration recall data[52] to identify the associated products and product volumes for each

[51] SASB Metric CN103-09 is a food safety accounting metric on "number of recalls issued, total amount of food product recalled".
[52] "Compliance Dashboards > Recalls". US Food & Drug Administration Data Dashboard. https://datadashboard.fda.gov/ora/cd/recalls.htm. Accessed July 2020

issued recall. This allows us to estimate actual units recalled[53] which can then be tied back to consumption. Since FDA and SASB both do not specify the associated food-borne illness with each recall, we assume that all recalled product would be associated with salmonella for demonstrative purposes. Any manufacturer conducting this analysis should identify the actual associated food-borne illness and look at the USDA ERS database on foodborne illnesses to collect the relevant estimate.

The impact estimate

Using company A's and B's cereal recall as an example, we determine the average ounces of product per unit of sales. For company A, this is the simple average of the two box sizes and for company B, the simple average is multiplied by the 14 boxes in each case. We then multiply ounces per unit of sales by total units recalled to estimate the total volume recalled in ounces. To approximate the number of consumers exposed to recalled cereal, we then divide the recalled volume by an industry assumption on a reasonable per person cereal consumption level. Finally, we calculate the cereal recall impact by multiplying the number of individuals affected by the recall with the per person cost for a food-borne illness. For the total recall impact, we repeat this calculation for all recalls. For demonstrative purposes, we display recall impact from mandatory and voluntary recalls. Manufacturers estimating their own recall impact could use the actual sales volume and associated food-borne illness for only mandatory issued recalls to estimate the number of customers affected.

5.5. Packaged foods: Quality – effectiveness

TABLE 22

Effectiveness Impact of Company A and B

Data				**Estimation**		
Company datapoints		**A**	**B**		**A**	**B**
Nielsen & USDA	Fiber sold (g)	65.7bn	32.5bn	Fiber sold	65.7bn	32.5bn
	Sodium sold (mg)	7,321bn	2,494bn		÷	
	Trans fat sold (g)	3.03m	515.63m	Annualized DV of fiber	9,125	
	Sugar sold (g)	27.2bn	9.3bn		=	

	Whole grains sold (g)	0.7bn	73.0bn
Industry assumptions			
NCBI	Fiber on reduced CHD risk[54]	15.5%	
USDA	Annualized DV of fiber (g) [55] [56]	9,125	
BMJ	Sodium on CVD risk increase[57]	17%	
PLoS Med[58]	Excess sodium consumed (%)[59]	32%	
	Individual excess consumed (mg)	401,500	
PLoS Med[60]	Grains on reduced CHD risk	6.0%	
	Annual assoc. consumption	18,250	
New England Journal of Medicine [61]	Trans fat on CHD risk increase	23.0%	
	Annual assoc. consumption[62]	1,866	
Harvard Health Publ	Sugar on CVD risk[63]	38%	
UCSF	Excess sugar consumed (%)[64]	56%	
American Heart Association[65]	Prevalence of CHD[66]	5.23%	
	Medical cost of CHD	$5,297.62	
	Indirect cost of CHD	$5,892.86	
	Prevalence of CVD[67]	41.50%	
	Medical cost of CVD	$3,096.40	
	Indirect cost of CVD	$2,307.69	

Individuals reached	7,202,447	3,564,941
	x	
Fiber on reduced CHD risk	15.5%	
	x	
Prevalence of CHD	5.2%	
	x	
CHD costs	$11,190.48	
	=	
Fiber impact	**$653m**	**$323m**
Sodium sold	7,321bn	2,494bn
	x	
Excess sodium sold (%)	32.4%	
	÷	
Annual excess consumption	401,500	
	=	
Individuals reached	5,899,031	2,009,797
	x	
Sodium on increased risk	10.0%	
	x	
Prevalence of CVD	41.5%	
	x	
CVD costs	$5,404.09	
	=	
Sodium impact	**-$1,323m**	**-$451m**

[54] McRae, Marc. "Dietary Fiber is Beneficial for the Prevention of Cardiovascular Disease: An Umbrella Review of Meta-analyses." *J Chiopr Med.* Published October 2017. Accessed August 2020.
[55] "Dietary Guidelines for Americans 2015-2020". US Department of Health and Human Services and US Department of Agriculture. 8th Edition. Published December 2015. Accessed August 2020.
[56] Estimated based on the daily recommended value of fiber at 25g multiplied by 365 to scale to an annual value
[57] Strazzullo, Pasquale et al. "Salt intake, stroke, and cardiovascular disease: meta-analysis of prospective studies." *BMJ (Clinical research ed.)* Published November 2009. Accessed August 2020.
[58] Pearson-Stuttard, Jonathan et al. "Estimating the health and economic effects of the proposed US Food and Drug Administration voluntary sodium reformulation: Microsimulation cost-effectiveness analysis." *PLoS medicine*. Published Apr. 2018. Accessed August 2020.
[59] Estimated based on the excess sodium consumed as a percent of daily sodium consumed, where the recommended limit for sodium consumption is 2,300 mg and the average daily sodium consumption is 3,400 mg
[60] Lee Yujin et al. "Cost-effectiveness of financial incentives for improving diet and health through Medicare and Medicaid: A microsimulation study." *PLOS Medicine* Published March 2019. Accessed August 2020.
[61] Mozaffarian, Dariush et al. "Trans Fatty Acids and Cardiovascular Disease". *The New England Journal of Medicine.* Published April 2006. Accessed August 2020.
[62] Annual associated trans fat consumption estimated based on 2% of annual caloric intake with 2,300 daily caloric intake and 9 calories per gram of fat
[63] "The Sweet Danger of Sugar". *Harvard Health Publishing Harvard Medical School.* Updated November 2019. Accessed August 2020.
[64] "How Much is Too Much? The Growing Concern Over Too Much Added Sugar In Our Diets". *UCSF Sugar Science.* Accessed August 2020.
[65] "Cardiovascular Disease: A Costly Burden for America", American Heart Association. Published 2017. Accessed August 2020.
[66] The industry assumption for prevalence of CHD in these estimates are US based. Companies with sales in non-US geographies where the prevalence for CHD is significantly different may choose to use a more representative prevalence rate.
[67] Similarly, the industry assumption for prevalence of CVD in these estimates are US based. Companies with sales in non-US geographies where the prevalence for CVD is significantly different may choose to use a more representative prevalence rate.

Effectiveness impact	**-$1,561m**	**-$328m**

Packaged foods effectiveness

As mentioned in the previous section, the effectiveness of a packaged food product can be estimated through its nutrient value. Although consumers do purchase packaged foods for other reasons independent of nutrient value, such as convenience of pre-made meals or enjoyment from eating a chocolate bar, these additional qualities are secondary to the most basic goal of packaged food provision and consumption, which fundamentally boils down to nutrition. We capture this by looking at nutrients that have clear and consistent established relationships with health outcomes. Current research indicates that trans fat[68], added sugar[69], sodium[70], whole grains[71], and fiber[72] have clear associations with the relative risk for cardiovascular and coronary heart disease. We recognize that the associations between nutrition and health outcomes are not limited to these five nutrients and two diseases. Where medical research identifies clear associations for additional nutrients and health outcomes, companies can use this methodology to estimate the impact of those nutrients as well. Care in selecting additional nutrients is needed to ensure the overall effectiveness estimate is not falsely skewed positive from the addition of only positive nutrients. To provide an example of an additional nutrient that companies could choose to monetize, we will also describe the methodology that could be used for companies looking to include calcium in the appendix.

Data on product nutrient content and associated health outcomes

Given the differences in how packaged food manufacturers discuss and report nutritional information, we use Nielsen and USDA data to consistently estimate the amount of fiber, sodium, trans fat, and added sugar sold by manufacturer. For each product purchased in the Nielsen panel,

[68] According to the American Heart Association, "artificial trans fat, or trans fatty acids, are fats created in an industrial process that adds hydrogen to liquid vegetable oils to make them more solid. The primary dietary source for trans fat in processed foods is "partially hydrogenated oils".
[69] According to the Center for Disease Control, "Added sugars are sugars and syrups that are added to foods or beverages when they are processed or prepared. Naturally occurring sugars such as those in fruit or milk are not added sugars".
[70] According to the American Heart Association, "Salt and sodium are often used interchangeably, but they're not exactly the same thing. Sodium is a mineral that occurs naturally in foods or is added during manufacturing or both. Table salt is a combination of sodium and chloride. By weight, it's about 40 percent sodium and 60 percent chloride".
[71] According to the Whole Grains Council, "A grain is considered to be a whole grain as long as all three original parts — the bran, germ, and endosperm — are still present in the same proportions as when the grain was growing in the fields".
[72] According to the Nutrition Source at the Harvard T.H. Chan School of Public Health, "Fiber is a type of carbohydrate that the body can't digest. Though most carbohydrates are broken down into sugar molecules, fiber cannot be broken down into sugar molecules, and instead it passes through the body undigested. Fiber helps regulate the body's use of sugars, helping to keep hunger and blood sugar in check".

we merge the associated nutritional facts from the USDA data using UPC code to determine the nutrient volume associated with each purchase given the servings sold. We then sum to estimate the total volume of nutrients sold by Company A and B in the Nielsen panel and scale given the revenue represented by the Nielsen data with total revenue to extrapolate the full nutrient volume sold. In doing so, we assume the nutritional profile in the Nielsen panel is representative of the manufacturers' total nutrient sales and that all sold products are consumed.

Since whole grains are excluded from the USDA dataset, we estimate the whole grains sold using various company statements. Company A reports that a certain number of their brands contain a creditable ounce of whole grains per serving and Company B reports that all their cereal brands contain at least eight grams of whole grains. Combining these statements with average price per serving and total revenue, we can estimate the total amount of whole grains sold by both companies. A company estimating their own effectiveness impact should use actual nutrient volumes sold.

To determine the associated relative health risks with each nutrient, we use meta-analyses in medical literature to identify established relative risk associations. We then use cost estimates from the American Heart Association to estimate the associated health and productivity costs with cardiovascular and coronary heart disease.

We note that the medical literature on recommended nutrient consumption, relative health risks, and other nutrition and health-based estimates can change over time. These examples demonstrate estimates based on the latest guidance from widely accepted government departments and organizations. Although there may be a lag from contemporary literature, we find that the widely accepted guidance is updated on a regular cadence. For example, the Dietary Guidelines by the United States Department of Agriculture is updated every five years. Therefore, to ensure the assumptions used are current and consistent, the nutritional assumptions made in this example should be updated to reflect the latest provided guidance by these broader government and non-profit organizations.

The impact estimate

We calculate the impact of fiber sold by estimating the health impact on the individuals reached. First, we divide Company A and B's total fiber sold by an estimate of recommended

annual individual consumption[73] to estimate the equivalent individuals reached. We then calculate the impact from reducing the risk of coronary heart disease for these individuals by multiplying the number of individuals reached by the change in risk, prevalence, and associated costs. In the full effectiveness calculation, we also apply this methodology to whole grains and trans fat in the appendix, given the health outcome associations for these nutrients are independent of any consumption limits.

On the other hand, the sodium and added sugar have clear risk associations when consumed above a certain limit. Therefore, we provide an example of estimating sodium impacts to demonstrate how the limits on consumption can influence the calculation. As with fiber, we identify the amount of sodium sold by each manufacturer. We then multiply this by the excess sodium consumed to identify excess sodium sold. Dividing by the excess per person consumption, we can approximate the number of individuals reached and apply the prevalence, risk association, and costs to calculate the total sodium impact. To estimate the total effectiveness impact, we repeat the limit calculation for added sugar in the appendix and sum the impacts for all five nutrients.

We recognize different approaches can exist for the limit calculation with sodium and added sugar. For example, rather than estimating excess sodium from the total sodium sold, it is also possible to only include excess sodium from products where the sodium per calorie content is higher than the recommended level. While this product-level methodology aligns with the scope of manufacturer control, the total sum calculation aligns more with consumer behavior as it captures all sodium contributing to excess consumption.

For companies looking to include other nutrients, we describe the methodology for a sample nutrient, calcium. First, we determine if calcium is associated with any health outcomes. Second, we determine if calcium has any consumption limits. Having identified that calcium is associated with a decrease in osteoporosis and does not have any consumption limits, we choose to apply the methodology used for fiber, whole grains, and trans fat. Following that methodology companies can divide the amount of sodium sold by the annualized daily value of calcium consumption, 401.5 grams[74], to estimate the equivalent individuals reached. The number of individuals can then be

[73] In this example, we use the recommended daily consumption from the New England Journal of Medicine which reflects the latest guidance from the 2015-2020 USDA Dietary Guidelines to estimate annual individual consumption. As newer guidance is released, the annual estimate should also be updated to reflect the latest information.

[74] "Dietary Guidelines for Americans 2015-2020". US Department of Health and Human Services and US Department of Agriculture. 8th Edition. Published December 2015. Accessed August 2020.

multiplied by the prevalence (10.3%[75]), change in risk (65%[76]), and associated medical and productivity costs for osteoporosis ($15,343[77]) to estimate the impact of calcium sold.

5.6. Packaged foods: Quality – basic need

Basic needs met by packaged foods

Packaged food manufacturers have a basic need impact when they sell staple food products. Although we tend to use elasticity to identify products that meet a basic need, food products are one of the exceptions given there exists highly inelastic food products that do not meet a basic need. For example, demand for ice cream or sodas is often inelastic, but ice cream and sodas are not a basic need. Therefore, we use staple foods to determine whether the product sold meets a basic need. We reference the list of Nielsen product categories against the USDA food pyramid to identify the following categories as clearly staples: baby food, bread and baked goods, eggs, flour, fresh meat, fresh produce, and pasta. Since Companies A and B do not have significant sales in these categories, they have no basic need impact. Although there are other categories that could potentially qualify as staples, such as cereals and yogurt, we limit the estimate to the minimally processed staple products for conservatism. This list of staple products could be refined going forward as more companies apply this methodology and identify additional categories or products that are basic staples for consumption.

The impact estimate

For companies that do have significant sales in a staple category, the impact estimate could divide revenue from staple sales by the annual meal cost per person to identify the number of individuals reached. The number of individuals reached should then be multiplied by a monetization coefficient on the per person averted cost of hunger. Currently, we have identified $491.52 as the annual cost of meals for a single individual from data on supplemental food assistance programs. Similarly, we have identified $13.41 as the monetization coefficient on the individual cost to end

[75] Wright, Nicole et al. "The Recent Prevalence of Osteoporosis and Low Bone Mass in the United States Based on Bone Mineral Density at the Femoral Neck or Lumbar Spine". *J Bone Miner Res.* Published 2014. Accessed September 2020.
[76] Sunyecz, John. "The use of calcium and vitamin D in the management of osteoporosis." *Therapeutics and Clinical Risk Management.* Published August 2008. Accessed September 2020.
[77] Pike et al. "Direct and Indirect Costs of Non-Vertebral Fracture Patients with Osteoporosis in the US. *PharmacoEconomics.* Published September 2012. Accessed September 2020.

world hunger based on the 820 million individuals that are food insecure globally[78] and the $11 billion cost to ending world hunger[79]. We multiply the averted food insecurity cost against all individuals reached by a staple food, regardless of their food security status, given our goal is to monetarily proxy for the inherent goodness or basic need provided by a company that sells a staple food. As with the other dimensions, these industry assumptions should be refined and updated as more relevant and accurate figures become available.

1.1.1. Packaged foods: Optionality

Given Company A and B do not operate in a monopoly, do not sell addictive products, and have not provided false marketing or false information about their products, they both have no impact under the optionality dimension. This assumes that although products with high sugar or high fat are habit forming, they are not truly addictive. This is likely to be the case for most packaged food manufacturers.

5.7. Packaged foods: Environmental use

TABLE 23

Environmental Usage Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
CSR	Scope 3 emissions from goods			Emissions from usage	4,123,600	1,316,000
	CO2 emissions (home cooking)	2,783,430	888,300		x	
	CO2 emissions (home storage)	1,340,170	427,700	Cost per ton of carbon	$114	
					=	
Industry assumptions				**Emissions impact**	**-$470m**	**-$150m**
IWAI	Cost per metric ton of carbon[80]	$114				

The environmental usage impact of packaged food manufacturers captures the equivalence of emissions generated by use of the product, which includes cooking and storage of the product.

[78] "Transforming Food Systems for Affordable Healthy Diets". *Food and Agriculture Organization of the United Nations.* Published 2019. Accessed August 2020.
[79] "Ending world hunger is within reach: Study finds it will cost only USD 11 billion more a year". *International Institute for Sustainable Development.* Published October 2016. Accessed August 2020.
[80] David Freiberg, DG Park, George Serafeim and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information", Harvard Business School. Accessed August 2020.

While both Company A and B disclose some level of Scope 3 emissions from purchased goods and services, Company A reports aggregate emissions while Company B details the percentage of emissions from transportation, cooking, storage, and end of life treatment. To provide a more reasonable estimate for Company A given the aggregate estimate would likely include emissions beyond cooking and storage and therefore overstate the environmental usage impact, we apply the percentage emissions from Company B allocated to home cooking and storage relative to all Scope 3 emissions for demonstrative purposes. Ultimately, a company conducting this analysis could identify all emissions from home cooking and storage and use the cost per metric ton of carbon to identify the total emissions impact.

5.8. Packaged foods: End of life

TABLE 24

End of Life Recyclability Impact of Company A and B

Data			Estimation		
Company datapoints	**A**	**B**		**A**	**B**
CSR Scope 3 emissions from goods	1,340,170	427,700	Emissions from end of life	1,340,170	427,700
				x	
Industry assumptions			Cost per ton of carbon	$114	
IWAI Cost per metric ton of carbon	$114			=	
			End of life impact	**-$152.8m**	**-$48.8m**

As with the previous section, we apply the approximated or disclosed emissions from the end of life treatment of packaged foods and the cost of carbon to estimate the recyclability impact. Since Company A provided an aggregate total for emissions, we again use the percentage of emissions from end of life treatment from Company B to monetize the end of life treatment in this dimension. Given the definition of Scope 3 emissions, the end of life recyclability impact includes the impact from food waste.

CHAPTER 6

FINANCIALS SECTOR: CONSUMER FINANCE[81]

We apply the product impact framework within the consumer finance industry to ensure the framework is feasible, scalable, and produces estimates that are comparable across companies within the same industry. Through a deep-dive of two competitor companies, we provide a cohesive example that examines the impacts of credit cards across all the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating actual monetary values. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility, not to assess the performance of individual companies. We do note that the data is from two of the largest consumer finance companies.

TABLE 25

Product Impacts of Company A and B

				Dimensions of Customer Usage										
				Reach		Access		Quality			Option-ality	Env Use	End of Life	
Company	Revenue	Positive Product Impact	Negative Product Impact		Quantity	Affordability	Underserved	Health & Safety	Effectiveness	Need	Information	Emissions	Recyclability	
A	$43bn	$0.5bn	-$1.0bn	Cards	114m	-	-	-$951m	$476m	-	-$2.9m	-	-$11.4m	
				Merchants	20m									
B	$13bn	$3.6bn	-$1.1bn	Cards	57m	$1,592m	$1,665m	-$1,094m	$309m	-	-$0.6m	-	-$5.7m	
				Merchants	45m									

**variances from totals below due to rounding*

Self-disclosed company datapoints reflect information found in the company's disclosures from 2018 such as the Form 10-K or annual sustainability reports which often disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Because these disclosed metrics are often inputs rather than impacts, this data is supplemented with metrics from industry research firms and regulatory bodies, including the Consumer Financial Protection Bureau (CFPB). This allows us to translate these inputs into estimated impacts.

[81] Serafeim, George, and Katie Trinh. "Accounting for Product Impact in the Consumer Finance Industry." (pdf) Harvard Business School Working Paper, No. 21-061, November 2020. (Revised December 2020.)

Industry-wide assumptions on product fees and rates, consumer credit risk profiles, and various measures of financial health and associated costs come from the industry reports by organizations including the Consumer Financial Protection Bureau, Lending Tree, the Federal Reserve, and J.D. Power. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

For the consumer finance industry, we examine the impacts from their credit card services. For Company B, the relevant impact revenue is smaller than the full revenue because Company B's operations extend to additional non-credit card loans. We exclude that portion of the business to determine the relevant impact revenue. The reach dimension looks at the quantity of cards issued and the number of merchants. The affordability dimension captures the pricing of different fees and interest rates for non-luxury credit card services, compared to the industry average. Serving more customers with lower FICO scores proxy for underserved impact. Credit card exposure that is associated with indebtedness is monetized in the health and safety dimension. Effectiveness is proxied with customer satisfaction. The cost of unrecycled plastic is captured in the end of life recyclability dimension. There is no basic need or environmental usage impacts estimated in this industry given access to credit cards does not satisfy the basic need for financial access and the energy required for credit card use is minimal. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

6.1. Consumer finance: Reach

TABLE 26

Card Issued and Merchants of Company A and B

Data			
		A	B
10K	Cards issued	114,000,000	57,100,000
10K	Merchants	19,500,000	45,000,000
Nilson	Card per cardholder	1.41	1.28

Estimation		
	A	B
Cards issued	114,000,000	57,100,000
	÷	
Cards per cardholder	1.41	1.28
	=	
Cardholders	80,851,064	44,609,375

The customer

The goal of the reach category is to identify the number of individuals reached by the company. For consumer finance, we identify two customer groups, the credit cardholders and the merchants who accept the credit card for payment. This decision is rooted in the fact that both cardholders and merchants are receiving and paying for a service from these companies.

Unit of measurement

Given consumer finance companies often disclose the number of cards issued rather than the number of cardholders, the number of cards issued is the unit of measurement for the cardholder customer group. Estimating the number of merchants is more straightforward given companies do disclose the number of merchants in their network.

The estimate

When the number of cardholders, rather than the number of cards issued, is required, we divide the number of cards issued by the industry assumption from the Nilson Report[82] of number of company-specific cards per cardholder to estimate the cardholders served by the company.

6.2. Consumer finance: Access - affordability

TABLE 27

Product Affordability of Company A and B

Data				**Estimation**		
Company datapoints		**A**	**B**		**A**	**B**
Company marketing	*Non-luxury cards*			Underlying principal	$81.9bn	$72.9bn
	Cash back cards	3	4		x	
	Secured cards	0	1	Industry interest rate	13.64%	
	Student cards	0	1		÷	
	Luxury cards			Cards issued	114m	57m
	Travel cards	10	1		=	
	Reward cards	3	0	Industry interest cost	$97.99	$174.09
10K	Credit card fee	$51.00	$0.00		+	
	Interest rate	12.95%	12.12%	Industry card fee	$11.49	$11.40
	Merchant fee	2.37%	1.93%		=	
	Interest income	$10.6bn	$8.8bn	**Industry cardholder cost**	**$109**	**$185**
	Merchant volume	$1,184bn	$144bn		-	
				(Credit card fee	$51.00	$0.00
Industry assumptions					+	
Federal Reserve	Avg interest	13.64%		(Interest income	$10.6bn	$8.8bn
	Avg merchant fee	2.00%			÷	

[82] "US Cards – Credit, Debit, and Prepaid". *Nilson Report, (1147), 10-11.* Published February 2019. Accessed June 2020.

Card Fee Study	Cash back cards	$11.49
	Secured cards	$22.43
	Student cards	$0.00
	Travel cards	$93.17
	Reward cards	$41.38

Cards issued))	114m	57m
	=	
Company cardholder cost	**$144**	**$155**
	x	
Cards issued	114m	57m
	x	
Percent non-luxury cards	19%	86%
	=	
Card affordability	**-**	**$1,505m**
Percent non-luxury cards	19%	86%
	x	
(Industry average merchant fee	2.00%	
	-	
Merchant fee)	2.37%	1.93%
	x	
Merchant volume	$1,184bn	$144bn
	=	
Merchant fee affordability	**-**	**$86m**

Product affordability in consumer finance

Affordability in the consumer finance industry aims to capture the impact of providing non-luxury credit card services to cardholders and merchants more affordably than others in the industry. For cardholders, affordability can be measured through the credit card fee and the interest rate to the cardholder. For merchants, affordability can be measured through the transaction fee to the merchant. Given the luxury travel and reward cards are inherently unaffordable, we exclude those cards from our affordability impact estimate. Their inclusion would lead to unintuitive findings in which unaffordable travel and reward cards could have a positive affordability impact if they are priced below the much higher industry average for a travel or reward card. Our goal is to account for affordable service provision without penalizing other pricing strategies.

Pricing data

To estimate the affordability of these credit card services, we examine industry price averages and look for the corresponding company-specific metric. For industry price averages, the Federal Reserve provides the industry average interest rate on both interest-bearing accounts only and all accounts and the industry average merchant transaction fee.[83] For the average card fee, the

[83] Resendiz, Joe. "Average Credit Card Interest Rates". *Value Penguin by Lending Tree.* Published August 2020. Accessed October 2020. Data from the Federal Reserve Consumer Credit – G.19 Data Release.

Consumer Credit Card Fee Study[84], which analyzes the fees of hundreds of credit cards, provides industry average card fees by card type, inclusive of no-fee cards.

For the company-specific costs and fees, we looked to the company's Form 10-K and marketing materials to identify the appropriate corresponding data. In marketing materials, both Company A and Company B disclose descriptions of the different cards they offer. We use the marketing material to determine the type of card offered, such as cash back or reward. Ignoring the type of card offered and the associated benefits of the card would lead to miscalculated estimates as cards with more benefits tend to charge higher fees. Assuming an even distribution of cards offered across cardholders, we can then estimate a company-specific industry average benchmark for non-luxury cards offered. In practice, companies can estimate the industry average benchmark using the actual distribution of cards issued. For the average card fee, Company A disclosed their average card fee across all cards issued while company B's online credit card descriptions highlighted that they charge no annual fee. Since neither company explicitly disclosed their average interest rate, we estimated the interest rate on all accounts by dividing interest income from credit cards with credit card loan receivables. Both companies disclose the merchant transaction fee in their Form 10-K.

The impact estimate

We calculate card affordability impact only for non-luxury cards. To estimate the card affordability, we take the cost differential between the industry average and company average overall cost for credit card services as shown in Table 27 with a floor at zero.

To estimate the industry average overall cost for credit card services, we sum the industry average annual card fee with the interest income per card. To estimate the interest income per card, we apply the industry interest rate to the implied underlying principal of both companies and divide by the number of cardholders. To estimate the company average overall cost for credit card services, we sum the company average annual card fee with the interest income per card. A company estimating affordability with internal data could compare individual card fees and interest rates to the appropriate industry average benchmark to minimize discrepancies.

[84] US News Staff. "2019 Credit Card Fee Study". *US News.* Published October 2020. Accessed October 2020.

We calculate the merchant fee affordability by multiplying the difference in merchant transaction rates with a floor at zero with the total billed merchant volume to estimate the merchant fee affordability impact.

6.3. Consumer finance: Access - underserved

TABLE 28

Underserved Accessibility of Company A and B

Data			
Company datapoints		**A**	**B**
10K	Average FICO	740	-
	% FICO < 669	-	19.00%
Industry assumptions			
Experian	Fair FICO cutoff	669	
SF Fed	Financial exclusion cost	$196.50	

Estimation		
	A	**B**
"Fair" & riskier FICO customers	0%	19%
	x	
Cardholders	81m	45m
	x	
Financial exclusion cost	$196.50	
	=	
Underbanked impact	**-**	**$1,665m**

The underserved consumer

In the consumer finance space, we estimate the underserved impact by identifying under- and un-banked customers that have been reached. In this example, we use FICO score estimates to identify underbanked customers that have limited access to credit due to their credit risk score. Although the FICO credit score is used in the United States over other geographies, we make the simplifying assumption given data availability that a company's customer risk profile is consistent globally. Companies internally have much better proxies for the probability that a customer might be underserved.

From a public data perspective, this example focuses on FICO score to identify underserved customers. Companies with more granular internal data can identify additional underserved groups. For example, Company A touts its efforts to provide services to small businesses and Company B touts its efforts to provide services to students. Without demographic details, we cannot identify which students or small businesses are truly underserved and do not include these customer groups in our estimate per our conservatism principle[85]. Companies with more granular internal data can meaningfully make this distinction and could include additional

[85] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", p 12. Harvard Business School.

customer groupings in their underserved impact estimate. The intent is to capture customers who are truly under or un-banked.

FICO score data

To identify the cardholders that have a sub-prime FICO score, we use a mix of company self-reporting on the average FICO score of their cardholders and Experian data on the distribution of customer credit ratings. Given Experian and lenders often define customers with a "Fair" or "Very Poor" rating as "subprime", we use the cutoff for a Fair FICO score of 669 to identify which customers are underserved.[86]

For Company A, since their average FICO credit score is 740, we know that on average, their customers tend to receive the second highest credit rating of "Very Good". We therefore make the simplifying assumption that 0% of their customers have credit scores fall in the "Fair" or "Very Poor" group. This example understates Company A's underserved impact. In practice, Company A would use internal data to identify what percentage of their customers either have a credit score under 669 or no credit score.

On the other hand, Company B discloses the percentage of their customers that have a FICO score below 660 or no credit score. This metric can be used directly in the impact estimate calculation with no additional manipulation. Given Company B uses a more restrictive cut-off to identify underserved customers than the "Fair" cutoff of 669, this example potentially also understates Company B's underserved impact. The choice of 669 as the underserved cut-off score is an industry assumption that can and should be refined and updated as additional information and research is made available.

Given Company A's average credit score is higher than the underserved cut-off and Company B directly reports the percentage of their underserved customers, neither datapoint required additional manipulation to estimate the percent of subprime cardholders served. Therefore, we provide the following example in Table 29 to demonstrate how this percentage might be estimated for companies with average credit scores below the cut-off of 669. In this example, we take the difference between the company average credit score and the cut-off for the lowest credit score rating group to identify the "Very Poor" credit score ratings included. In the 550-Risk case, the 29 credit scores between 550 and 579. We then make two simplifying

[86] "What is a Good Credit Score". *Experian.* Accessed October 2020.

assumptions. First, that credit score ratings are evenly distributed within each risk band and second, that the distribution of credit scores in the general population is consistent with the company distribution. With these two assumptions, we multiply the included credit scores by the percentage of customers that have that credit score to identify the percentage of customers with a "Very Poor" credit score. We repeat this exercise for the "Fair" credit score and sum the two percentages to identify the total percentage of subprime cardholders served.

TABLE 29

Estimating Percentage of Subprime Customers from Average Credit Score

Industry assumptions

Risk	FICO Score	Population	% per FICO point
Very Poor	300 - 579	16%	0.0571%
Fair	580 - 669	18%	0.2000%
Good	670 - 739	21%	0.3000%
Very Good	740 - 799	25%	0.4167%
Exceptional	800 - 850	20%	0.3922%

Estimation

	550-Risk	600-Risk
(Very Poor [VP] cutoff	579	
	-	
Example company average FICO)	550	600
	=	
VP FICO score points included	29	-
	x	
% population per VP FICO score	0.0571%	
	=	
% "VP" customers	**2%**	**-**
	+	
(Fair cutoff	669	
	-	
Example company average FICO)	550	600
	=	
Fair FICO Points included	90	69
	x	
% population per VP FICO score	0.2000%	
	=	
% fair customers	**18%**	**14%**
Fair & riskier FICO customers	**20%**	**14%**

The impact estimate

We multiply the estimated or reported percent of subprime cardholders with the total number of cardholders to calculate the number of subprime cardholders served. We then apply industry assumptions on the cost of financial exclusion to estimate the underserved impact. As noted above, companies that identify additional underserved customer groups can repeat this calculation for those additional groups.

6.4. Consumer finance: Quality – health & safety

TABLE 30

Health and Safety Impact of Company A and B

Data			
Company datapoints		**A**	**B**
10K	Past due & TDR loans	$1.7bn	$4.8bn
	Past due & TDR receivables	$644m	
	Average loan amount	$732	$1,276
	Average receivables amount	$511	
	Cards per cardholder	1.41	1.28
	% cards in region of data breaches	47%	100%
CFPB	Data breach complaints recorded	99	376
Industry assumptions			
Aging & M. Heal	Relative risk for depression from debt	106%	
J Clin Psych	Prevalence of depression	6%	
J Clin Psych	Annual cost of depression	$5,769.00	
IBM	Cost of data breach	$150	
LRI	Unreported issues per complaint	26	

Estimation		
	A	**B**
Outstanding loans	$1.7bn	$4.8bn
	÷	
Average loan amount	$732	$1,276
	÷	
Cards per cardholder	1.41	1.28
	=	
Customers with loan debt	1.7m	2.9m
	+	
Customers with receivables debt	0.9m	-
same calculation as loans	=	
Customers in debt	2.5m	2.9m
	x	
Relative risk for depression	106%	
	x	
Prevalence of depression	6%	
	=	
Customers with increased risk	164,639	189,312
	x	
Prevalence of depression	$5,769.00	
Indebtedness impact	**-$950m**	**-$1,092m**
Recorded breach complaints	99	376
	÷	
% cards in region w/ breach	47%	100%
	=	
Implied global breach complaints	210	376
	x	
Unreported issues for each complaint	26	
	x	
Cost of data breach	$150	
Data breach impact	**-$0.8m**	**-$1.5m**
Health and safety impact	**-$951m**	**-$1,094m**

Consumer finance health and safety

In the health and safety dimension, we look at whether there have been any breaches of health and safety related to the product. For consumer finance, the health and safety breaches that occur are breaches of financial health and data privacy. In this example, we examine the negative health effects associated with excessive indebtedness and reported data privacy complaints. As

lending practices in the consumer finance space evolve, other health and safety breaches may become relevant for these estimates.

Data on indebtedness and data breaches

Since consumer finance companies do not disclose metrics that directly identify cardholders that are delinquent or have defaulted, we use the company's past due or troubled debt restructuring loans and receivables and the average loan or receivables amount for a single cardholder to estimate excessive indebtedness. We then look to the medical literature to identify the health outcomes associated with indebtedness[87], the prevalence of those outcomes and the associated costs[88]. In this example, the industry assumptions for prevalence and health costs are specific to the United States. In practice, a company estimating their indebtedness impact can use more specific prevalence assumptions based on their operating geographies. On the other hand, referring back to the incentive alignment principle in the product impact framework[89], the health cost used should be consistent regardless of geography, given the toll of depression on a cardholder is not lower where the associated health cost is lower. In line with our conservatism principle, we use US-based estimates of health costs given healthcare costs in the US tend to be on the higher end, allowing us to capture the maximum possible negative impact.

For data breaches, although companies do not report instances of cardholder or merchant data privacy breaches, we use the Consumer Financial Protection Bureau's Consumer Complaint Database and Virtual Hold Technology's estimate of unreported issues per complaint to measure data breach occurrences.[90] Any consumer finance company conducting this analysis could calculate the health and safety impact using actual instances of cardholder or merchant data breaches.

The impact estimate

For the indebtedness impact, we divide the past due or in troubled debt restructuring loans or receivables by the average loan or receivables amount for a single cardholder to estimate the

[87] Gillian L. Marshall, Eva Kahana, William T. Gallo, Kim L. Stansbury, and Stephen Thielke. "The price of mental well-being in later life: the role of financial hardship and debt". *Aging & Mental Health*. Published 2020. Accessed 2020.
[88] Paul E. Greenberg, Andree-Anne Fournier, Tammy Sisitsky, Crystal T. Pike, and Ronald C. Kessler. "The Economic Burden of Adults with Major Depressive Disorder in the United States". *The Journal of Clinical Psychology, 76(2): 155-162.* Published November 2014. Accessed October 2020.
[89] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", p 12. Harvard Business School.
[90] VHT Marketing. "Customer Service: Stats that Matter Part II". *Virtual Hold Technology Solutions.* Accessed October 2020.

number of cardholders that have excessive debt. We then multiply the number of cardholders with excessive debt by the relative risk of indebtedness on depression and the prevalence of depression to estimate the change in prevalence of depression due to indebtedness. A company with more granular data could use prevalence for the relevant geography.

For the data breach impact, we start with the number of recorded cardholder complaints. Given the Consumer Complaint Database only captures complaints made in the US, a company with global operations would have an understated number of complaints. We assume that the complaint rate is consistent across geographies and calculate the implied total number of complaints by dividing the number of US cardholder complaints by the percent of cards issued in the US. Given the number of customer complaints understates the actual rate of issue occurrence, we multiply the number of complaints by the estimated number of unreported issues per complaint determine global data breach occurrences. Finally, we multiply the total occurrences by the cost of a data breach to estimate the breach impact.

6.5. Consumer finance: Quality – effectiveness

TABLE 31

Effectiveness Impact of Company A and B

Data			
Company datapoints		**A**	**B**
JD P	Customer satisfaction	83.0%	83.6%
10K	Annual average card & interest fees	$144	$155
Industry assumptions			
JD P	Industry average satisfaction	80.1%	

Estimation		
	A	**B**
Customer satisfaction	83.0%	83.6%
	-	
Average satisfaction	80.1%	
	=	
Satisfaction differential	2.9%	3.5%
	x	
Total cards issued	114.0m	57.1m
	=	
Satisfied customers over average	3.3m	2.0m
	x	
Averted fee and interest loss	$144	$155
	=	
Effectiveness impact	**$476.2m**	**$309.2m**

Consumer finance effectiveness

For consumer finance, effectiveness cannot yet be directly measured with publicly available data. We therefore use customer satisfaction to estimate the effectiveness of the product. Although customer satisfaction is influenced by a range of characteristics, it does reflect the

customer's perception of the performance of the product. In this example, we note that the customer satisfaction captures the effectiveness impact to the cardholder rather than the merchant. Over time, as the industry begins to record and report data that directly captures the product's performance to both cardholders and merchants. It may be possible to more directly measure effectiveness impacts, such as averted instances of fraud for cardholders and merchants, increased business through business analytics services for merchants, and reward benefits for cardholders.

Data on customer satisfaction

Data on company and industry customer satisfaction comes from JD Power, an established consumer insights firm. The firm conducts the Credit Card Satisfaction Study[91] which measures customer satisfaction based on various card characteristics, including credit card terms, communication and interaction, benefits and services, and rewards. The averted fee and interest cost estimates come from the company provided average card fee and average interest income per cardholder.

The impact estimate

We calculate the impact of customer satisfaction by estimating the additional or averted costs from having a below or above average customer satisfaction rate. First, we take the difference between company and industry customer satisfaction rate. We then calculate the number of individuals that are satisfied with their card over or under the industry average. Multiplying the number of individuals by the annual cost associated with the card allows us to estimate the costs averted by additional customer satisfaction.

6.6. Consumer finance: Quality – basic need

The basic need dimension aims to capture whether the product or service provided satisfies some basic need. In the financial services sector, only products or services that provide access to finance, such as a bank account so an employee can have a direct deposit for payroll, qualify for basic need. For most consumer finance companies, the products and services provided do not have a basic need impact. In the case of Company A and B, credit cards provide access to a line of credit

[91] "US Credit Card Satisfaction Study". *J.D. Power.* Published 2018. Accessed 2020. < https://www.jdpower.com/business/financial-services/us-credit-card-satisfaction-study>

and enable cashless payment and transactions. While these services make financial access more efficient, they do not enable financial access itself.

6.7. Consumer finance: Optionality

TABLE 32

Optionality Impact of Company A and B

Data			
Company datapoints		**A**	**B**
CFPB	Marketing & advertising complaints	368	152
10K	% cards in region of complaints	47%	100%
10K	Annual average card & interest fees	$144	$155
Industry assumptions			
LRI	Unreported issues per complaint	26	

Estimation		
	A	**B**
Recorded marketing complaints	368	152
	÷	
% cards in region w/ complaint	47%	100%
	=	
Implied global marketing complaints	781	152
	x	
Unreported issues for each complaint	26	
	x	
Cost of service to coerced customer	$144	$155
Optionality impact	**-$2.9m**	**-$0.6m**

Although Company A and B do not operate in a monopoly and do not sell addictive products, there are instances in of false marketing and information in the industry. The optionality impact in consumer finance captures the impact from false marketing and information. To estimate the instances of false marketing and information, we refer to the Consumer Financial Protection Bureau's Consumer Complaint Database. This dataset not only provides counts of data breach complaints as used for health and safety, but also records false marketing complaints.

Using the same method for health and safety, we divide the marketing complaint counts by the percentage of cards issued in the US to estimate a global number of complaints. We then multiply this by the estimated unreported issues per complaint[92] to estimate the global number of optionality issues. We multiply the number of issues by the lost costs incurred by having the card, as we did with effectiveness, in which we estimate card fees and interest income per cardholder. The small estimates associated with the optionality dimension is a reflection of the small number of marketing failure instances. In the context of large and systematic failures, this estimate would be considerably larger. For example, with Wells Fargo's fraudulent account scandal, during which potentially 3.5 million unauthorized accounts were opened[93], the optionality impact would be around -$523 million assuming similar costs as Company A and B to the coerced consumer.

[92] VHT Marketing. "Customer Service: Stats that Matter Part II". *Virtual Hold Technology Solutions.* Accessed October 2020.
[93] Keller, Laura J. "Wells Fargo Boosts Fake-Account Estimate 67% to 3.5 Million". *Bloomberg.* Published August 2017. Accessed October 2020.

6.8. Consumer finance: Environmental use

For consumer finance companies, we do not estimate an environmental usage impact given there are minimal emissions or efficiencies enabled during use of the credit card. While purchases enabled by credit card lending have downstream environmental impacts, we do not include these downstream effects in a consumer finance's environmental usage impact given credit card lending occurs independent of spending decisions. The consumer, rather than the credit card lender, solely determines how the credit card loan is used. On the other hand, a bank that actively approves loans for a specific purpose or use would have the downstream environmental impacts enabled by lending included in the environmental usage dimension. Ultimately, a consumer finance company with more detailed information could include the energy required for use of a card reader in the environmental usage dimension, but those impacts are expected to be immaterial for consumer finance companies.

6.9. Consumer finance: End of life

TABLE 33

End of Life Recyclability Impact of Company A and B

Data			Estimation		
Company datapoints	**A**	**B**		**A**	**B**
Assumed Unrecycled cards	114,000,000	57,100,000	Unrecycled cards	114,000,000	57,100,000
Assumed Plastic per card (tons)	0.00001			x	
			Plastic per card (tons)	0.00001	
Industry assumptions				x	
Cost of plastic (ton)	$18,150		Cost of plastic (ton)	$18,150	
			End of life impact	**-$11.4m**	**-$5.7m**

Consumer finance end of life impact

The end-of-life and recyclability impact for a consumer finance company consists of the impacts from wasted, recycled, and recovered product. This consists of paper statements and the plastic used in credit cards. For this example, we rely on available assumptions to estimate the amount of plastic wasted. A company conducting this analysis could specify the actual amount of paper and plastic that is used and the relevant end of life treatment.

Credit card plastic data

Consumer finance companies do not yet disclose the amount of plastic in a card, the recyclability of cards, and the average product volume recycled or recovered. In this example, we rely on industry assumptions to estimate the average amount of plastic contained in a credit card and assume no cards are recycled.

Company A has noted in its disclosures that it plans to report information on plastic volume contained in cards and the amount that is recycled. As companies begin disclosing this information, the end of life impact estimate can reflect those datapoints.

Consumer finance end of life estimate

To estimate the unrecycled plastic volume created by these companies, we multiply the cards issued by the average plastic contained in a credit card. We then multiply the total unrecycled plastic volume by the cost associated with unrecycled plastic to estimate the end of life impact.

CHAPTER 7

INDUSTRIALS SECTOR: AVIATION[94]

We apply the product impact framework of the Impact-Weighted Accounts Initiative within the airlines industry to ensure the framework is feasible, scalable, and comparable in the space. Through a deep-dive of two competitor companies, we provide a cohesive example that examines the impacts of airlines across the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating actual monetary values. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility and is not to assess the performance of individual companies. We do note that the data is from two of the largest airlines.

Self-disclosed company datapoints reflect information found in the company's disclosures from 2018 such as the Form 10-K or annual sustainability reports which often disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Industry-wide assumptions on airfare pricing, industry average timeliness, and associated costs for accidents or delays also come from the Bureau of Transportation Statistics, National Transportation Safety Board, and various economic and academic studies. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

TABLE 34

Product Impacts of Company A and B

				Dimensions of Customer Usage										
				Reach		Access		Quality			Optionality	Env Use	End of Life	
Company	Revenue	Positive Product Impact	Negative Product Impact	Quantity		Affordability	Underserved	Health & Safety	Effectiveness	Need	Monopoly	Emissions	Recyclability	
A	$8bn	$0.7bn	-$0.3bn	Passengers Miles	42m 51bn	$213m	-	-	$291m	-	-$112m	Captured in another IWAI pillar	To be represented as data is available	
B	$44bn	$1.6bn	-$3.3bn	Passengers Miles	192m 225bn	-	-	-$2m	$1,614m	-	-$3,309m			

[94] Serafeim, George, and Katie Trinh. "Accounting for Product Impact in the Airlines Industry." (pdf) Harvard Business School Working Paper, No. 21-066, November 2020. (Revised February 2021.)

* Total positive and negative product impact may differ from the sum of product impact within each dimension given health and safety and effectiveness are composed of impacts positive and negative in magnitude.

For the airlines industry, the affordability dimension captures airfare pricing, the health and safety dimension captures various accidents and incidents, the effectiveness dimension captures timeliness and customer satisfaction, and the optionality dimension captures gate control monopoly impacts. There is no underserved and need impact given most of air travel can be considered a luxury good. We recognize that some portion of air travel might be considered a basic need but we estimate that to be a very small percentage of the total volume of travel and we currently have no data to allow us to incorporate that into our methods. There is also no environmental usage impact since all emissions from use of the product are operational and therefore, already fully accounted for elsewhere in the IWAI framework, the environmental pillar[95]. Finally, current disclosure levels prevent estimation of the recyclability impact. Since both companies A and B have disclosed some information around their recycling of plastic and other packaging waste, we provide an example of how plastic and packaging waste impacts can be estimated. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

7.1. Aviation: Reach

TABLE 35

Customers of Company A and B

Data			
		A	**B**
10K	Revenue passengers	42,150,000	192,000,000
10K	Revenue miles	50,790,000,000	225,243,000,000

Airline reach

The goal of the reach category is to identify the number of individuals served by the company. Unlike other industries where the number of individuals served needs to be estimated, airlines often directly disclose the number of individuals they serve through the metric, revenue

[95] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

passengers. In addition, airlines also disclose the total distance these passengers have travelled through revenue miles.

7.2. Aviation: Access - affordability

TABLE 36

Fare Affordability of Company A and B

Data			
Company datapoints		**A**	**B**
MIT	Yield / passenger mile	$0.1349	$0.1504
Industry assumptions			
MIT	Industry yield / p.m.	$0.1391	

Estimation		
	A	**B**
(Industry yield	$0.1391	
	-	
Company yield)	$0.1349	$0.1504
	=	
Estimated price difference	$0.0042	-$0.0113
	x	
Revenue miles	51bn	225bn
	=	
Fare affordability	**$213m**	**-**

Fare affordability in the airlines industry

For affordability in aviation, we aim to capture how affordable the fare offered by an airline is. Although the average fare price for a one-way or roundtrip ticket is often directly reported by airline companies, the metric can be influenced by the distances, routes, and fare classes the airline aims to serve. To minimize the influence of distance on fare, we use a price per passenger mile estimate in this example.

Price per passenger mile estimate

Since some companies do not provide a price per passenger mile, we use estimates from the Airline Data Project which provides data from the US Department of Transportation Form 41 in a single, easily accessible location.[96] Both company-specific and industry average price per passenger mile is provided by this source. Companies without the limitation of publicly available data can use more granular segmentation of price per passenger mile by fare class or route.

The impact estimate

[96] Airline Data Project. "System Passenger Yield". *MIT Global Airline Industry Program.* Updated 2019. Accessed October 2020 at <http://web.mit.edu/airlinedata/www/Revenue&Related.html>.

As shown in Table 36, we use the difference between the industry and company specific price per mile to determine the affordability of a single mile of travel enabled. We then multiply the difference for a single mile by the total passenger miles travelled to calculate the full affordability impact. Finally, we apply a floor at zero given our goal is to capture the positive impact created from offering an affordable product rather than any impacts associated with premium pricing strategies. While the price per mile estimates are estimated across fare classes, a company looking to apply a more granular segmentation can estimate the repeat and sum the methodology shown in Table 36 by identifying passenger miles flown and the relevant pricing for fare classes and routes of interest.

7.3. Aviation: Access - underserved

Underserved airline routes

The underserved dimension aims to capture the impact created from a company serving an underserved group with a product or service that enables sustainable development, as outlined by the UN Sustainable Development Goals. For the aviation industry, airlines would have an underserved impact if they credibly and affordably provide transportation to areas that otherwise would not be served.

To determine if airlines enable underserved access or if air travel is a luxury service, we examine the origin and destination of single carrier routes with below-industry average fares using data from the US Department of Transportation's Consumer Airfare Report.[97] Although there are a number of affordably priced single carrier routes, the origin or destination airports of these routes are predominantly leisure travel destinations, indicating that air travel is indeed a luxury service.

In this example, both Company A and B do not have an underserved impact and it is expected that in general, other airlines will also not have underserved impacts. Airlines that can identify or introduce routes that affordably provide transportation to areas that would otherwise be unserved by other modes of transportation would be exceptions in the industry.

[97] Consumer Airfare Report. "Table 1a. All US Airport Pair Markets". *US Department of Transportation.* Updated 2019. Accessed October 2020 at <https://data.transportation.gov/Aviation/Consumer-Airfare-Report-Table-1a-All-U-S-Airport-P/tfrh-tu9e>.

7.4. Aviation: Quality – health & safety

TABLE 37

Health and Safety of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
NTSB	Individuals affected by accident	0	4	Individuals affected by accident	0	4
					x	
Industry assumptions				Accident costs	$525,821.00	
BITRE	Accident costs	$525,821			=	
				Health and safety impact	**-**	**-$2m**

Airline safety

For health and safety in aviation, we aim to capture instances where safe travel has been breached. We examine averted occurrences of flight-related accidents and incidents to estimate safe travel. While airlines and regulatory bodies report on pilot and crew safety trainings and failed safety tests, we do not include these metrics in our estimate since they are captured by the overall occurrence of flight-related accidents and incidents.

We note that within safe travel, multiple airlines have implemented flight crew training efforts on recognizing and reporting suspected trafficking occurrences. Given current disclosure levels focus on training efforts rather than averted instances of criminal activity, we do not include impacts from averted criminal activity within the overall health and safety dimension in this example. As companies begin to monitor and disclose data on averted criminal activity, these impacts could be included in the health and safety dimension. We provide an example in Table 38 that estimates Company A's impact from averted criminal activity.

TABLE 38

Averted Criminal Activity of Company A

Data			Estimation	
Company datapoints		**A**		**A**
10K	Trafficking reports	26	Reported incidents	26
				x
Industry assumptions			Implied averted	$228,202
Wilmerhale	Restitution payments	$228,202		=
			Safe travel impact	**$6m**

Data on airline safety

For accident and incident data, both companies self-reported their number of accidents per SASB metric TR 201-09. We supplement this information with data from the National Transportation Safety Board Aviation Accident Database to identify the number of individuals affected by the accident or incident. We include all injured and affected individuals in our estimate, regardless of whether they are identified as crew or passenger for conservatism.

The cost associated with accidents and incidents is from the Bureau of Transport and Regional Economics of Australia[98]. The cost associated with trafficking applied in Table 38 is based on restitution payments made for trafficking as estimated by The Human Trafficking Pro Bono Legal Center and Wilmer Cutler Pickering Hale and Dorr LLP[99].

The impact estimate

To estimate the impact of safe travel, we multiply the number of individuals affected by a flight accident or incident by the associated cost of an accident or incident to estimate the impact from accident occurrence. A company estimating their own health and safety impact could identify the actual type of accident or incident that has taken place and use a more specific estimate of the associated costs.

7.5. Aviation: Quality - effectiveness

TABLE 39

Effectiveness Impact of Company A and B

Data				**Estimation**		
Company datapoints		**A**	**B**		**A**	**B**
BTS	Arrival delay (%)	26.7%	13.7%	Industry delays (%)	18.8%	
BTS	Cancellations (%)	2.1%	0.4%		-	
	Cancellation fee	$25.00	$200.00	Company delays (%)	26.7%	13.7%
SASB	Average fare	$175.11	$182.03		x	
ATCR	Baggage issues / 1000 passengers	1.39	1.20	Passengers	42m	192m
ASCI	Customer satisfaction	79%	74%		x	
				Cost of delay	$34.28	
Industry assumptions				**Delay impact**	**-$114m**	**$332m**
BTS	Industry arrival delay (%)	18.8%				
UMD	Cost per delayed passenger	$34.28		Industry cancellations (%)	1.6%	

[98] "Cost of Aviation Accidents and Incidents, Report 113". *Department of Transportation and Regional Services, Bureau of Transport and Regional Economics.* Published February 2006. Accessed November 2020.
[99] Alexandra Levy, Martina Vandenberg, and Lyric Chen. "When Mandatory Does Not Mean Mandatory: Failure to Obtain Criminal Restitution in Federal Prosecution of Human Trafficking Cases in the United States". *The Human Trafficking Pro Bono Legal Center and Wilmer Cutler Pickering Hale and Dorr LLP.* Accessed November 2020.

BTS	Industry cancellations (%)	1.6%
ACTR	Baggage issues / 1000 passengers	2.84
Luglock	Cost of mishandling	$50.00
ASCI	Customer satisfaction	73%

	-	
Company cancellations (%)	2.1%	0.4%
	x	
Passengers	42m	192m
	x	
Cost of cancellation (fee + fare)	$200.11	$382.03
Cancellation impact	**-$40m**	**$917m**
Industry baggage mishandling	2.84	
	-	
Company baggage mishandling	1.39	1.20
	x	
Passengers (thousands)	42,150	192,000
	x	
WTP for proper handling	$50.00	
Baggage mishandling impact	**$3.0m**	**$15.7m**
Company satisfaction	79%	74%
	-	
Industry satisfaction	73%	
	x	
Passengers (thousands)	42m	192m
	x	
Average fare	$175.11	$182.03
Customer satisfaction impact	**$443m**	**$350m**
Effectiveness impact	**$291m**	**$1,614m**

Airline effectiveness

In the effectiveness dimension, we aim to capture aspects of timeliness and service. While timeliness can be directly captured through airline delay and cancellation rates, aspects of service are more nebulous. Customers experience airline service from booking to baggage claim. Characteristics of airline service can include convenience of check-in, ease of boarding, helpfulness of flight crew, cabin and seat comfort, and meals and other perks. Given the range in service offerings, we measure airline service with customer satisfaction and baggage handling.

Data on timeliness and customer satisfaction

Carrier-specific and industry-average delay and cancellation rates come from the Bureau of Transportation Statistics' dataset on on-time performance.[100] Industry and carrier baggage mishandling rates come from the Office of Aviation Enforcement and Proceedings' Air Travel

[100] "On-Time Performance – Reporting Operating Carrier Flight Delays at a Glance". *Bureau of Transportation Statistics TranStats.* Accessed November 2020.

Consumer Report.[101] Customer satisfaction data comes from the American Customer Satisfaction Index.[102] Industry assumptions regarding the cost to travelers from delay come from research reports by The National Center of Excellence for Aviation and Operations Research.[103] Costs associated with cancellation are estimated using the sum of the average airfare and cancellation fee charged by the airline itself. Costs associated with mishandled baggage are estimated using the average cost of baggage tracking devices which are applied as a proxy for traveler willingness-to-pay for properly handled baggage.

The impact estimate

We calculate the impact of timeliness by estimating the reduced or excess number of passengers experiencing delays and cancellations compared to the industry average. First, we calculate the difference in the industry and carrier delay and cancellation rates. We multiply the difference by the total number of passengers to determine the reduction in or additional passengers experiencing delay or cancellation compared to the industry average. We multiply the number of delayed or cancelled passengers by the associated cost of delay or cancellation to determine the timeliness impact. We recognize that airlines have begun to build buffers into their flight schedule and flight times to reduce delay. Since schedule buffers reduce the occurrence of flight delays, but not alter the delay impact itself, we do not factor schedule buffers into the timeliness impact or separately estimate the impact from schedule buffers. However, we note that excessive schedule buffers likely influence a customer's overall satisfaction with the airline and would then be captured in the service impact.

To estimate the service impact, we calculate impact from reduced or excess baggage mishandling and overall customer satisfaction. For the baggage mishandling, we calculate the difference in the industry and carrier baggage mishandling rates. We then multiply the difference in baggage mishandling by the number of passengers, assuming each passenger has one piece of luggage that they check, to estimate the excess or averted instances of mishandled baggage. We multiply the instances of mishandled baggage by a customer's willingness-to-pay for properly

[101] "Air Travel Consumer Report". *The Office of Aviation Enforcement and Proceedings. Aviation Consumer Protection Division.* Published February 2019. Accessed November 2020.
[102] "Benchmarks by Industry – Airlines". The *American Customer Satisfaction Index.* Published 2019. Accessed November 2020.
[103] Michael Ball, Cynthia Barnhart, Martin Dresner, Mark Hansen, Kevin Neels, Amedeo Odoni, Everett Peterson, Lance Sherry, Antonio Trani, Bo Zou. "Total Delay Impact Study". *The National Center of Excellence for Aviation Operations Research.* Published October 2010. Accessed November 2020.

handled baggage to estimate the impact from baggage handling. For customer satisfaction, we calculate the difference in the industry and carrier customer satisfaction. We multiply the difference in satisfaction by the number of passengers to identify the number of additional or fewer satisfied customers compared to the industry average. We multiply the additional or fewer satisfied customers by the average fare paid to estimate the service impact from satisfaction.

While we use customer satisfaction and baggage mishandling as proxy for service, we note that there are other aspects to airline service that may be more directly measured with internal data.

Given data availability, this example relies on satisfaction as a proxy. A company estimating their own effectiveness impact could instead look at actual aspects of service such as check-in time saved or lost, crew member satisfaction scores, and other relevant internal data. The application of internal data to estimate the service impact is towards the goal of more accurate measurement rather than avoidance of unfavorable customer satisfaction ratings.

7.6. Aviation: Quality - basic need

Basic needs met by airlines

The basic need dimension aims to capture the impact created from a company by providing a service or product that meets a basic need. In the case of airlines, we previously determined that air travel is a luxury service within the underserved dimension. Therefore, airlines do not provide a service that meets a basic need.

Another method of identifying whether a product or service is a basic need is by examining how sensitive demand for the product is to price, the price elasticity of demand. While this method is not always applicable for luxury products such as a designer handbag, which clearly does not meet a basic need, but exhibits highly inelastic demand, the airlines industry is generally accepted to have highly elastic demand.[104] This further indicates that air travel is not a basic need.

7.7. Aviation: Optionality

TABLE 40

Optionality Impact of Company A and B

[104] Stacey Mumbower, Laurie Garrow, and Matthew Higgins. "Estimating flight-level price elasticities using online airline data: A first step toward integrating pricing, demand, and revenue optimization". *Transportation Research Part A: Policy and Practice,* Volume 66. Published August 2014. Accessed November 2020.

Data			
Company datapoints		**A**	**B**
BTS	Monopolistic routes	4	12
BTS	Passengers on routes	3.4m	97.2m
SASB	Average fare	$175.11	$182.03
Industry assumptions			
DOT	Hub premium pricing	18.7%	

Estimation		
	A	**B**
Passengers on routes	3.4m	97.2m
	x	
Average fare paid	$175.11	$182.03
	x	
Hub pricing premium	18.7%	
Optionality impact	**-$112m**	**-$3,309m**

Optionality in airlines

The optionality dimension aims to capture the impact from consumers lacking freedom of choice when making a purchase, which we determine by examining whether the industry is monopolistic, whether the product or service is addictive, and whether there have been any information failures. Although there is competition present between airlines in the aviation industry as a whole, single airlines do exhibit monopolistic control over gates at different airports, limiting competition in different routes. [105] This issue is identified by SASB as financially material for aviation, with the inclusion of a metric measuring competitive behavior, TR201-07, in the Sustainability Accounting Standard for airlines.[106]

Airlines optionality data

To determine which airlines and to what extent airlines have monopolistic control over gates and routes, we examine the Air Carrier Statistics dataset from the Bureau of Transportation Statistics.[107] This dataset provides the number of passengers and associated airline for every origin and destination airport pair. For each airline, we identify the routes and passengers between each origin and destination airport in which the airline provides transportation to more than half of the passengers. The premium pricing associated with these routes comes from studies by the US Department of Transportation and US Government Accountability Office which estimate the price premium of hub airports dominated by one airline.[108] While contemporary literature estimates price premiums of both hub airports and low-cost carrier entry, we apply the estimate from the

[105] Scott Wolla and Carolyn Backus. "The Economics of Flying: How Competitive Are the Friendly Skies?". *Federal Reserve Bank of St. Louis Economic Research.* Published November 2018. Accessed November 2020.
[106] "Airlines Sustainability Accounting Standard". *Sustainability Accounting Standards Board.* Published October 2018. Accessed November 2020.
[107] "Air Carriers: T-100 Domestic Market (All Carriers)". *Bureau of Transportation Statistics.* Published April 2020. Accessed November 2020.
[108] Michael Thretheway and Ian Kincaid. "The Effect of Market Structure on Airline Prices: A Review of Empirical Results". *Journal of Air Law and Commerce* Volume 70, Issue 3. Published 2005. Accessed November 2020.

DOT and GAO given our goal is to apply an estimate that has been widely accepted by the industry.[109] As regulatory bodies adopt findings from contemporary literature, the assumptions applied in this example would be refined to reflect the new industry consensus.

The impact estimate

We estimate the total fare paid by customers without optionality by multiplying the estimated number of passengers on monopolistic routes with the airline's average fare. We then multiply the total fare paid by the pricing premium associated with hub airports to estimate the excess fare paid due to the lack of optionality within the industry. An airline with internal data could estimate their optionality impact using the actual fares on monopolistic routes.

7.8. Aviation: Environmental use

The environmental usage dimension aims to capture any environmental emissions, pollutants, or efficiencies produced from use of the product. While airlines produce carbon and greenhouse gas emissions through customer air travel, the environmental impact of airlines from customer usage is fully captured by the environmental framework of the Impact-Weighted Accounts given these impacts are also operational.[110] Any innovations made to improve efficiency, such as use of renewable fuel, new aircraft design or improved navigation systems, would be reflected in the operational environmental impact. To avoid double-counting, we do not include impacts from environmental usage within the overall product impact.

7.9. Aviation: End of life

The end of life dimension aims to measure the averted and created emissions from the end of life treatment of the product. For airlines, the end of life dimension could capture recycling of renewable fuel, aircraft recycling, and even waste and recycling from in-flight food and beverage offerings. While airlines do have end of life impacts to be measured, adoption of renewable fuel and innovation in aircraft recycling is only in initial stages and data on food and beverage offerings is only partially reported.

[109] Darin Lee and Maria Jose Luengo-Prado. "The Impact of Passenger Mix on Reported "Hub Premiums" in the US Airline Industry". *Southern Economic Journal*. Published October 2005. Accessed November 2020.
[110] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

TABLE 41

End of Life Recyclability Impact of Company A

Data	
Company datapoints	**A**
Plastic bottles recycled	30m
Industry assumptions	
8oz bottles in 1 ton of plastic	72,000
Cost of plastic waste (ton)	$18,150

Estimation	
	A
Bottles recycled	30m
	÷
Bottles / ton of plastic	72,000
	x
Cost / ton of plastic	$18,150
Recycling impact	**$7.6m**

We provide an example of how the impact from Company A's recycling of bottles from in-flight beverages could be measured in Table 41. Companies estimating their own end of life recyclability impact could apply similar logic to internally available data. As the industry continues to adopt end of life and other recyclability innovations, we would expect disclosure and reporting on these innovations to improve, enabling more comprehensive impact estimates.

CHAPTER 8

COMMUNICATION SERVICES SECTOR: TELECOMMUNICATIONS[111]

We apply the product impact framework of the Impact-Weighted Accounts Initiative within the telecommunications industry to ensure the framework is feasible, scalable, and comparable in the space. Through a deep-dive of two competitor companies, we provide a cohesive example that examines the impacts of telecommunications companies across the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating actual monetary values. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility and is not to assess the performance of individual companies. We do note that the data is from two of the largest telecommunications firms globally.

Self-disclosed company datapoints reflect information found in the company's disclosures from 2018 such as the Form 10-K or annual sustainability reports which often disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Industry-wide assumptions on industry ARPU, value of rural connectivity, average broadband speed available and associated activities enabled, and cost and value associated with e-waste also come from the CTIA Wireless Association, the United States Telecom Association, the World Bank, the Federal Communications Commission, the Bureau of Labor Statistics, and various economic and academic studies. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

TABLE 42

Product Impacts of Company A and B

[111] Serafeim, George, and Katie Trinh. "Accounting for Product Impact in the Telecommunications Industry." (pdf) Harvard Business School Working Paper, No. 21-105, March 2021. (Revised May 2021.)

							Dimensions of Customer Usage								
						Reach	Access		Quality			Optionality	Env Use	End of Life	
Company	Revenue	Relevant Impact Revenue	Positive Product Impact	Negative Product Impact		Quantity	Affordability	Underserved	Health & Safety	Effectiveness	Need	Monopoloy	Emissions	Recyclability	
A	$171bn	$102bn	$9.2bn	-$12.7bn	Wireless customers	171m	$439m	$4,980m	-	-$8,622m	$3,752m	-$2,097m	-$422m	-$1,555m	
					Broadband connection	14m									
B	$131bn	$117bn	$13.9bn	-$5.3bn	Wireless customers	118m	-	$558m	-	$8,990m	$2,584m	-$1,848m	-$484m	-$1,281m	
					Broadband connection	7m									

* Total positive and negative product impact may differ from the sum of product impact within each dimension given effectiveness is composed of impacts positive and negative in magnitude.

For the telecommunications industry, the access dimension captures affordability of wireless and internet provision and service provision to rural, emerging market, and other underserved populations. The effectiveness dimension captures network efficiency and the need dimension captures connectivity benefits from internet and wireless access. The optionality dimension captures price rents from monopoly exposure. The environmental usage dimension captures emissions from product use and the recyclability dimension captures the cost and value associated with e-waste generation and recycling. There is no health and safety impact given the telecommunications industry does not have clear, demonstrable issues associated with customer health and safety. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

8.1. Telecommunications: Reach

TABLE 43

Customers of Company A and B

Data			
		A	**B**
10K	Wireless customers	171,327,000	117,999,000
10K	Broadband connections	14,409,000	6,961,000

The goal of the reach dimension is to identify the number of individuals served by the company. For applicability and comparability, we limit this example to examining the impact of traditional and pure telecommunications services. While some telecommunication companies have

additional business lines around media, content creation, and content distribution, we exclude these business lines from this example given the product is inherently different from telecommunications. These firms could estimate their overall product impact by separately estimating their product impact from communications as outlined in this paper and their product impact from content creation and distribution. Within the communications businesses, both telecommunications companies disclose the number of wireless customers they serve and the number of broadband connections they maintain.

8.2. Telecommunications: Access - affordability

TABLE 44

Affordability of Company A and B

Data			
Company datapoints		**A**	**B**
10-K	Wireless ARPU	$49.73	$42.03
10-K	Broadband ARPU	$49.83	$96.43
Industry assumptions			
CTIA	Industry wireless ARPU	$37.85	
US Telcom	Industry broadband ARPU	$52.37	

Estimation		
	A	**B**
(Industry wireless ARPU	$37.85	
	-	
Firm wireless ARPU)	$49.73	$42.03
	=	
Savings enabled	$0.00	$0.00
	x	
Wireless customers	171m	118m
	=	
Wireless affordability	**-**	**-**
(Industry broadband ARPU	$52.37	
	-	
Firm broadband ARPU)	$49.83	$96.43
	=	
Monthly savings enabled	$2.54	$0.00
	x	
Wireless customers	14m	7m
	x	
Annualization	12	
	=	
Broadband affordability	**$439m**	**-**
Affordability impact	**$439m**	**-**

Affordability in telecommunications

The goal of the affordability dimension is to identify the positive impact of more affordable product or service provision. Affordability in the telecommunications industry aims to capture the

impact of providing wireless and internet services more affordably than others in the industry. This can be measured with estimates of monthly service fees.

Pricing data

To estimate the affordability of wireless and internet services, we examine industry price averages and look for the corresponding company-specific metric. For industry price averages, the CTIA Wireless Association provides monthly average revenue per unit (ARPU)[112] and the United States Telecom Association provide estimates of average broadband pricing using the Federal Communications Commission Urban Rate Survey.[113]

For the company-specific costs and fees, we looked to the company's Form 10-K and marketing materials to identify the appropriate corresponding data. In marketing materials and financial disclosures, both Company A and Company B disclose their wireless and broadband ARPU.

The impact estimate

To estimate the wireless and broadband service affordability, we take the monthly cost differential between the industry average ARPU and company average ARPU for services as shown in Table 44 with a floor at zero. We calculate the overall affordability impact by multiplying the number of customers experiencing the more affordable pricing and annualizing. Given data availability, this example estimates the affordability impact at the overall company average level. A company with internal data could estimate a more granular affordability impact by applying the same methodology at the product or market level.

8.3. Telecommunications: Access - underserved

The underserved customer

The goal of the underserved dimension is to identify the impact associated with provision of service to underserved customers. In the telecommunications space, we estimate the underserved impact by identifying customers in rural geographies or emerging markets and lower-income customers.

[112] "CTIA Annualized Wireless Industry Survey Results". *CTIA Wireless Association.* Accessed December 2020.
[113] Arthur Menko. "2020 Broadband Pricing Index". *US Telecom Association.* Accessed December 2020.

TABLE 45

Underserved Customers of Company A and B

Data			
Company datapoints		**A**	**B**
Firm PR	Rural homes connected	660,000	0
10-K	Emerging market customers	12,264,000	0
10-K	Pre-paid customers	17,000,000	4,646,000
News	Pre-paid cost-savings	$7.73	$10.00
Industry assumptions			
Microsoft	Value of rural connectivity	$2,100	
WB	Value of relevant emerging mkt	$164.48	-

Estimation		
	A	**B**
Rural homes connected	660,000	0
	x	
Value of rural connectivity	$2,100	
	=	
Rural impact	**$1,386m**	**-**
Emerging market customers	12m	-
	x	
Value of connectivity	$164	-
	=	
Emerging market impact	**$2,017m**	**-**
	-	
Pre-paid customers	17.0m	4.6m
	x	
Pre-paid cost savings	$7.73	$10.00
	x	
Annualization	12	
	=	
Pre-paid impact	**$1,577m**	**$558m**
Underserved impact	**$4,980m**	**$558m**

Price or cost savings data

To identify customers in rural geographies or emerging markets, we use company self-reporting on the number of customers or households with broadband connectivity in a rural geography and the number of customers with wireless connectivity in emerging markets. Company A provides the estimated number of households connected in a rural region as defined by the FCC along with the number of wireless customers served in Mexico. Company B does not provide an estimate of households or customers connected in a rural region and solely operates in the United States. The value of rural household connectivity is estimated by Microsoft.[114] The value of emerging markets connectivity is estimated from the GDP and population of the relevant emerging market given the World Bank estimates a 10% increase in connectivity penetration is associated with a 0.17% increase in GDP.[115] Given the current literature relies on GDP to estimate the value of connectivity in emerging markets, we use the available GDP-based estimate as a proxy for more direct measures of productivity and other benefits from connectivity in emerging markets. As more

[114] "An Update on Connecting Rural America". The 2018 Microsoft Airband Initiative. Accessed December 2020.
[115] Tim Kelly and Carlo Maria Rossotto. "Broadband Strategies Handbook." *The World Bank*. Accessed December 2020.

direct estimates become available, those could more accurately capture the underserved impact to emerging markets.

To identify lower-income customers, we identify pre-paid customers as a proxy for lower-income customers given pre-payment tends to be associated with cost-savings compared to post-paid services. Both companies disclose the number of pre-paid customers. To estimate the cost savings associated with pre-payment, we take the difference between pre-paid and post-paid ARPU for Company A. For Company B, we rely on secondary marketing materials to estimate the average cost-savings for pre-payment.

The impact estimate

We multiply the number of households connected in rural regions by the value of rural connectivity to estimate the underserved impact within rural populations. Similarly, we multiply the number of wireless customers connected in emerging markets by the per person value of connectivity in emerging markets to estimate the underserved impact within emerging markets. Lastly, we multiply the number of pre-paid customers by the monthly cost-savings from pre-payment and annualize to estimate the underserved impact to pre-paid customers. We then sum the underserved impact to these three populations to estimate the overall underserved impact.

8.4. Telecommunications: Quality – health & safety

The health and safety dimension aims to capture instances where a customer's health, safety has been affected, or privacy has been breached. For a telecommunications company, a health and safety impact could be estimated by identifying instances of breaches to customer data or privacy. We note that government or law-enforcement mandated disclosures are not considered to be breaches of customer data or privacy in this example, assuming that such mandated disclosures are consistent with the laws of the country. As such, Companies A and B have not faced any data security or privacy breaches and do not have a health and safety impact.

8.5. Telecommunications: Quality – effectiveness

TABLE 46

Effectiveness Impact of Company A and B

Data			
Company datapoints		**A**	**B**
Firm PR	High-speed internet offered	50.25	486.46
10-K	High-speed customers	13,729,000	6,100,000
Firm PR	Low-speed internet offered	2.88	6.08
10-K	Low-speed customers	20,000	861,000
Firm PR	Wireless speed	21.10	101.80
Industry assumptions			
FCC	Median internet speed	72.00	
FCC	Cut-off speed for internet work-use	50.00	
OOKLA	Average wireless download speed	27.33	
Assumed	Maximum speed increase with value realized	150%	
BLS	Annual seconds on internet for work	2,779,110	
BLS	Annual seconds on internet for leisure	2,266,650	
eMarketer	Annual seconds on wireless internet for multi	470,850	
World Bank	Global hourly wage	$4.24	
Pharmaco	Global hourly value of leisure	$1.11	

Estimation		
	A	**B**
(High-speed internet speed	50.25	486.46
Activity affected by speed	*(Leisure)*	*(Leisure)*
	-	
Median internet speed)	72.00	
	=	
Speed differential (up to max)	-21.75	36.00
	x	
Leisure seconds on internet	2,266,650	
	=	
Missing or gained megabytes	-49m	82m
	÷	
Median internet speed	72.00	
	=	
Equivalent hours lost / gained	-190.2	314.8
	x	
High-speed internet customers	14m	6m
	=	
Total hours lost / gained	-2,611m	1,920m
	x	
Value of hourly leisure	$1.11	
	=	
High-speed effiency impact	**-$2,902m**	**$2,134m**
Effectiveness impact	**-$8,622m**	**$8,990m**

Telecommunications effectiveness

In the effectiveness dimension, we aim to capture whether the product or service is effective at meeting customer expectations. For telecommunications, this includes aspects of efficient and reliable service provision. Given public data availability, we examine network speed to estimate the effectiveness impact of efficient service provision. A company with internal data on interruption frequency and duration can also estimate the effectiveness impact of reliable service provision.

Data on network speeds, activities enabled, and associated time spent

Company data on network speed is self-disclosed in network performance marketing materials. Both Company A and B provide download speed in Mbps for their internet offerings by speed tier. Given public data availability does not identify customers by speed tier, we calculate an average company speed for each internet offering. We do not estimate the effectiveness impact of network reliability given public data availability. We note however that as companies do begin to report reliability data per SASB metric TC-TL-550a.1 which covers system interruption

frequency and duration, the impact from network reliability would be included within the effectiveness impact.

The industry average broadband[116] and wireless network speed[117] is provided at the country level by the Federal Communications Commission and Ookla, an internet testing and analysis data provider. In this example, we apply a country-level benchmark given available data granularity. A company with more granular internal data can apply a benchmark of the average speed available to a customer at a more specific geography level. We note that in geographies with only one service provider, the industry average speed available would match the company average speed available, resulting in no effectiveness impact within that specific geography. This is consistent with the incentive alignment principle[118], as the impact estimate should not discourage companies from providing service below the national average speed in rural areas that would otherwise be unserved.

We also examine the internet speed required for different activities and the associated average time spent, given variation in internet speed enables different activities rather than the speed of a single activity. The FCC broadband speed guide[119] outlines the broadband speed required for various general usage, video, conferencing and gaming related activities. We group the activities into work and leisure use to identify 50 Mbps as the speed required for work-related activities. We use the American Time Use Survey[120] from the Bureau of Labor Statistics to estimate the associated time spent online for work and leisure, allocating 50% of the time in the work and work-related activities, educational activities, and telephone calls, mail, and e-mail categories as internet-enabled work use and the time in the socializing and communicating and watching television categories as internet-enabled leisure use. For wireless use, we refer to industry reported estimates of time spent on mobile devices.[121] Since several wireless activities, such as texting and social media, are enabled at much lower speeds than the industry average, we reference the FCC speed guide to identify leisure activities that would be affected by higher wireless speed

[116] "Eighth Measuring Broadband America Fixed Broadband Report". *Federal Communications Commission Office of Engineering and Technology.* Published December 2018. Accessed December 2020.
[117] "Mobile Speedtest Data Report 2018 United States". *Ookla.* Published July 2018. Accessed December 2020.
[118] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", Harvard Business School. Accessed July 6, 2020.
[119] "Broadband Speed Guide". *Federal Communications Commission Consumer and Governmental Affairs Bureau.* Published February 2020. Accessed December 2020.
[120] "American Time Use Survey – 2019 Results". *Bureau of Labor Statistics*. Published June 2020. Accessed December 2020.
[121] Yoram Wurmser. "Mobile Time Spent 2018". *eMarketer.* Published June 2018. Accessed December 2020.

availability. We identify multi-media use as an activity that would be affected and refer to the Comscore Mobile App Report[122] to estimate time allocated for multi-media use.

For estimates on the value of work and leisure, we apply a global hourly wage estimate from the World Bank as discussed in the product framework application to automobile manufacturers[123] and calculate the hourly value of leisure based on literature that suggests leisure is valued at approximately 26% of paid work[124].

The impact estimate

We identify the relevant activity affected by the company offered internet speed. In the example provided in Table 46, both companies offer an internet speed above the speed required for work use. This indicates that the activity impacted will be leisure. We calculate the difference between the company and industry speed to identify the difference in download speed compared to the industry. To estimate the experienced data gains or losses per customer, we multiply the speed differential by the seconds spent on the relevant activity, in this case, leisure. We then estimate the time gained or lost due to internet speed by dividing the data gains or losses by the industry average speed. To estimate the overall effectiveness impact from the higher-speed internet provided, we multiply the time gained or lost per customer by the number of customers on higher-speed internet and the hourly value of leisure. We repeat this methodology, as detailed in the telecommunications appendix, to calculate the effectiveness impact of the lower-speed internet offering and wireless and note that the lower-speed internet offering for both companies affects work rather than leisure use.

[122] "The 2017 U.S. Mobile App Report". *Comscore White Paper.* Published August 2017. Accessed December 2020.
[123] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", Harvard Business School. Accessed July 6, 2020.
[124] Verbooy K, et al. "Time Is Money: Investigating the Value of Leisure Time and Unpaid Work." *PharmacoEcon Outcomes News* 808. Published July 2018. Accessed December 2020.

8.6. Telecommunications: Quality – basic need

TABLE 47

Basic Need Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
10-K	Wireless customers	171,327,000	117,999,000	Minimum unique customers	171,327,000	117,999,000
					x	
Industry assumptions				Averted connectivity loss	$21.90	
Deloitte	Loss from lack of connectivity	$21.90			=	
				Basic need impact	**$3,752m**	**$2,584m**

Basic needs met by telecommunications

The basic need dimension aims to capture the impact created from a company by providing a service or product that meets a basic need. In the case of telecommunications, provision of broadband and wireless meets a basic need of connectivity. Examining the price elasticity of broadband cements this designation as the long-run price elasticity is in the inelastic range.[125]

Value of connectivity data

To estimate the value of connectivity, we examine the economic losses associated with an internet outage as estimated by Deloitte.[126] Deloitte estimates an internet outage affecting 10 million individuals in a country with low internet connectivity would cost $0.6 million daily. This is equivalent with a $219 million loss annually that implies the per person loss associated with lack of internet connectivity annually is $21.90. To identify the number of individuals reached by Company A and B, we refer to figures self-reported by the companies as shown in the previous sections.

The impact estimate

To estimate the basic need impact from provision of internet services, we multiply the number of individuals connected by Company A and B by the averted economic loss associated with lack of connectivity. For conservatism, we estimate the number of individuals reached assuming complete

[125]Richard Cadman and Chris Dineen. "Price and Income Elasticity of Demand for Broadband Subscriptions: A Cross-Sectional Model of OECD Countries". *Telenor ASA.* Published 2009. Accessed January 2021.
[126] "The economic impact of disruptions to Internet connectivity". *Deloitte LLP.* Published October 2016. Accessed December 2020.

overlap of wireless and broadband customers. A company estimating their own basic need impact could apply the number of unique customers connected.

8.7. Telecommunications: Optionality

TABLE 48

Optionality Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
JD Power	Customer satisfaction	81.1%	82.2%	Customers dissatisfied (%)	18.9%	17.8%
				x		
10-K	Total service subscriptions	185,736,000	124,960,000	Total service subscriptions	185,736,000	124,960,000
				=		
10-K	Avg monthly service price	$49.78	$69.23	Customer monopoly exposure	35,104,104	22,242,880
				x		
Industry assumptions				Monthly service price	$49.78	$69.23
				x		
Roos. Inst.	Monopoly price premium	10%		Monopoly price premium	10%	
				x		
				Annualization	12	
				=		
				Optionality impact	**-$2,097m**	**-$1,848m**

Optionality in telecommunications

The optionality dimension aims to capture the impact from consumers lacking freedom of choice when making a purchase, which we determine by examining whether the industry is monopolistic, whether the product or service is addictive, and whether there have been any information failures. In the case of telecommunications, consumers lack freedom of choice given the industry's monopolistic nature, as evidenced by the industry's HHI of 2,800.[127] The optimality impact estimates the losses consumers face from anti-competitive price rents and reduced quality as a result of the monopolistic industry.

Monopolistic pricing and exposure data

We identify the impact of the telecommunications monopolistic nature on pricing as a 10% price premium as estimated by the Roosevelt Institute.[128] Given we cannot directly identify customer exposure to monopolistic effects, we apply customer dissatisfaction as a proxy for monopoly

[127] Gene Kimmelman and Mark Cooper. "A Communications Oligopoly on Steroids." *Washington Center for Equitable Growth.* Published July 2017. Accessed December 2020.
[128] Mark Cooper. "Overcharged and Underserved: How a Tight Oligopoly on Steroids Undermines Competition and Harms Consumers in Digital Communications Markets". *Roosevelt Institute Working Paper.* Published December 2016. Accessed December 2020.

exposure with satisfaction data from J.D. Power.[129] To identify the total service subscriptions of Company A and B, we refer to figures self-reported by the companies as shown in in estimating Reach.

The impact estimate

To estimate customer monopoly exposure, we multiply the number of service subscriptions of Company A and B by customer dissatisfaction. We multiply the service subscriptions with dissatisfied customers by the price premium of the average monthly service fee and annualize to estimate the overall optionality impact.

8.8. Telecommunications: Environmental use

TABLE 49

Environmental Usage Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
CSR	Emissions from use of product	3,705,329	4,241,232	Emissions from usage	3,705,329	4,241,232
					x	
Industry assumptions				Cost per ton of carbon	$114	
IWAI	Cost per metric ton of carbon	$114			=	
				Emissions impact	**-$422m**	**-$484m**

Environmental usage in telecommunications

The environmental usage dimension aims to capture any environmental emissions, pollutants, or efficiencies produced from use of the product. For telecommunications, we estimate the impact from the emissions generated by customer usage of the service. For example, the emissions associated with the electricity used to power a router for internet services would be included within the environmental usage dimension. However, we exclude the impact from the emissions associated with powering a cellular tower as those impacts are fully captured by the environmental framework of the Impact-Weighted Accounts given these impacts are operational.[130] We note that this example excludes efficiencies gained from Internet of things (IoT) innovations. As this

[129] "Social Media Emerges as Wireless Customer Service Channel of Choice, J.D. Power Finds" *J.D. Power.* Published January 2018. Accessed December 2020.
[130] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

technology becomes more widely adopted, the environmental usage impact of IoT can be estimated as companies will have better internal information and public data disclosures.

Environmental usage data

We identify a company's emissions from product use in their corporate sustainability reporting. While Company A's Scope 3 disclosures report the emissions associated with product use, Company B's Scope 3 disclosures are limited to employee travel. We therefore estimate Company B's emissions associated with product use by assuming the ratio of emissions to relevant impact revenue for Company A is representative for Company B. The cost associated with a metric ton of carbon is estimated in the environmental framework of the Impact-Weighted Accounts.[131]

The impact estimate

We estimate a company's environmental usage impact by multiplying the emissions from usage by the cost of emissions.

8.9. Telecommunications: End of life

TABLE 50

End of Life Impact of Company A and B

Data			
Company datapoints		**A**	**B**
Estimated	Tons of e-waste generated	3,688,639	3,082,833
CSR	Tons of e-waste recycled	4,876	21,067
Industry assumptions			
Journal	Cost associated with ton of e-waste	$423	
UN	Value of recycled e-waste (ton)	$1,072	

Estimation		
	A	**B**
(Tons of e-waste generated	3,688,639	3,082,833
	x	
Cost associated with e-waste)	-$423	
	=	
E-waste generation impact	-$1,560m	-$1,304m
	+	
(Tons of e-waste recycled	4,876	21,067
	x	
Cost associated with e-waste)	$1,072	
	=	
E-waste recycled impact	$5m	$23m
	=	
End of life impact	**-$1,555m**	**-$1,281m**

[131] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

End of life impact in telecommunications

The end of life dimension aims to measure the averted and created emissions from the end of life treatment of the product. For telecommunications, the end of life dimension captures the impacts e-waste generated and recycled. As the industry continues to adopt end of life and other recyclability innovations, we would expect disclosure and reporting on these innovations to improve, enabling more comprehensive impact estimates.

Waste generation and recyclability data

We estimate the volume of e-waste generated and recycled given sustainability and financial disclosures. For Companies A and B, we estimate the volume of e-waste generated from the number of broadband and wireless connections and an assumed volume for a broadband and mobile device. We estimate the volume of e-waste recycled for Company A from the reported number of recycled devices and the same assumed volume for a broadband and mobile device. Company B discloses the volume of recycled e-waste directly in their sustainability report. Given public data availability, we apply the e-waste volume as disclosed by Company B and note that this volume may be overstated given firms tend to include operational e-waste in their disclosures. The cost associated with a ton of e-waste is estimated in environmental science literature[132] and the value associated with a ton of recycled e-waste is estimated by the United Nations.[133]

The impact estimate

We estimate a company's end of life recyclability impact from waste generation by multiplying the volume of e-waste generated by the cost of e-waste generated. We estimate a company's end of life recyclability impact from waste recycled by multiplying the volume of e-waste recycled by the value of recycled e-waste.

[132] Brett H. Robinson. "E-waste: An assessment of global production and environmental impacts". *Science of the Total Environment,* 408 (2) pp. 183-191. Published December 2009. Accessed December 2020.
[133] Vanessa Forti, Cornelis Peter Baldé, Ruediger Kuehr, and Garam Bel. "The Global E-waste Monitor 2020". *United Nations University.* Published 2020. Accessed December 2020.

CHAPTER 9

UTILITIES SECTOR: WATER UTILITIES[134]

We apply the product impact framework of the Impact-Weighted Accounts Initiative within the water utilities industry to ensure the framework is feasible, scalable, and comparable in the space. Through a deep-dive of two competitor companies, we provide a cohesive example that examines the impacts of water utilities across the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating actual monetary values. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility and is not to assess the performance of individual companies. We do note that the data is from two of the largest water utilities globally, with Company A being one of the largest in the US and Company B being one of the largest in Brazil.

Self-disclosed company datapoints reflect information found in the company's disclosures from 2018 such as the Form 10-K or annual sustainability reports which often disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Industry-wide assumptions on average cost of water, cost associated with waterborne disease, and economic losses associated with lack of proper sanitation and dehydration also come from the World Health Organization, IWAI's research on the cost of water[135], United Sates Department of Agriculture Economic Research Service, and various economic and academic studies. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

[134] Serafeim, George, and Katie Trinh. "Accounting for Product Impact in the Water Utilities Industry." (pdf) Harvard Business School Working Paper, No. 21-104, March 2021.
[135] DG Park, George Serafeim and Rob T. Zochowski. "Measuring the Cost of Corporate Water Usage", Harvard Business School. Accessed January 5, 2021.

TABLE 51

Product Impacts of Company A and B

						Dimensions of Customer Usage							
				Reach		Access		Quality			Option-ality	Env Use	End of Life
Company	Revenue	Positive Product Impact	Negative Product Impact	Quantity		Affordability	Underserved	Health & Safety	Effectiveness	Need	Information	Emissions	Recyclability
A	$3bn	$1.1bn	-$3.9bn	Customers	14m	-	$7m	-$342m	-$3,515m	$1,109m	-	-	-
				Volume (kgal)	344m								
B	$4bn	$2.0bn	-$1.6bn	Customers	25m	-	$60m	-	-$1,586m	$1,988m	-	-	-
				Volume (kgal)	557m								

* Total positive and negative product impact may differ from the sum of product impact within each dimension given health and safety and effectiveness are composed of impacts positive and negative in magnitude.

For the water utilities industry, the access dimension captures cost savings associated with service provision for the underserved, the health and safety dimension captures various water quality incidents, the effectiveness dimension captures system commodity loss, and the need dimension captures sanitation and hydration benefits from water access. There is no affordability impact given water utilities provide a commodity and have minimal price control. There is also no environmental usage impact since all emissions and water withdrawn from use of the product are operational and therefore, already fully accounted for elsewhere in the IWAI framework, the environmental pillar[136]. Finally, current innovation and disclosure levels prevent estimation of the recyclability impact. As efforts to recycle and re-use water become more prevalent, the impact from such efforts could be estimated within the recyclability dimension. Similarly, companies with internal information on energy recovery from wastewater treatment could estimate those impacts within the recyclability dimension. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

[136] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

9.1. Water utilities: Reach

TABLE 52

Customers of Company A and B

Data			
		A	**B**
10K	Number of connections	-	9,053,000
10K	Number of customers	14,000,000	25,100,000
10K	Sales volume (kgal)	344,482,000	556,848,159

The goal of the reach dimension is to identify the number of individuals served by the company. Unlike other industries where the number of individuals served needs to be estimated, both water utilities disclose the number of individuals they serve as number of customers. In addition, these water utilities also disclose the sales volume of water to these customers.

9.2. Water utilities: Access - affordability

The goal of the affordability dimension is to identify the positive impact of more affordable product or service provision. Unlike other industries in which firms exhibit price control and price differentiation is observed, water utilities provide a commodity and are often government regulated entities. Given water utilities exhibit limited price control over their services as government regulated entities that provide a commodity, firms within this industry do not have an affordability impact. If there are any instances in which a water utility is not price regulated, there would be an affordability impact to be estimated.

9.3. Water utilities: Access - underserved

TABLE 53

Underserved Customers of Company A and B

Data			
Company datapoints		**A**	**B**
Program	Aggregate cost savings support	483,386	-
10K	Customers in geography	660,000	-
Assumed	Other customers w. cost savings (%)	0.25%	6.00%
Assumed	Average cost savings per person	$203.10	$40.07

Estimation		
	A	**B**
Total customers	14,000,000	25,100,000
	x	
Customers w. cost savings (%)	0.25%	6.00%
	x	
Cost savings per person	$203.10	$40.07
	=	
Underserved impact	**$7m**	**$60m**

The underserved customer

The goal of the underserved dimension is to identify the impact associated with provision of service to underserved customers. In the water utilities space, we estimate the underserved impact by identifying customers who receive water services at reduced pricing due to their income level. While we identify underserved customers in other industries based solely on demographic information, the water utilities space requires a more conservative identification of underserved customers given the regulatory nature of the industry mandates service provision to all within the contracted region. We therefore examine price or cost savings, rather than income level or other demographic information, to identify the underserved customer.

Price or cost savings data

To identify customers receiving cost savings support with their water utility bills, we use company self-reporting on the number of percentage of customers receiving bill support and the average or total amount of bill support. Company A provides the aggregate amount of cost savings, the number of individuals receiving cost savings, and the total number of customers served within one of the states in which it operates through program-specific and financial disclosures. Given public data availability, we generalize within this example the average cost savings per customer within the state, $203.10, and the percent of customers within the state receiving bill support, 0.25%, to the other customers served by Company A.

Company B provides their pricing structure by residential category in their financial disclosures and notes that customers residing in a *favela,* residential areas characterized by a lack of urban infrastructure, are billed a lower price for consumption to assist lower-income customers. They also disclose the total number of customers and the overall volume billed per connection. Given Company B does not identify the number of customers residing in a *favela*, we assume the percentage of customers residing in a *favela* reflects the distribution within the country at 6%. Given public data availability, we estimate the cost savings per person to be $40.07 from the disclosed average volume per connection and the pricing difference between residential and *favela* customers.

In practice, both companies could identify other underserved groups that receive cost savings and would use internal data to identify what percentage of their customers receive bill support and the average cost savings.

The impact estimate

We multiply the estimated percent of customers receiving bill support with the total number of customers to calculate the number of customers receiving bill support. We then apply the estimated cost savings per customer to estimate the underserved impact. Companies that identify additional underserved customer groups can repeat this calculation for those additional groups.

9.4. Water utilities: Quality – health & safety

TABLE 54

Health and Safety of Company A and B

Data			
Company datapoints		**A**	**B**
CSR	Number of acute violations	4	-
CSR	Number of non-acute violations	2	-
Assumed	Individuals affected by each violation	8,750	-
Industry assumptions			
USDA ERS	Cost of e.Coli	$6,510	

Estimation		
	A	**B**
Number of acute violations	4	-
	+	
Number of non-acute violations	2	-
	x	
Individuals affected	8,750	-
	x	
Cost of e.Coli	$6,510	
	=	
Health and safety impact	**-$342m**	**-**

Water health and safety

For health and safety of water utilities, we aim to capture instances where consumption of safe and clean water has been breached. In this example, we examine water quality violations reported by government enforcement agencies to identify instances of water safety breaches. While water quality violations should be representative of water contaminant levels, companies could supplement public water quality violation data with internal data on actual contaminants present in water, such as lead and mercury, which are hazardous in trace amounts. The actual contaminants for evaluation can vary by geography, with the example of utilities in Argentina[137] and Bangladesh[138] facing challenges around arsenic contamination.

Water quality violation data

[137] P. L. Smedley, H. B. Nicolli, D. M. J. Macdonald, and D. G. Kinniburgh, "Arsenic in groundwater and sediments from La Pampa Province, Argentina". *British Geological Survey.* Published 2008. Accessed January 2021.
[138] D. G. Kinniburgh and P. L. Semdley, "Arsenic contamination of groundwater in Bangladesh". *British Geological Survey.* Published 2001. Accessed January 2021.

For water quality violation data, Company A self-reported the number of acute and non-acute violations they received in their sustainability disclosures. To identify the number of customers affected by these violations, we assume one violation affects one of the 1,600 communities Company A serves and that Company A's customers are evenly distributed across these communities given public data availability. This example also makes the simplifying assumption for demonstrative purposes that e.Coli is the relevant waterborne contaminant for all the violations and does not differentiate between acute and non-acute violations. In practice, Company A could use internal data to identify the number of customers that have been served contaminated water and apply the costs associated with the relevant type and level of contaminant. Company B self-reported their water quality testing procedure in their sustainability disclosure but did not report any violations or contaminants found. In practice, Company B could use internal data to identify communities that have been served contaminated water, if any, along with the level and type of contaminant present.

The impact estimate

To estimate the impact of safe water, we multiply the total number of quality violations by the number of customers affected per violation to estimate the total number of customers affected by a water quality violation. We multiply the total number of customers affected by a water quality violation by the associated cost of the contaminant present to estimate the impact from breaches to safe water provision. A company estimating their own health and safety impact could identify the actual number of customers served contaminated water, the type of contaminant that has been found, and use a more specific estimate of the associated costs. Companies could use internal data to include contaminants that are of particular concern within their operating geography regardless of whether a violation has been recorded.

9.5. Water utilities: Quality - effectiveness

TABLE 55

Effectiveness Impact of Company A and B

Data			
Company datapoints		**A**	**B**
CSR	System commodity loss (%)	20%	-
20F	System commodity loss (kgal)	-	255,764,220
CSR	Total water withdrawn (kgal)	438,677,435	-
Industry assumptions			
IWAI	Cost of water withdrawn (kgal)	$40.07	$6.20

Estimation		
	A	**B**
System commodity loss (%)	20%	-
	x	
Total water withdrawn	438,677,435	-
	=	
System commodity loss (kgal)	87,735,487	255,764,220
	x	
Cost of water withdrawn (kgal)	$40.07	$6.20
	=	
Effectiveness impact	**-$3,515m**	**-$1,586m**

Water utility effectiveness

In the effectiveness dimension, we aim to capture whether the product or service is effective at meeting customer expectations. For water utilities, this includes aspects of reliable and consistent water provision. We examine overall system commodity loss given it encompasses all service disruptions, flooding, pipe breaks and leaks, and other water loss issues as per SASB metric IF-WU-140a.2 on real water losses. We note that losses from other reported measures of lapse in water provision, such as SASB metric IF-WU-450a.3 on the number of unplanned service disruptions in main breaks per mile, would be included in overall system commodity loss. While we recognize that current available technology for water pipes is not capable of no system commodity loss, we choose to examine the absolute amount of water loss in our calculations per our application principles of conservatism and incentive alignment[139].

Data on system commodity loss and cost of water

Company data on system commodity loss is self-disclosed in financial and sustainability disclosures. Company A provides the percentage of non-revenue real water loss in their sustainability disclosure. Company B provides the volume of water lost per connection per day in their financial disclosures. For Company A, we estimate the volume of water lost by multiplying the percentage of water loss with the total volume of water withdrawn. For Company B, we annualize the volume of water lost per connection and multiply by the number of connections to estimate the volume of water lost. We use the total volume of water lost for conservatism given

[139] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", Harvard Business School. Accessed July 6, 2020.

data availability. A company that can identify which losses are borne by the company can exclude that loss volume from the impact estimate as the customers would be unaffected by those losses.

Country-level cost of water data comes from environmental and water-related research conducted by IWAI.[140] The cost of water estimates from IWAI are scaled to reflect water scarcity as defined by the Availability of Water Remaining (AWARE) model. The differences in the cost of water per kilo-gallon for Company A and B reflects the significant difference in water scarcity between the countries in which Company A and B operate. Company A faces a high cost of water given they operate in and serve water resource scarce areas, such as California.

The impact estimate

We calculate the impact of water loss by multiplying the estimated volume of water loss by the cost of water per kilo-gallon in United States for Company A and in Brazil for Company B.

9.6. Water utilities: Quality – basic need

TABLE 56

Basic Need Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
10K	Number of customers	14,000,000	25,100,000	Customers	14,000,000	25,100,000
					x	
Industry assumptions				Loss fr. lack of water per person	$79.20	
WHO	Loss fr. lack of water per person	$79.20			=	
				Basic need impact	**$1,109m**	**$1,988m**

Basic needs met by water utilities

The basic need dimension aims to capture the impact created from a company by providing a service or product that meets a basic need. In the case of water utilities, provision of water meets a basic need as water is fundamental to sustaining life. Examining the elasticity of water demand cements this designation, given price sensitivity to water significantly decreases in situations of water scarcity.[141]

[140] DG Park, George Serafeim and Rob T. Zochowski. "Measuring the Cost of Corporate Water Usage", Harvard Business School. Accessed January 5, 2021.
[141] Paolo Garrone, Luca Grilli, and Ricardo Marzano. "Price elasticity of water demand considering society and attitudes", *Utilities Policy* Volume 59. Published August 2019. Accessed January 2021.

Sanitation and averted dehydration data

To estimate the value of provision of water as a basic need, we examine the economic losses associated with lack of access to water as estimated by the World Health Organization (WHO). The WHO estimates that the total global economic loss associated with inadequate water supply and sanitation is $260 billion annually, that 2.5 billion individuals lack proper sanitation, and that 783 million individuals use unimproved drinking-water sources. We make the simplifying assumption the individuals without proper sanitation are not the ones with unimproved drinking-water sources to ensure a conservative per person economic loss estimate. Dividing the total global economic loss associated with inadequate water supply and sanitation by the sum of individuals lacking proper sanitation and using unimproved drinking-water sources, we estimate that the economic loss associated with inadequate water supply and sanitation at $79.20 per person. To identify the number of individuals reached by Company A and B, we refer to figures self-reported by the companies.

The impact estimate

To estimate the basic need impact from provision of water, we multiply the number of individuals reached by Company A and B by the economic loss associated with inadequate water supply and sanitation that has been averted.

9.7. Water utilities: Optionality

The optionality dimension aims to capture the impact from consumers lacking freedom of choice when making a purchase, which we determine by examining whether the industry is monopolistic, whether the product or service is addictive, and whether there have been any information failures. In the case of water utilities, while there is limited optionality given the industry is a natural monopoly, there is no optionality impact given the regulatory nature of the industry.

The impact from consumers lacking freedom of choice in the case of monopoly tends to result in experienced price rents and reduced innovation or quality. With the former, as in the affordability dimension, the nature of water utilities as a regulated industry prevents the price rents observed in other industries. With the latter, issues around reduced innovation would lead to

system-wide inefficiencies or water quality issues that would already be captured by the quality dimension under effectiveness and health and safety.

9.8. Water utilities: Environmental use

The environmental usage dimension aims to capture any environmental emissions, pollutants, or efficiencies produced from use of the product. While the use of water does have environmental impact, the impacts from the withdrawn water is fully captured by the environmental framework of the Impact-Weighted Accounts given these impacts are also operational.[142] Any innovations made to improve efficiency, such as replacement of pipes or innovative meters, would be reflected in the operational environmental impact. Furthermore, where the innovations reduce system commodity loss, the improvements would be reflected in the product effectiveness impact. To avoid double-counting, we do not include impacts from environmental usage within the overall product impact.

9.9. Water utilities: End of life

The end of life dimension aims to measure the averted and created emissions from the end of life treatment of the product. For water utilities, the end of life dimension could capture the impacts from re-use water and wastewater treatment. While both water utilities mention efforts towards water re-use and wastewater treatment, data on volume and use case of recycled and reclaimed water and energy recovery from wastewater treatment is still unreported. While this example does not estimate the end-of-life impact for water utilities due to public data availability, a water utility could use internal data to estimate their own impact from re-use water specific to the volume and value associated with the use case of recycled and reclaimed water. Similarly, a water utility could use internal data to estimate their own impact from wastewater treatment specific to amount of and value associated with the energy recovered. As the industry continues to adopt end of life and other recyclability innovations, we would expect disclosure and reporting on these innovations to improve, enabling more comprehensive impact estimates.

[142] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

CHAPTER 10

TECHNOLOGY SECTOR: SOCIAL MEDIA[143]

We apply the product impact framework of the Impact-Weighted Accounts Initiative within the interactive media and services industry to ensure the framework is feasible, scalable, and comparable. Through a deep-dive of two competitor companies, we provide a cohesive example that examines the impacts of interactive media and services companies on social media users across the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating actual monetary values. We also examine the impacts of interactive media and services companies on advertisers, but do not estimate actual monetary values given data availability. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility and not to assess the performance of individual companies. We do note that the data is from two of the largest interactive media and services firms globally.

This application is based on publicly available data from company disclosures and industry-wide assumptions informed by regulatory bodies and established research firms. These examples reference user effects as identified in academic literature, and make use of existing data and metrics with the goal of incorporating publicly available data.

Self-disclosed company datapoints reflect information found in the companies' 2018 disclosures, such as the Form 10-K or annual sustainability reports, which often disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Industry-wide assumptions on leisure time, addiction, depression, privacy, and misinformation come from various economic, academic, and medical studies. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined prices and valuations.

[143] Park, DG, George Serafeim, and Katie Trinh. "Accounting for Product Impact in the Interactive Media and Services Industry." (pdf) Harvard Business School Working Paper, No. 21-134, June 2021.

TABLE 57

Product Impacts of Company A and B

					Dimensions of Customer Usage									
					Reach		Access		Quality			Optionality	Env Use	End of Life
Company	Revenue	Relevant Impact Revenue	Positive Product Impact	Negative Product Impact	Quantity		Affordability	Underserved	Health & Safety	Effectiveness	Need	Addiction & Information Failure	Emissions	Recyclability
A	$56bn	$56bn	$57.5bn	-$51.1bn	Daily active users	1,520m	-	-	-$1,089m	$57,456m	-	-$50,034m	-	-
B	$3bn	$3bn	$5.2bn	-$5.6bn	Daily active users	126m	-	-	-	$5,216m	-	-$5,560m	-	-

Table 57 summarizes the monetary impact estimates of two interactive media and services companies on their daily active users. The quality dimension examines the impact to users of data breaches[144] and user satisfaction.[145] The optionality dimension captures the impact to social media users of misinformation[146] and addiction.[147] We note that the impact to advertisers is not included in these estimates and discuss how a firm can apply internal information to examine their product impact on advertisers within this framework. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

10.1. Interactive media & services: Reach

Users reached in interactive media and services

The goal of the reach dimension is to identify the number of individuals served by the company. For interactive media and service companies, we identify the number of users reached through financial disclosure data.

In financial disclosures, firms tend to disclose both the number of daily and monthly active users. To be conservative, this example refers to the number of daily active users, which is the lower of

[144] Hassan Zamir. "Cybersecurity and Social Media". *Cybersecurity for Information Professionals: Concepts and Applications, CRC Press.* Published June 28, 2020. Accessed April 2021.
[145] Cass R. Sunstein. "Willingness to Pay to Use Facebook, Twitter, Youtube, Instagram, Snapchat, and More: A National Survey". *Harvard Law School*, available at SSRN. Published June 2018. Accessed April 2021.
[146] Hunt Allcott, Matthew Gentzkow, and Chuan Yu. "Trends in the diffusion of misinformation on social media." *Research and Politics April-June 2019: 1-8.* Accessed April 2021.
[147] Hunt Allcott, Luca Braghieri, Sarah Eichmeyer, and Matthew Gentzkow. "The Welfare Effects of Social Media". *American Economic Review 2020, 110(3): 629-676.* Accessed April 2021.

the two. We note that companies estimating their own reach can use their own discretion to determine a conservative estimate of the number of users reached.

TABLE 58

Users Reached by Company A and B

Data			
		A	B
10K	Daily active users	1,520,000,000	126,000,000

Advertisers reached in interactive media and services

While this example does not examine the advertiser side of product impact given public data availability, a company estimating its own advertising reach could identify the number of advertisers served on its platform and the number of ads delivered.

10.2. Interactive media & services: Access - affordability

Interactive media and services affordability to users

The goal of the affordability dimension is to identify the positive impact of more affordable product or service provision. With interactive media and service companies, there are complexities to affordability considerations. While these firms do not monetarily charge users for platform use, these firms use data from their users without any monetary payment. This suggests that service provision in this industry is not simply affordable in monetary terms as users indirectly pay for these services through their data and privacy. Due to these complications, we do not currently estimate an affordability impact and instead, estimate the data and privacy impact within the health and safety and optionality dimensions. The other benefits enabled by service provision are estimated within the effectiveness dimension.

Interactive media and services affordability to advertisers

However, interactive media and service companies do have an affordability impact on advertisers as they do charge for advertising services. While this example does not estimate Company A or B's affordability impact on advertisers, companies could estimate this impact by comparing internal data on the cost per click to the industry average cost per click and multiplying the difference with a floor at zero by the number of ad clicks enabled to estimate the affordability

impact. We note that more granular affordability benchmarks and comparisons by advertiser size or industry could provide a more precise affordability impact estimate. For example, of the advertising options available to a smaller business, interactive media and services might provide an affordable advertising venue compared to alternatives.

10.3. Interactive media & services: Access - underserved

The goal of the underserved dimension is to identify the impact associated with provision of products or services to underserved customers. For a product or service to enable underserved access, two criteria need to be met as outlined in the initial framework and discussed in subsequent applications to pharmaceuticals[148], airlines[149], and others. First, the product or service must be accessed by an underserved population. Second, the product or service must enable sustainable development, as outlined by the UN Sustainable Development Goal.

While interactive media and services companies do provide services to underserved populations, including users and advertisers in emerging markets, the services provided do not meet a UN Sustainable Development Goal. We note that while provision of internet to these underserved populations as discussed in the telecommunications application[150] would qualify for underserved impact as it meets the target 9C[151] of the Sustainable Development Goals, the activity enabled by interactive media and services companies in emerging markets as outlined by Pew Research surveys, such as broader social network and communication[152] and easier political engagement[153], are a result of mobile and internet access rather than enabling mobile and internet access. Thus, we do not estimate an underserved impact for interactive media and services companies based on their current scope of service.

[148] Amanda Rischbieth, George Serafeim and Katie Trinh. "Accounting for Product Impact in the Pharmaceuticals Industry", Harvard Business School. Accessed May 2021.
[149] George Serafeim and Katie Trinh. "Accounting for Product Impact in the Airlines Industry", Harvard Business School. Accessed April 2021.
[150] George Serafeim and Katie Trinh. "Accounting for Product Impact in the Telecommunications Industry", Harvard Business School. Accessed April 2021.
[151] Department of Economic and Social Affairs. "Sustainable Development Goal 9". *United Nations.*
[152] Laura Silver and Christine Huang. "In Emerging Economies, Smartphone and Social Media Users Have Broader Social Networks". *Pew Research Center.* Published August 2019. Accessed April 2021.
[153] Aaron Smith, Laura Silver, Courtney Johnson, JingJing Jiang. "Publics in Emerging Economies Worry Social Media Sow Division, Even as They Offer New Chances for Political Engagement". *Pew Research Center.* Published May 2019. Accessed April 2021.

10.4. Interactive media & services: Quality – health & safety

TABLE 59

Health and Safety Impact of Company A and B

Data			Estimation		
Company datapoints	**A**	**B**		**A**	**B**
10-K Users affected by data breach	29m	m	Users affected by breach	29m	-
				x	
Industry assumptions			Value of online info protection	$37.56	
JMIS Value of user protection from breach	$37.56			=	
			Health & safety impact	**-$1,089m**	**-**

Interactive media and services health and safety for users

The health and safety dimension aims to capture instances where a customer's health, safety, or privacy has been breached. For an interactive media and services company, this dimension is where we examine cybersecurity data breaches to social media users.[154] We note that this dimension examines unexpected health and safety issues outside of expected product performance. While there exists other studied welfare effects of addiction and user misinformation on data use from social media use that can affect mental health and privacy, these welfare effects are not a result of unanticipated breaches to expected product performance and thus not captured within the health and safety dimension.[155] Instead, these effects are inherent to service use and therefore captured in the optionality dimension.

Data on cybersecurity data breaches

In this example, we identify data on the number of users affected by a data breach from Company A and B's financial disclosures. While news media also reports separately on data breach incidents, we turn to financial disclosures for consistency. For example, Company B experienced an internal bug and advised users to change their passwords through a press release announcement but also noted that there was no evidence of breach or misuse. Thus, this incident was not reflected in their financial disclosures, and this example's estimate of Company B's users affected by a data breach excludes this incident. However, a company estimating its own health and safety impact could turn to internal data on the number of user accounts affected by a data breach.

[154] Hassan Zamir. "Cybersecurity and Social Media". *Cybersecurity for Information Professionals: Concepts and Applications, CRC Press.* Published June 28, 2020. Accessed April 2021.
[155] Hunt Allcott, Luca Braghieri, Sarah Eichmeyer, and Matthew Gentzkow. "The Welfare Effects of Social Media". *American Economic Review 2020, 110(3): 629-676.* Accessed April 2021.

For an estimate on the value associated with user protection from a data breach, we turn to academic literature on the willingness to pay associated with online privacy protection against errors and improper access relating to personal information.[156] Given a range of estimates is provided, we apply the average in this example.

The impact estimate

In Table 59, we provide an example of estimating the health and safety impact for Company A and B. We multiply the number of user accounts affected by a data breach by the average willingness to pay associated with online privacy protection to estimate the health and safety impact of both firms.

Interactive media and services health and safety to advertisers

This example does not provide estimates of Company A or B's product impact on advertisers. However, companies could estimate the health and safety impact to advertisers by examining both data breaches and brand safety. With data breaches, a company could identify the advertisers affected by a data breach and multiply that with an estimate for the lost value associated with a data breach at the business rather than individual level. Examples of this estimate could include academic literature on the cost associated with improper access to corporate data or advertiser willingness-to-pay for privacy. With brand safety, a company could examine whether there have been any incidents in the past year that affect their own branding and identify the cost to associated advertisers.

[156] Il-Horn Hann, Kai-Lung Hui, Sang-Yong Tom Lee & Ivan P.L. Png. "Overcoming Online Information Privacy Concerns: An Information-Processing Theory Approach". Journal of Management Information Systems 24(2):13-42. Published 8 December 2014. Accessed April 2021.

10.5. Interactive media & services: Quality – effectiveness

TABLE 60

Effectiveness Impact of Company A and B

Data			
Company datapoints		**A**	**B**
ASCI	Customer satisfaction	63%	69%
HLS	Willingness-to-pay for service	$60	$60

Estimation		
	A	**B**
Daily active users	1,520m	126m
	x	
Customer satisfaction	63%	69%
	=	
Satisfied users	958m	87m
	x	
WTP for service	$60	$60
	=	
Effectiveness impact	**$57,456m**	**$5,216m**

Interactive media and services effectiveness

In the effectiveness dimension, we aim to capture whether the product or service is effective at meeting customer expectations. For interactive media and services, we aim to measure how effective the service is at meeting customer expectations of expected platform and network performance. Since the efficacy of these services is intangible and difficult to directly measure, we examine customer satisfaction as we have done in other industry applications, including autos[157] and consumer finance[158] where efficacy cannot be directly measured.

Data on customer satisfaction

As with the other industry applications, we turn to the American Customer Satisfaction Index to estimate the customer satisfaction of users with Company A and Company B. We recognize that the application of these estimates assumes that the satisfaction of the American user is representative of global satisfaction. Given the services provided by Company A and B do not differ significantly by geography, we believe this is a reasonable assumption.

For industry assumptions on the value to a satisfied user, we turn to academic literature on the beneficial welfare effects of social media which estimate willingness-to-pay for various social media platforms.[159] We note that this literature not only estimates willingness-to-pay, but also willingness-to-accept, and provides both the mean and median for both estimates. Given

[157] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", Harvard Business School. Accessed April 2021.
[158] George Serafeim and Katie Trinh. "Accounting for Product Impact in the Consumer Finance Industry", Harvard Business School. Accessed April 2021.
[159] Cass R. Sunstein. "Willingness to Pay to Use Facebook, Twitter, YouTube, Instagram, Snapchat, and More: A National Survey". *Harvard Law School.* Published June 2018, Available at SSRN. Accessed April 2021.

willingness-to-accept is much higher than willingness-to-pay and may reflect the addictive nature of these platforms, we apply the willingness-to-pay estimates in this example for conservatism.[160] We also note that willingness-to-pay estimates may still be skewed by addiction effects. However, we do not adjust these estimates to reflect addiction given the addiction effects are estimated separately within the optionality dimension. Similarly, we apply the median rather than the mean estimate for conservatism as the mean is much higher than the median given large positive estimates in some cases. We note that as newer estimates of willingness-to-pay become available, the industry assumption applied should reflect contemporary literature and research.

The impact estimate

In Table 60, we provide an example of estimating the effectiveness impact of Company A and B to users. We estimate the number of satisfied users by multiplying Company A and B's customer satisfaction rate by the number of daily active users. We then multiply the number of satisfied active users by the median willingness-to-pay for platform service to estimate the effectiveness impact.

We note one nuance to this methodology that differs from the other industry applications, which also apply customer satisfaction (such as autos). In this industry application, we estimate the value to all satisfied users whereas in the other industry applications, we estimate the value to satisfied users over the industry average. We make this determination due to two differences between these industries. First, the auto industry does not provide their product free of charge while interactive media and services companies do. Second, customers choosing an automobile are substituting between automobiles within the industry. Interactive media and services customers might not substitute between different platforms, but can use platforms in addition to one another and instead substitute against time (which is accounted for in the optionality dimension). Therefore, the industry assumption applied for the auto industry is implied lost value or averted lost value whereas the assumption applied for interactive media and services is willingness-to-pay. Implied lost value or averted lost value is established in comparison to some baseline, in this case, average customer satisfaction. On the other hand, willingness-to-pay applies to all satisfied customers.

[160] The national survey on willingness-to-pay for social media reports that the median willingness-to-pay ranges from $5 to $10 monthly ($60 to $120 annually) and that the median willingness-to-accept ranges from $88 to $100 monthly ($1,056 to $1,2000 annually).

Interactive media and services effectiveness to advertisers

Depending on internal data availability and relevance to the particular company, companies estimating the effectiveness impact to advertisers could examine a variety of different metrics, such as advertiser satisfaction, advertiser brand loyalty, enabled sales, and various conversion rates. We note that in line with the nuance noted in the previous section, since advertisers can substitute between different platforms for advertising services and are charged for the service, these metrics should be comparative to a reasonable and conservative benchmark, such as the industry average.

10.6. Interactive media & services: Quality – basic need

The basic need dimension examines whether the product or service provides some basic need to the population. While the United Nations and various countries have declared connectivity is viewed as a basic human right, the focus is on access to internet and internet connectivity.[161] Thus, while interactive media and service companies do improve connectivity between users and to advertisers, they do not provide the basic need of internet access and internet connectivity. The value generated from the increased connectivity enabled by social media is instead estimated within the effectiveness dimension. We note that like other industry applications which turn to elasticity to identify products that are basic needs as discussed in the initial product framework paper, the income elasticity for various internet services suggests that these services do not constitute a necessity.[162]

[161] Frank La Rue. "Report of the Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression". *United Nations General Assembly, Human Rights Council Seventeenth Session.* Published May 2011. Accessed April 2021.
[162] Rajeev K. Goel, Edward T. Hsieh, Michael A. Nelson, and Rati Ram. "Demand elasticities for Internet services". *Applied Economics* 38(9): 975-980. Published August 2006. Accessed May 2021.

10.7. Interactive media & services: Optionality

TABLE 61

Optionality Impact of Company A and B

Data			
Company datapoints		**A**	**B**
Statista	Adolescent users	43m	10m
Statista	Users encountering fake news	58%	49%
Industry assumptions			
W. et al.	Social media addiction prevalance	12%	
	Cost of lost leisure time	$21.36	
PLoS One	Adolescent risky use prevalance	4.50%	
J Clin Psych	Cost of depression	$5,769	
CHEQ	Per person cost of fake news	$19.70	
S. et al.	Value of basic online privacy	$11.66	

Estimation	**A**	**B**
(Daily active users	1,520m	126m
	x	
Privacy loss from platform use	$11.66	
	=	
Info failure of privacy loss)	**-$17,723m**	**-$1,469m**
	+	
(Users encountering fake news	58%	49%
	x	
Daily active users	1,520m	126m
	x	
Per person cost of fake news	$19.70	
	=	
Info failure of fake news)	**-$17,365m**	**-$1,216m**
Information failure impact	**-$35,088m**	**-$2,685m**
(Daily active users	1,520m	126m
	x	
Addiction prevalence	12%	
	x	
Cost of lost leisure time	$21.36	
	=	
General addiction)	**-$3,897m**	**-$323m**
	+	
(Adolescent users	43m	10m
	x	
Risky use prevalence	5%	
	x	
Cost of depression	$5,769	
	=	
Addiction for vulnerable popl.	**-$11,049m**	**-$2,551m**
Addiction impact	**-$14,946m**	**-$2,874m**
Optionality impact	**-$50,034m**	**-$5,560m**

Optionality in interactive media and services to users

The optionality dimension aims to capture the impact from consumers lacking freedom of choice when making a purchase, which we determine by examining whether the industry is monopolistic, whether the product or service is addictive, and whether there have been any information failures. To estimate the optionality impact to users of interactive media and service companies, we examine the impact of an addictive service and user misinformation.

Psychological literature indicates that interactive media companies do provide an addictive service to users that is associated with mental health problems such as stress, anxiety, and

depression,[163] and impacts how users spend their leisure time.[164] In this example, we assume that all addicted users experience loss to their leisure time and identify addicted users that would be vulnerable to mental health problems with a proxy of at-risk adolescent users.[165]

Economic literature indicates that interactive media companies do contribute to information failure from both misinformation through false content[166] and misinformation regarding company use of user information.

The impact from misinformation through false content is currently estimated within the optionality dimension as information failure given interactive media and services companies are not responsible for the content on their platforms at a regulatory level per Section 230.[167] However, we note that as these firms have increasing liability and responsibility for their content, the impact of false content could be estimated within the effectiveness rather than the optionality dimension.

Similarly, surveys indicate that most social media users are unaware of how interactive media and services companies use their personal information.[168] We thus estimate this impact within the optionality dimension as information failure. As users do become more aware of this over time, this impact no longer is information failure and could be estimated within the other dimensions. Whether the personal data use is estimated as a health and safety, effectiveness, or even affordability impact can depend on nuances around how the data is accessed and used.

Finally, given interactive media and services companies provide their service to users free of charge, we do not estimate a monopoly impact within the optionality dimension for users given no price rents are experienced. We however acknowledge that while users do not experience a price rent, the companies' provision of services for free further preserves the monopolistic nature of the industry and could contribute to the other optionality issues as discussed above. We thus do not estimate a separate monopoly impact to users as we intend the other optionality dimensions to

[163] Yubo Hou, Dan Xiong, Tonglin Jiang, Lily Song, and Qi Wang. "Social media addiction: Its impact, mediation, and intervention". *Cyberpsychology: Journal of Psychosocial Research on Cyberspace,* 13(1) Article 4. Published 2019. Accessed April 2021.
[164] Hunt Allcott, Luca Braghieri, Sarah Eichmeyer, and Matthew Gentzkow. "The Welfare Effects of Social Media". *American Economic Review 2020, 110(3): 629-676.* Accessed April 2021.
[165] Fanni Banyai, Agnes Zsila, Orsolya Kiraly, Aniko Maraz, Zsuzsuanna Elekes, Mark Griffiths, Cecile Andreassen, and Zsolt Demetrovics. "Problematic Social Media Use: Results from a Large-Scale Nationally Representative Adolescent Sample". *PLoS One,* 12(1). Published 2017. Accessed April 2021.
[166] Hunt Allcott, Matthew Gentzkow, and Chuan Yu. "Trends in the diffusion of misinformation on social media." *Research and Politics April-June 2019: 1-8.* Accessed April 2021.
[167] Katie Canales. "Mark Zuckerberg says Facebook should be liable for 'some content,' but the social giant and other platforms still shouldn't be regulated as publishers or telecom firms". *Business Insider.* Published November 2020. Accessed April 2021.
[168] Paul Hitlin and Lee Rainie. "Facebook Algorithms and Personal Data". *Pew Research Center.* Published January 2019. Accessed April 2021.

capture these issues. While users may not experience price rents associated with monopoly, we discuss the potential monopoly impact to advertisers.

Misinformation and addiction data

Given public data availability, we turn to secondary sources for estimates on the number of adolescent users and the percentage of users encountering "fake news" or false content. A company estimating their own optionality impact could refer to internal data on adolescent users and the prevalence of false content.

The percent of users affected by addiction to social media[169], the percent of at-risk adolescents[170], and the cost of depression[171] comes from psychology literature. We estimate the cost associated with lost leisure time by multiplying the average leisure hours used for well-being as determined by the U.S. Bureau of Labor Statistics[172] by the global leisure wage as applied in the automobile and telecommunications industry applications. We note that we assume the leisure hours essential to well-being are representative globally and thus apply US estimates.

We estimate the per person cost of fake news or false content exposure by dividing the global economic cost of fake news[173] by the number of global interactive media and services users.[174] We apply estimates of willingness-to-pay around online privacy including concealing browser history, contacts, and location[175] as a proxy for the value of basic online privacy.

The impact estimate

[169] Yubo Hou, Dan Xiong, Tonglin Jiang, Lily Song, and Qi Wang. "Social media addiction: Its impact, mediation, and intervention". *Cyberpsychology: Journal of Psychosocial Research on Cyberspace,* 13(1) Article 4. Published 2019. Accessed April 2021.
[170] Fanni Banyai, Agnes Zsila, Orsolya Kiraly, Aniko Maraz, Zsuzsuanna Elekes, Mark Griffiths, Cecile Andreassen, and Zsolt Demetrovics. "Problematic Social Media Use: Results from a Large-Scale Nationally Representative Adolescent Sample". *PLoS One,* 12(1). Published 2017. Accessed April 2021.
[171] Paul E. Greenberg, Andree-Anne Fournier, Tammy Sisitsky, Crystal T. Pike, and Ronald C. Kessler. "The Economic Burden of Adults with Major Depressive Disorder in the United States". *The Journal of Clinical Psychology, 76(2): 155-162.* Published November 2014. Accessed October 2020.
[172] "American Time Use Survey". *US Bureau of Labor Statistics.* Published June 2020. Accessed April 2021.
[173] University of Baltimore. "The Economic Cost of Bad Actors on the Internet Fake News | 2019". *CHEQ.* Published 2019. Accessed April 2021.
[174] Brian Dean. "Social Network Usage & Growth Statistics: How Many People Use Social Media in 2021?" Backlinko. Updated April 2021. Accessed April 2021.
[175] Scott Savage and D. Waldman. "The Value of Online Privacy". *University of Colorado at Boulder.* Published October 2013. Accessed April 2021.

We estimate the optionality impact to users in Table 61. We first estimate the impact from misinformation regarding company use of user information by multiplying the number of daily active users and the lost value of basic online privacy from general platform participation. Next, we estimate the impact from misinformation from false content by multiplying the number of daily active users by the percent of users encountering false content and the per person cost associated with false content. We sum both of these impacts to estimate the optionality impact due to misinformation.

To estimate the impact from provision of an addictive service, we estimate both the impact of lost time to all addicted users and the additional cost associated with depression for at-risk users. We multiply the number of daily active users by the prevalence of addiction to social media and the cost of lost leisure time to estimate the impact from lost time. We then multiply the number of adolescent users by the percent that are at-risk and the cost of depression to estimate the additional impact from social media addiction on mental health. We sum both impacts to estimate the optionality impact due to addiction. We then sum the optionality impact due to misinformation and the optionality impact due to addiction to estimate the overall optionality impact of Companies A and B.

Optionality in interactive media and services to advertisers

For advertisers using interactive media and service companies, advertisers lack freedom of choice given the industry's monopolistic nature, as evidenced by the industry's HHI which exceeds 3,000.[176] A company estimating their optionality impact to advertisers could examine the price rents their advertisers experience from the monopolistic nature of the industry.[177]

10.8. Interactive media & services: Environmental use

The environmental usage dimension aims to capture any environmental emissions, pollutants, or efficiencies produced from use of the service or product. We examine two examples to determine that interactive media and services firms do not have an environmental usage impact given platform users and advertisers do not generate emissions from use of the service itself.

[176] Christian Fuchs. "The Google and Facebook Online Advertising Duopoly". *The Online Advertising Tax as the Foundation of a Public Service Internet: A CAMRI Extended Policy Report*, University of Westminster Press, London, 2018, pp. 11–19. JSTOR. Accessed April 2021.
[177] Fiona M. Scott Morton and David C. Dinielli. "Roadmap for a Digital Advertising Monopolization Case Against Google". Omidyar Network. Published May 2020. Accessed April 2021.

First, we examine efficiency improvements to data centers as disclosed by Company A. Since these improvements affect the energy use of Company A's operations rather than the platform user, these improvements are reflected in the environmental pillar of the Impact-Weighted Accounts methodology.[178]

Second, we examine the energy used in powering the devices on which Company A and Company B's services are accessed. We choose to exclude the energy required to power the devices on which Company A and B's services are accessed given Company A and B have no control over the device used and how the device is powered. This determination is further supported by both firms not disclosing any information related to this use case.

10.9. Interactive media & services: End of life

The end-of-life dimension aims to measure the averted and created emissions from the end-of-life treatment of the product, as well as the associated volume of product associated with the end-of-life treatment. For interactive media and services firms, users and advertisers generate no physical waste from use of the service. We thus do not estimate an end-of-life impact for these firms.

[178] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information", Harvard Business School. Accessed April 2021.

CHAPTER 11

HEALTHCARE SECTOR: PHARMACEUTICALS[179]

We apply the product impact framework of the Impact-Weighted Accounts Initiative within the pharmaceutical industry to ensure the framework is feasible, scalable, and comparable. Through an analysis of two competitor companies, we provide a cohesive example that examines the impacts of pharmaceutical companies across the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating actual monetary values. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility and not to assess the performance of individual companies. We do note that the data is from two of the largest pharmaceutical firms globally.

Self-disclosed company datapoints reflect information found in the company's disclosures from 2018 such as the Form 10-K or annual sustainability reports, which increasingly disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Industry-wide assumptions on treatment price and efficacy come from Medicaid, prescribing information, and various economic, academic, and medical studies. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

TABLE 62

Product Impacts of Company A and B

							Dimensions of Customer Usage								
						Reach	Access		Quality			Option-ality	Env Use	End of Life	
Company	Revenue	Relevant Impact Revenue	Positive Product Impact	Negative Product Impact		Quantity	Affordability	Underserved	Health & Safety	Effectiveness	Need	Monopoly	Emissions	Recyclability	
A	$42bn	$25bn	$42bn	-$12bn	Categories represented	5	$4,751m	$1,430m	-	$10,029m	$25,958m	-$11,752m	-$17m	-$5m	
					Patients treated	135m									
B	$17bn	$14bn	$30bn	-$6.5bn	Categories represented	1	-	$954m	-	-	$28,560m	-$6,499m	-$7m	-$2.1m	
					Patients treated	29m									

[179] Rischbieth, Amanda, George Serafeim, and Katie Trinh. "Accounting for Product Impact in the Pharmaceuticals Industry." Harvard Business School Working Paper, 2021.

For the pharmaceuticals industry, the access dimension captures affordability of pharmaceutical drugs and service provision to emerging market and other underserved populations through access and procurement programs. The quality dimension captures drug safety and recalls, pharmaceutical efficacy, and the basic health benefits enabled by pharmaceuticals. The optionality dimension captures price rents[180] from monopoly exposure. The environmental usage dimension captures emissions from product use and the recyclability dimension, emissions associated with end-of-life treatment. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

11.1. Pharmaceuticals: Reach

Reach in pharmaceuticals

The goal of the Reach dimension is to identify the number of individuals served by the company. For pharmaceutical companies, we estimate or identify the number of patients reached through financial disclosure data. Given data availability, we do not estimate the product impact for each pharmaceutical product sold and we limit ourselves to common product categories found across leading pharmaceutical companies. We identify these common product categories by examining six leading pharmaceutical companies and limiting this example to the following categories in which at least half of the firms manufacture a drug for the following: Cardiovascular, Diabetes, Immunology, Neuroscience, Oncology, Vaccines, and Women's Health.

TABLE 63

Estimated Patients Reached by Company A and B

[180] As defined by the OECD per the "Glossary of Industrial Organisation Economics and Competition Law", In modern economics, rent refers to the earnings of factors of production (land, labour, capital) which are fixed in supply. Thus, raising the price of such factors will not cause an increase in availability but will increase the return to the factor… When the availability of a good is artificially restricted (for example by laws limiting entry), then the increased earnings of the remaining suppliers are termed monopoly rents."

Data			
Company datapoints		**A**	**B**
	Patients reached per category		
Estimated from financial disclosures	Oncology	1,088,935	
	Vaccines	128,654,690	
	Immunology	40,251	
	Diabetes	3,449,984	28,900,000
	Cardiovascular	1,430,325	

Data on patients reached

We look to company financial disclosures for data on the number of patients reached. Where firms disclose the number of patients they have reached, we apply that figure directly in this dimension. Where companies do not disclose this data, we identify category revenue and leading treatment from the company's financial disclosures, treatment price from Medicaid data[181], and company-specific price premium for products within the US to estimate patients reached.[182] For Company A, we estimate the number of patients treated given public data availability and for Company B, we apply the number of patients treated as identified in financial disclosures.

Estimating patients reached

We estimate the number of patients reached by dividing the relevant category revenue by the estimated treatment price scaled for the US price premium where companies do not disclose an estimate of patients reached.

TABLE 64

Estimating Patients Reached by Company A

[181] "Medicaid Drug Spending Dashboard". *Center for Medicare & Medicaid Services.* Updated 2020. Available at: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Information-on-Prescription-Drugs/Medicaid. Accessed July 2020.

[182] Nancy L. Yu, Zachary Helms, and Peter B. Bach. "R&D Costs for Pharmaceutical Companies Do Not Explain Elevated US Drug Prices". *Health Affairs Blog*. Published March 7, 2017. Accessed May 2021.

Data			Estimation	
Company datapoints		**A**		**A**
10K	Immunology revenue	$1,475m	Immunology revenue	$1,475m
Medicaid	Price per dose of lead product	$7,830		÷
Presc. Info	Annual doses per treatment	12	(Price per dose	$7,830
				x
Industry assumptions			Doses per treatment	12
Health Affairs	Company US price premium	39%		x
			Company US price premium)	39%
				=
			Patients reached	**40,251**

Given data availability, we apply the simplifying assumption in this example that the leading product within the seven selected categories represents impact and reach across the entire category. We note that the dosage per treatment is an approximation given dosage can vary by condition and patient and is ultimately dependent on physician discretion. The number of patients reached can also be affected by adherence factors. However, we do not currently account for adherence in estimating the number of patients reached given limited adherence data exists and adherence reflects more than company decision-making as it is also driven by consumer behavior. As adherence data becomes more readily available, patients reached could then be estimated with appropriate adjustments for adherence.

A pharmaceutical company estimating its own product impact with more granular data on patients reached or access to private data on patients reached from various health industry data providers, such as IQVIA can rely on more direct estimates and data on number of patients treated rather than the methodology applied in this example.

11.2. Pharmaceuticals: Access: affordability

The goal within access is to estimate both the impact from provision of a more affordable product and the impact from provision of a product to underserved consumers. In the case of pharmaceuticals, we examine the impact from affordable pharmaceutical treatment and service provision to emerging market and other underserved populations through access and procurement programs.

Pharmaceutical affordability

The goal of the affordability dimension is to identify the positive impact of more affordable product or service provision. Affordability in the pharmaceutical industry aims to capture the impact of providing pharmaceutical drugs more affordably than others in the industry. This can be measured with estimates of annual treatment price.

TABLE 65

Affordability of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
Medicaid	Treatment price of lead product			Avg. price of alternative lead product	6,073	9,995
	Oncology	$19,410			-	
	Vaccines	$145		Treatment price of lead product	$4,696	$11,169
	Immunology	$93,961			=	
	Diabetes	$4,696	$11,169	Affordability of lead product	$1,377	$0
	Cardiovascular	$3,639			x	
				Patients reached	3,449,984	28,900,000
Industry assumptions					=	
Medicaid	Avg. price of alternative lead product			Diabetes treatment affordability	$4,751m	$m
	Oncology	$7,446		**Overall affordability impact**	**$4,751m**	**$m**
	Vaccines	-				
	Immunology	$55,504				
	Diabetes	$6,073	$9,995			
	Cardiovascular	$2,052				

Pricing data

We estimate treatment affordability with pricing data from Medicaid. For each product category, we assume that the company's leading drug by revenue is representative of the category's affordability. We identify the average price per dose of the leading drug and the approximated dosage per treatment to estimate an average treatment price. For each leading drug, we identify alternate treatments from the FDA's information by drug class.[183] We then estimate the average price per treatment of the alternate treatments using pricing data from Medicaid and dosage information from the prescribing information. We recognize that Medicaid pricing represents estimates of treatment price within a single geography, the US. Given pharmaceutical prices in the US tend to be higher than in other markets, we believe this example using US pricing data provides a conservative estimate of the affordability impact.

[183] "Information by Drug Class". *US Food & Drug Administration.* Updated September 2020. Accessed December 2020.

The impact estimate

To estimate treatment affordability, we take the differential between the average price of alternate treatments and the lead product treatment price with a floor at zero and multiply with the patients reached as shown in Table 64 with the example of the diabetes category. We calculate the overall affordability impact by repeating the above calculation for all product categories. For this example, we assume the leading product by revenue for each category is representative of the category's affordability impact. A company could estimate a more granular affordability impact by applying this methodology at the product level for all products.

11.3. Pharmaceuticals: Access - underserved

TABLE 66

Underserved Customers of Company A and B

Data			
Company datapoints		**A**	**B**
CSR & Procurement reports	Estimated patients reached		
	Family Planning	6,500,000	-
	Vaccines	9,145,555	-
	Diabetes	-	300,000
Industry assumptions			
UNFPA	Averted cost through family planning	$34.26	
HSPH	Social & economic ROI from vaccines	$132.00	
ADA	Global cost of diabetes	$3,180.72	

Estimation		
	A	**B**
Family planning patients reached	6,500,000	-
	x	
Averted cost of family planning	$34.26	
	=	
Family planning for underserved	$223m	-
Vaccine patients reached	9,145,555	-
	x	
S/EROI from vaccines	$132.00	
	=	
Vaccines to underserved	$1,207m	-
Diabetes patients reached	-	300,000
	x	
Global cost of diabetes	$3,180.72	
	=	
Diabetes care for underserved	-	$954m
Underserved impact	**$1,430m**	**$954m**

The underserved customer

The goal of the underserved dimension is to identify the impact associated with provision of service to underserved customers. In the pharmaceuticals space, we can identify which pharmaceutical product sales are affordable and beneficial to underserved populations through procurement of products within the World Health Organization's list of prequalified medicinal products.[184] This example focuses on WHO prequalified medicinal products given current

[184] As described by the World Health Organization, "The vision of WHO medicines prequalification is simple: good quality medicines for everyone. Its mission is to work in close cooperation with national regulatory agencies and partner organizations to make quality priority medicines available for those who urgently need them. This is achieved through assessment and inspection

disclosures, per SASB metric HC-BP-240a.2 (list of products on the WHO List of Prequalified Medicinal Products as part of its Prequalification of Medicines Programme). This decision also aligns with our conservatism principle and ensures the products are of a well-accepted standard of quality, safety, and efficacy. Towards the goal of estimating the impact from affordable provision of beneficial pharmaceutical products to underserved populations, a company estimating their underserved impact could conservatively include efforts across other access programs that meet these criteria. We note that within the underserved dimension, the efforts we examine within the product framework of IWAI are aligned with the Access to Medicine Foundation's Product Delivery Technical Area. We note that this framework does not examine research and development or governance efforts on access as the IWAI product framework accounts for impacts only once they have been realized.

Pre-qualification and procurement data

To identify which products meet the WHO prequalification standard, we examine company disclosure per SASB metric 240a.2. Company A provides a list of the products that meet this standard. We then estimate the number of individuals reached through procurement of these products by the units guaranteed in procurement deals as reported by the Reproductive Health Supplies Coalition[185], Market Information for Access to Vaccines[186], and The Global Fund.[187] We recognize that these reported procurement deals likely understate the total procurement enabled by pharmaceutical companies. A company estimating their own underserved impact would have more internal information available to comprehensively estimate their underserved impact. For Company B, we apply the firm's estimate of individuals they have reached through access programs.

The per person value of access to family planning products is estimated from the United Nations Population Fund.[188] We divide the total estimated healthcare cost savings enabled by the UNFPA contraceptive provision by the number of people reached by UNFPA family planning

activities, building national capacity for manufacture, regulation and monitoring of medicines, and working with regulators to register those medicines quickly."

[185] "Product Brief Caucus on New and Underused Reproductive Health Technologies". *Reproductive Health Supplies Coalition.* Published July 2013. Accessed July 2020.

[186] "MI4A: Vaccine Purchase Data". *World Health Organization.* Updated August 2020. Available at: https://www.who.int/immunization/programmes_systems/procurement/mi4a/platform/module1/en/. Accessed July 2020.

[187] "Price & Quality Reporting Summary". *The Global Fund.* Updated April 2020. Accessed July 2020.

[188] "Annual Report 2016". *United Nations Population Fund.* Published 2016. Accessed July 2020.

programs and services. The value of vaccine provision to the underserved is estimated by the John Hopkins Bloomberg School of Public Health to be 44 times the vaccination cost[189] and the vaccination cost is estimated at $3 per vaccination by the Disease Control Priorities Project of the World Bank.[190] We estimate the value of provision of diabetes products with a proxy of the per person global cost associated with diabetes from the American Diabetes Association.[191]

The impact estimate

We multiply the number of patients reached through procurement and access programs by the value enabled or averted cost of access the specific product provided by the procurement or access programs. A company estimating their own underserved impact could estimate the value enabled or averted cost associated with the specific products provided in their procurement or access programs following this methodology.

11.4. Pharmaceuticals: Quality – health & safety

The health and safety dimension aims to capture instances where a customer's health, safety, or privacy has been breached. For a pharmaceutical company, a health and safety impact could be estimated with recall volume and other FDA reporting. In 2018, neither firm had a serious recall or FDA reported issue per SASB metrics 250a.1 (products listed in the FDA's MedWatch Safety Alerts), 250a.2 (fatalities associated with products as reported in the FDA Adverse Event Reporting System) or 250a.3 (recalls issued, total units recalled).

For demonstrative purposes, we describe the methodology for estimating the health and safety impact with a 2004 recall of a nonsteroidal anti-inflammatory drug linked to heart attacks. We multiply the number of individuals affected by the recalled product[192] (27,785) by the medical cost associated with a heart attack[193] ($760,000) to estimate the health and safety impact of this

[189] Sachiko Ozawa, Samantha Clark, Allison Portnoy, Simrun Grewal, Logan Brenzel and Damian Walker. "Return on Investment from Childhood Immunization in Low- and Middle-Income Countries, 2011–2020". *Health Affairs* 35(2):199-207. Published February 2016. Accessed July 2020.
[190] Susan Foster, Richard Laing, Bjørn Melgaard, and Michel Zaffran. 2006. "Ensuring Supplies of Appropriate Drugs and Vaccines" in *Disease Control Priorities in Developing Countries.* 2nd edition. *Washington (DC): The World Bank*
[191] Christian Bommer, Vera Sagalova, Esther Heesemann, Jennifer Manne-Goehler, Rifat Atun, Till Bärnighausen, Justine Davies, and Sebastian Vollmer. "Global Economic Burden of Diabetes in Adults: Projections From 2015 to 2030". *Diabetes Care* 41(5): 963-970. Published May 2018. Accessed July 2020.
[192] "Report: Vioxx linked to thousands of deaths". *NBC News.* Published October 2004. Accessed July 2020.
[193] Steve Vernon. "How much would a heart attack cost you?". *CBS News.* Published April 2010. Accessed July 2020.

recall at -$21.1 billion. A company estimating their health and safety impact could identify the recalled products, reason for recall, and apply the relevant cost associated with the reason for recall.

11.5. Pharmaceuticals: Quality - effectiveness

TABLE 67

Effectiveness Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
Prescribing Information	Effectiveness of lead product			Effectiveness of lead product	47%	37%
	Oncology	71%			-	
	Vaccines	98%		Minimum effectiveness of alternate	28%	37%
	Immunology	31%			=	
	Diabetes	47%	37%	Difference in effectiveness	19%	0%
	Cardiovascular	47%			x	
				Patients reached	3,449,984	28,900,000
Industry assumptions					x	
Prescribing Information	Minimum effectiveness of alternate			Associated averted cost	$2,647	$2,647
	Oncology	46%		Diabetes treatment effectiveness	$1,735m	$m
	Vaccines	98%		**Overall effectiveness impact**	**$10,029m**	**$m**
	Immunology	28%				
	Diabetes	28%	37%			
	Cardiovascular	47%				
Medical Literature	Associated averted productivity cost					
	Oncology	$30,444				
	Vaccines	$5				
	Immunology	$5,822				
	Diabetes	$2,647	$2,647			
	Cardiovascular	$11,190				

Pharmaceutical effectiveness

In the effectiveness dimension, we aim to capture whether the product or service is effective at meeting customer expectations. For pharmaceuticals, we examine the efficacy of treatment and minimum efficacy of alternate treatments available. We note that with pharmaceuticals, we apply the minimum efficacy of alternate treatments rather than the average efficacy. This decision reflects the assumption that all effective medical treatment creates positive impact with treatments that are less effective than the industry average creating positive impact of lesser magnitude. This aligns with our treatment of effectiveness impacts in industry applications

to consumer-packaged foods[194] and water utilities[195] where the direction of the impact is determined and the magnitude of that impact is what varies.

For each set of treatments, we identify a commonly reported measure of efficacy to enable comparison between different treatments. For Company A's oncology treatment, we examine survival rate at follow-up (one year). For Company A's vaccine, we examine rate of cervical cancer prevention. For Company A's immunology treatment, we examine the percent of patients achieving ACR50[196] at six months. For Company A's diabetes treatment, we examine the percent of patients achieving A1C < 7%. For Company A's cardiovascular treatment, we examine reduction in LDL-C[197] and the associated reduction in risk for a cardiovascular event. For Company B's diabetes treatment, we also examine the percent of patients achieving A1C[198] < 7%. We provide the efficacy measures applied across Company A and B's treatments to highlight that with pharmaceutical companies, identifying the appropriate measure of efficacy is highly specific to the treatment or product. While not an issue of framework scope, we note that these intricacies to determining the appropriate measure of efficacy highlight the following potential measurement issues. With long-term treatments, as with Company B's diabetes treatment, efficacy is more difficult to measure. Efficacy is also influenced by concurrent treatments, condition, and other patient-specific characteristics. We acknowledge the experimental nature of determining appropriate measures of efficacy and look to guidance from medical literature to identify reasonable estimates.

Data on clinical efficacy

We identify data on the measures of clinical efficacy outlined above in the prescribing information of the relevant treatments. We turn to the medical literature for estimates of the medical,

[194] Amanda Rischbieth, George Serafeim and Katie Trinh. "Accounting for Product Impact in the Consumer-Packaged Foods Industry", Harvard Business School. Accessed April 2021.
[195] George Serafeim and Katie Trinh. "Accounting for Product Impact in the Water Utilities Industry", Harvard Business School. Accessed April 2021.
[196] Per the American College of Rheumatology, "the ACR50 is a composite measure defined as both improvement of 50% in the number of tender and number of swollen joints and a 50% improvement in three of the following five criteria: patient global assessment, physician global assessment, functional ability measure, visual analog pain scale, and erythrocyte sedimentation rate or C-reactive protein".
[197] Per the Centers for Disease Control and Prevention, "LDL-C (low-density lipoprotein cholesterol), sometimes called 'bad' cholesterol, makes up most of your body's cholesterol. High levels of LDL-C raise your risk for heart disease and stroke.
[198] Per the National Institute of Diabetes and Digestive and Kidney Diseases, "A1C is a blood test for type 2 diabetes and prediabetes. It measures your average blood glucose, or blood sugar, level over the past 3 months… Doctors also use the A1C to see how well you are managing diabetes. Your A1C test result is given in percentages. The higher the percentage, the higher your blood sugar levels have been… The A1C goal for many people with diabetes is below 7".

productivity and indirect costs associated with the diseases these treatments target to estimate the value associated with higher clinical efficacy.

For Company A's oncology treatment, we apply the averted medical costs associated with cancer over six months.[199] For Company A's vaccine, we apply the annual medical cost associated with cervical cancer[200] and scale by global cervical cancer prevalence[201]. For Company A's immunology treatment, we apply the annual indirect productivity cost associated with rheumatoid arthritis.[202] For Company A and B's diabetes treatment, we apply the indirect productivity cost associated with diabetes.[203] For Company A's cardiovascular treatment, we apply the medical and indirect cost of coronary heart disease.[204] We note that we do not account for mortality rates and instead focus on medical and productivity costs associated with various health outcomes. This allows us to estimate monetary impacts while avoiding the ethical dilemma and discussion associated with the statistical value of a life (VSL).[205] [206] These estimates aim to capture the value enabled by higher clinical efficacy of treatment and the latest guidance from medical literature should further refine these estimates.

The impact estimate

In Table 67, we provide an example of estimating the effectiveness impact with Company A and B's lead diabetes treatment. We calculate the difference between the treatment efficacy and the minimum efficacy of alternate treatments to determine Company A and B's treatment efficacy above the industry treatment minimum. We multiply the difference in efficacy rate by the number of patients reached to estimate the number of patients that have achieved better outcomes by using

[199] K. Robin Yabroff, Jennifer Lund, Deanna Kepka, and Angela Mariotto. "Economic Burden of Cancer in the US: Estimates, Projections, and Future Research". *Cancer Epidemiol Biomarkers Prev.* 20(10): 2006-2014. Published October 2011. Accessed July 2020.
[200] Harrell W. Chesson, Donatus U. Ekwueme, Mona Saraiya, Meg Watson, Douglas R. Lowy, and Lauri E. Markowitz. "Estimates of the annual direct medical costs of the prevention and treatment of disease associated with human papillomavirus in the United States". *Vaccine* 30(42): 6016-6019. Published September 2012. Accessed July 2020.
[201] Marc Arbyn, Elisabete Weiderpass, Laia Bruni, Silvia de Sanjose, Mona Saraiya, Jacques Ferlay, and Freddie Bray. "Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis". *The Lancet Global Health* 8(2): 191-203. Published February 2020. Accessed July 2020.
[202] Gary M. Owens. "Managed Care Implications in Managing Rheumatoid Arthritis". *AJMC* 20(7). Published May 2014. Accessed July 2020.
[203] "The Cost of Diabetes". *American Diabetes Association. Published 2017. Accessed July 2020.*
[204] "Cardiovascular Disease: A Costly Burden for America", American Heart Association. Published 2017. Accessed August 2020.
[205] : Andersson, H. and N. Treich: 2011, Handbook in Transport Economics, Chapt. 'The Value of a Statistical Life', pp. 396-424, in de Palma, A., R. Lindsey, E. Quinet and R. Vickerman (eds.) Edward Elgar, Cheltenham, UK.
[206] Lisa A. Robinson. "How US Government Agencies Value Mortality Risk Reductions". *Review of Environmental Economics and Policy.* Published January 2007. Accessed April 2021.

Company A and B's treatment for their condition. To estimate the overall effectiveness impact for the diabetes treatments, we multiply the number of patients that have achieved better outcomes with the associated averted costs enabled by higher efficacy. We repeat this methodology for the other representative treatments to calculate the effectiveness impact for both companies.

11.6. Pharmaceuticals: Quality – basic need

TABLE 68

Basic Need Impact of Company A and B

Data				Estimation		
Industry assumptions		**A**	**B**		**A**	**B**
Prescribing Information	Minimum effectiveness of alternate			Minimum treatment effectiveness	28%	37%
	Oncology	46%			x	
	Vaccines	98%		Patients reached	3,449,984	28,900,000
	Immunology	28%			x	
	Diabetes	28%	37%	Associated averted cost	$2,647	$2,647
	Cardiovascular	47%		Diabetes treatment basic need	$2,557m	$28,560m
	Associated averted productivity cost			**Overall basic need impact**	**$25,958m**	**$28,560m**
	Oncology	$30,444				
	Vaccines	$5				
	Immunology	$5,822				
	Diabetes	$2,647	$2,647			
	Cardiovascular	$11,190				

Basic needs met by pharmaceuticals

The basic need dimension examines whether the product or service provides some basic need to the population. As discussed in the initial product framework paper, elasticity can be used to identify products that are basic needs.[207] In the case of pharmaceuticals, provision of pharmaceutical drugs meets a basic need of health. Examining the price elasticity of pharmaceuticals cements this designation as the long-run price elasticity is in the inelastic range.[208]

Minimum efficacy and health cost data

To estimate the health outcomes enabled by the pharmaceutical drug, we examine the minimum efficacy for the type of pharmaceutical drug. This provides us with an estimate of the percent of individuals who have achieved positive health outcomes attributable to the pharmaceutical drug. The estimates identified for minimum clinical efficacy are the same as those identified and

[207] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", Harvard Business School. Accessed July 6, 2020.
[208] Adil Abdela and Marshall Steinbaum. "The United States has a Market Concentrating Problem". Roosevelt Institute. Published September 2018. Accessed April 2021.

discussed for effectiveness. We note that the minimum efficacy for Company A and B's diabetic treatments differs since the treatments have different alternates as they lower blood sugar through different avenues.

To identify the value of enabled health, we examine the averted medical and indirect productivity costs associated with successful treatment. The estimates identified for averted medical and indirect productivity costs associated with treatment are also the same as those identified and discussed for effectiveness.

The impact estimate

In Table 68, we provide an example of estimating the basic need impact with Company A and B's lead diabetes treatment. We multiply the minimum effectiveness of the two treatment types by the estimated number of patients reached and the averted indirect costs associated with lack of treatment. We repeat this methodology for the other representative treatments to calculate the basic need impact for both companies.

11.7. Pharmaceuticals: Optionality

TABLE 69

Optionality Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
Financial disclosures	Revenue			Revenue across product categories	$25,004m	$13,828m
	Oncology	$8,243m			x	
	Vaccines	$7,261m		Industry price rent from monopoly	47%	
	Immunology	$1,475m			=	
	Diabetes	$5,995m	$13,828m	**Optionality impact**	**-$11,752m**	**-$6,499m**
	Cardiovascular	$2,030m				
Industry assumptions						
	Industry price rent from monopoly	47%				

Optionality in pharmaceuticals

The optionality dimension aims to capture the impact from consumers lacking freedom of choice when making a purchase, which we determine by examining whether the industry is monopolistic, whether the product or service is addictive, and whether there have been any information failures as previously discussed per the impact-weighted accounts product

framework.[209] In the case of pharmaceuticals, consumers can sometimes lack freedom of choice given the industry's monopolistic nature, as evidenced by the industry's HHI which exceeds 2,900.[210] While the monopolistic nature of the industry could enable investments in research and development, it could also lead to high barriers to entry, low competition, and supranormal rents for incumbents. The optionality impact estimates the losses consumers face from anti-competitive price rents.

Monopolistic pricing and exposure data

Overall treatment sales revenue for Companies A and B come from financial disclosures. We identify the impact of the pharmaceutical monopolistic nature on pricing as a 47% price premium as estimated by the Open Markets Institute[211] and assume all customers are exposed to these monopolistic effects. We note that firm variation on the optionality dimension is thus solely price driven in this example. As the academic and medical literature identifies characteristics that allow for firm differentiation in monopolistic price rent behavior, those nuances could be incorporated to estimate the optionality impact.

The impact estimate

To estimate the optionality impact, we multiply the total revenue from the treatment categories of interest by the anti-competitive price premium for pharmaceuticals.

11.8. Pharmaceuticals: Environmental use

TABLE 70

Environmental Usage Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
GRI 305-3	Emissions from use	148,100	60,141	Emissions from usage	148,100	60,141
					x	
Industry assumptions				Cost per ton of carbon	$114	
IWAI	Cost per metric ton of carbon	$114			=	
				Emissions impact	**-$17m**	**-$7m**

[209] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", Harvard Business School. Accessed July 6, 2020.
[210] Adil Abdela and Marshall Steinbaum. "The United States Has A Market Concentration Problem". *Roosevelt Institute*. Published 2018. Accessed July 2020.
[211] Michael Bluhm. "The Role of Monopoly in America's Prescription Drug Crisis". *Open Markets*. Published December 2019. Accessed July 2020.

Environmental usage in pharmaceuticals

The environmental usage dimension aims to capture any environmental emissions, pollutants, or efficiencies produced from use of the product. For pharmaceuticals, we estimate the impact from the emissions generated by customer usage of the service.

Environmental usage data

We identify a company's emissions from product use in their corporate sustainability reporting. Company A's sustainability disclosure reports the emissions associated with product use per GRI metric 305-3. Since Company B's disclosures outline activities and measures taken to limit emissions associated with product use but do not report emissions, we estimate an environmental usage impact for Company B assuming Company B generates the same emissions from use per dollar of revenue as Company A. The cost associated with a metric ton of carbon is estimated in the environmental framework of the Impact-Weighted Accounts.[212]

The impact estimate

We estimate a company's environmental usage impact by multiplying the emissions from usage by the cost of emissions.

11.9. Pharmaceuticals: End of life

TABLE 71

End-of-Life Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
GRI 305-3	Emissions from end-of-life treatment	44,900	18,233	Emissions from usage	44,900	18,233
					x	
Industry assumptions				Cost per ton of carbon	$114	
IWAI	Cost per metric ton of carbon	$114			=	
				End of life impact	**-$5m**	**-$2m**

End-of-life impact in pharmaceuticals

The end-of-life dimension aims to measure the averted and created emissions from the end-of-life treatment of the product, as well as the associated volume of product associated with the

[212] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

end-of-life treatment. For pharmaceuticals, the end-of-life dimension captures the impact associated with the waste after pharmaceutical administration, including packaging and other remaining material. As the industry continues to adopt end-of-life and other recyclability innovations, we would expect disclosure and reporting on these innovations to improve, enabling more comprehensive impact estimates. For example, while this example does not delve into the emerging issue of pollution from pharmaceutical product waste given current levels of disclosure around unused waste product,[213] these effects would be captured in the end-of-life dimension. Within the Sustainability Accounting Standard for Biotechnology and Pharmaceuticals, metric HC-BP-250a.4 covers the amount of unused product that is accepted through take-back initiatives. While this metric focuses on the handled unused product, the effects from all unused waste product could be estimated within this dimension as disclosures and public data become more readily available on unused product waste.

Waste generation and recyclability data

For this example, we apply the company's emissions from end-of-life treatment given data availability in corporate sustainability reporting. Company A's sustainability disclosure reports the emissions associated with end-of-life per GRI metric 305-3. Company B's disclosures provide examples of efforts to design recyclable and recoverable products and efforts to recover plastic waste, such as those found in insulin pens. Since these disclosures do not detail the waste or recover volumes or associated emissions, we estimate an end-of-life impact for Company B by assuming Company B generates the same emissions from end-of-life treatment per dollar of revenue as Company A. The cost associated with a metric ton of carbon is estimated in the environmental framework of the Impact-Weighted Accounts.[214]

The impact estimate

We estimate a company's end-of-life recyclability impact by multiplying the emissions from end-of-life treatment by the cost of emissions. A company with internal data on generated, recycled, and recovered waste volume could estimate a more comprehensive end-of-life impact.

[213] David Freiberg, Jean Rogers, and George Serafeim. "How ESG Issues Become Financially Material to Corporations and Their Investors. Harvard Business School Working Paper, No. 20-056. Revised November 2020.
[214] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

CHAPTER 12

ENERGY SECTOR: OIL AND GAS[215]

We apply the product impact framework of the Impact-Weighted Accounts Initiative within the oil and gas industry to ensure the framework is feasible, scalable, and comparable. Through a deep-dive of two competitor companies, we provide a cohesive example that examines the impacts of oil and gas companies on consumers across the seven product impact dimensions of the framework to uncover nuances of the framework application in estimating monetary values. The companies will be referred to as Companies A and B given the purpose of this exercise is to examine feasibility and not to assess the performance of individual companies. We do note that the data is from two of the largest oil and gas firms globally.

Self-disclosed company data points reflect information found in the company's disclosures from 2018 such as the Form 10-K or annual sustainability reports, which often disclose Sustainability Accounting Standards Board (SASB) and Global Reporting Initiative (GRI) metrics. Industry-wide assumptions on energy conversions, energy consumption, power outage costs, and emissions from oil and gas come from various economic, academic, industry and government studies. Given the methodology determines monetary impacts, the industry wide assumptions inevitably rely on some market-determined price and valuations.

TABLE 72

Product Impacts of Company A and B

[215] Katie Panella, George Serafeim, and Katie Trinh. "Accounting for Product Impact in the Oil and Gas Industry." Harvard Business School Working Paper, 2021.

							Dimensions of Customer Usage									
						Reach	Access		Quality			Optionality	Env Use	End of Life		
Company	Revenue	Relevant Impact Revenue	Positive Product Impact	Negative Product Impact	Quantity		Affordability	Underserved	Health & Safety	Effectiveness	Need	Monopoloy	Emissions	Recyclability		
A	$290bn	$279bn	$24bn	-$128bn	Motor gasoline (barrels)	809m	-	$1,393m	-	-	$22,124m	-	-$128,407m	-		
					Other petroleum (barrels)	1,203m										
					Natural gas (mcf)	4,027m										
B	$388bn	$340bn	$32bn	-$152bn	Motor gasoline (barrels)	797m	-	$5,689m	-	-	$25,830m	-	-$152,084m	-		
					Other petroleum (barrels)	1,679m										
					Natural gas (mcf)	3,944m										

Table 72 summarizes the monetary product impact estimates of two oil and gas companies as estimated by oil and gas sales. The underserved dimension examines the impact of electricity enabled by gas provision to emerging markets. The health and safety dimension examines the impact of fuel recalls. The need dimension examines the impact of energy enabled by oil and gas provision. Within environmental usage, we examine the emissions created from use of oil and gas sold. The following sections dive into the details, assumptions, and decisions behind these estimated impacts.

12.1. Oil and gas: Reach

TABLE 73

Oil and Gas Sales Volume of Company A and B

Data			
		A	B
10K	Motor gasoline sold (barrels annually)	809,205,000	797,160,000
10K	Other petroleum sold (barrels annually)	1,202,675,000	1,678,635,000
10K	Natural gas sold (mcf annually)	4,026,680,000	3,944,051,000

The goal of the reach dimension is to identify the number of individuals served by the company. For oil and gas companies, consumption is nearly impossible to measure in real-time given the large number of end-users.[216] Thus, for oil and gas companies, we examine sales volume

[216] John Kemp. "Is U.S. gasoline consumption overstated and if so by how much?" *Reuters.* Published April 2016. Accessed May 2021 at <https://www.reuters.com/article/us-usa-gasoline-kemp-idUSKCN0X827N>.

as reported in financial disclosure data as an indirect estimate for individuals reached. Company A and B both report petroleum product sales in thousands of barrels daily. Since both companies report gasoline sales within their petroleum product categories, we examine gasoline separately from other petroleum sales. For other petroleum sales, we sum sales from all categories aside from gasoline. For natural gas sales, Company A reports natural gas sales in millions of cubic feet per day. Since Company B does not report natural gas sales, we refer to Company B's volume of natural gas available for sale. Lastly, we multiply these figures by 365 to convert daily sales to an estimate of annual sales volume.

We note that while oil and gas companies have other products outside of petroleum and natural gas, we limit this example to the product impact of downstream petroleum and natural gas product lines. We choose to exclude other product lines, such as petrochemicals and other energy sources since the downstream petroleum and natural gas product lines make up over 85% of Company A and B's revenue. A company with significant revenue from other energy sources can estimate their own product impact and reach as described in this paper. For petrochemicals, a company could estimate the product impact of specific petrochemicals by applying the general product framework to the relevant or predominant petrochemical.

12.2. Oil and gas: Access – affordability

The goal of the affordability dimension is to identify the positive impact of more affordable product or service provision. Unlike other industries in which firms exhibit price control and price differentiation is observed, oil and gas companies provide a commodity and price is effectively determined by four industry inputs: cost of crude oil, refining costs, distribution costs, and taxes.[217] Thus, as with the application of the IWAI product impact framework to water utilities, firms within the oil and gas industry do not have an affordability impact.

[217] "Gasoline explained: Factors affecting gasoline prices". *US Energy Information Administration.* Updated March 2021. Accessed May 2021 at < https://www.eia.gov/energyexplained/gasoline/factors-affecting-gasoline-prices.php>.

12.3. Oil and gas: Access - underserved

TABLE 74

Underserved Impact of Company A and B

Data				Estimation		
Company datapoints		**A**	**B**		**A**	**B**
10-K	% natural gas sales by market			% natural gas sales in Africa	0.12%	10.45%
	Africa	0.12%	10.45%		x	
	Asia	28.83%	31.55%	% natural gas for electric power	80.50%	
	South America	0.00%	6.01%		x	
				Natural gas sold (mcf annually)	4,027m	3,944m
					=	
				Natural gas for electric in Africa	3.8m	331.9m
Industry assumptions					x	
IGT	% natural gas for electric power			kWh in mcf of natural gas	303.55	
	Africa	80.50%			=	
	Asia	38.50%		kWh enabled in Africa	1,159m	100,745m
	South America	47.50%			÷	
EIA	kWh in mcf of natural gas	303.55		Annual per capita kWh consumed	485.72	
	Annual per capita kWh consumed				=	
World Bank	Africa	486		Individuals reached in Africa	2.4m	207.4m
	Asia	1,877			x	
	South America	1,695		Averted outage loss	$18.65	
	Per capita loss from outage	$18.65			x	
				Underserved impact in Africa	**$45m**	**$3,868m**
				Overall underserved impact	**$1,393m**	**$5,689m**

Sales to the underserved

The goal of the underserved dimension is to identify the impact associated with provision of products or services to underserved customers. For a product or service to enable underserved access, two criteria need to be met as outlined in the initial framework and discussed in subsequent applications to pharmaceuticals[218], airlines[219], and others. First, the product or service must be accessed by an underserved population. Second, the product or service must enable sustainable development, as outlined by the UN Sustainable Development Goals (UN SDG).

Thus, we estimate the underserved impact in the oil and gas space by examining natural gas sales used for electricity in emerging markets. Per the first criteria, we examine sales to emerging markets as a proxy for estimating access to an underserved population. Per the second criteria, we determine that natural gas sales used for electricity meets SDG 7 which focuses on

[218] Amanda Rischbieth, George Serafeim and Katie Trinh. "Accounting for Product Impact in the Pharmaceuticals Industry", Harvard Business School. Accessed May 2021.
[219] George Serafeim and Katie Trinh. "Accounting for Product Impact in the Airlines Industry", Harvard Business School. Accessed April 2021.

ensuring access to affordable, reliable, sustainable, and modern energy for all.[220] We note that natural gas sales for other purposes and petroleum sales do not meet the criteria outlined in the indicators of SDG 7 which include access to electricity and reliance on clean fuels. While petroleum (specifically kerosene) is used in many households as the primary cooking fuel, we do not examine petroleum sales for cooking in the underserved dimension given the identified adverse health effects from pollution associated with household kerosene combustion.[221]

Natural gas sales data

To identify emerging market natural gas sales, we use company self-reported data on the percent of natural gas sales by region. Given public data availability, we include all sales within the following markets: Africa, Asia, and South America. A company estimating their own underserved impact could identify relevant markets for inclusion with more granularity.

For industry-wide assumptions, we refer to the Institute of Gas Technology and World Bank estimates on the percent of natural gas used for electric power in these geographies and the per capita electric consumption in these geographies.[222] [223] We refer to the US Energy Information Administration for conversion rate for natural gas to energy in kilowatt-hours.[224]

We estimate per capita averted loss associated with lack of power in emerging markets from World Bank data on the average annual output loss from power shortages for representative emerging markets[225] divided by the relevant population.

The impact estimate

We multiply Company A and B's total natural gas sales by the percent of natural gas sales in the relevant emerging market geography and the percent of natural gas sales used for electric power in the same geography to estimate Company A and B's emerging market natural gas sales for electricity. We then multiply the emerging market natural gas sales for electricity by the

[220] "Sustainable Development Goals 7". *United Nations Department of Economic and Social Affairs.* Accessed May 2021 at <https://sdgs.un.org/goals/goal7>.
[221] Michael N Bates and Nigel Bruce. "WHO Indoor Air Quality Guidelines: Household Fuel Combustion. *World Health Organization.* Published 2012. Accessed May 2021.
[222] Donald L. Klass, Riaz A. Khan and Salahuddin Khwaja. "The Domestic Natural Gas Industry in Developing Countries". Published May 1992. Accessed May 2021.
[223] The World Bank Data. "Electric power consumption (kWh per capita)". *IEA Statistics © OECD/IEA.* Accessed May 2021.
[224] "What are Ccf, Mcf, Btu, and therms? How do I convert natural gas prices in dollars per Ccf or Mcf to dollars per Btu or therm?" *US Energy Information Administration.* Updated June 2020. Accessed May 2021 at < https://www.eia.gov/tools/faqs/faq.php?id=45&t=8>.
[225] Fan Zhang. "In the Dark". *World Bank Group.* Published 2019. Accessed May 2021.

conversion rate for kilowatt-hours and divide by the average per capita energy consumed within that geography to estimate the number of individuals reached within that geography. We multiply the number of individuals reached by the per capita estimated averted loss associated with lack of power to estimate the underserved impact within the relevant emerging market geography. Table 74 provides an example of this calculation for Company A and B's sales in Africa. We repeat this calculation for the other emerging markets in which Company A and B sell natural gas to estimate the overall underserved impact.

12.4. Oil and gas: Quality – health & safety

Oil and gas health and safety

The health and safety dimension aims to capture instances where a customer's health, safety, or privacy has been breached. We note that this dimension examines unexpected health and safety issues outside of expected product performance. For an oil and gas company, this dimension is where we examine oil and gas recalls due to faulty fuel. Both Company A and B did not have any oil and gas recalls or faulty fuel related issues in 2018. Thus, both Company A and B do not have a health and safety impact for this year.

Impact estimate methodology

To demonstrate how a company could estimate their own health and safety impact if they did have a recall or issues with faulty fuel, we include an example for another firm that experienced a gasoline recall in 2012 in Table 75. We divide the gasoline recall volume by the assumed fuel tank capacity to estimate the number of fuel tanks affected by the gasoline recall. We then multiply this figure by the cost associated with cleaning a fuel tank system to estimate the total health and safety impact.

TABLE 75

Health and Safety Impact Example

Data		
Company datapoints		**Sample**
10-K	Gasoline recall volume	2,100,000
Industry assumptions		
Estimated	Gallons in a full tank	14.00
Chi. Tribune	Fuel tank system cleaning cost	$1,200

Estimation	
	Sample
Gasoline recall volume	2,100,000
	÷
Gallons in a full fuel tank	14.00
	=
Individual fuel tanks affected by recall	150,000
	x
Fuel tank system cleaning cost	$1,200
	=
Health and safety impact	**-$180m**

12.5. Oil and gas: Quality - effectiveness

In the effectiveness dimension, we aim to capture whether the product or service is effective at meeting customer expectations. In industries where efficacy can be directly measured, including airlines and pharmaceuticals, we estimate the effectiveness impact by examining differences in performance. In industries where efficacy cannot be directly measured, including autos[226] and consumer finance[227], we have estimated the effectiveness impact by examining differences in customer satisfaction.

For the oil and gas industry, we do not estimate an effectiveness impact for Company A and B given the lack of differentiation in a commodity product. While oil and gas companies qualitatively discuss performance differences driven by octane level, additives present, and efficiency, their financial disclosures provide aggregate figures without granularity by octane level, additives, or efficiency. Thus, current reporting not only suggests a lack of differentiation in performance, but also prevents any measurement of differences in performance where they to exist. The oil and gas industry also does not exhibit differences in customer satisfaction, as the American Customer Satisfaction Index aggregates customer satisfaction at the industry level rather than providing firm level estimates.[228]

While we do not currently estimate an effectiveness impact for oil and gas firms, we note that as performance differences in oil and gas are realized through research, development and

[226] George Serafeim and Katie Trinh. "A Framework for Product Impact-Weighted Accounts", Harvard Business School. Accessed April 2021.
[227] George Serafeim and Katie Trinh. "Accounting for Product Impact in the Consumer Finance Industry", Harvard Business School. Accessed April 2021.
[228] "Benchmarks by Company Gasoline Stations". *American Customer Satisfaction Index.* Updated 2020. Accessed May 2021 at <https://www.theacsi.org/industries/retail/gas-station>.

innovation, an effectiveness impact for oil and gas firms may be estimated, either as enabled by public data availability or by companies estimating their own effectiveness impact.

12.6. Oil and gas: Basic need

TABLE 76

Basic Need Impact of Company A and B

Data			Estimation		
Industry assumptions				**A**	**B**
EIA	Energy in 1 mcf natural gas (MMBtu)	1.04	(Natural gas sold (mcf)	4,027m	3,944m
	Energy in 1 barrel gasoline (MMBtu)	5.22	x		
	Energy in 1 barrel kerosene (MMBtu)	5.67	Energy in 1 mcf natural gas)	1.04	
	Global annual per capita MMBtu use	68.80	=		
Energy & Econ	Global per capita power outage cost	$100.00	*Energy from natural gas sold*	*4,176m*	*4,090m*
			+		
			(Gasoline sold (barrels)	809m	797m
			x		
			Energy in 1 barrel gasoline)	5.22	
			=		
			Energy from gasoline sold	*4,226m*	*4,163m*
			+		
			(Other petroleum sold (barrels)	1,203m	1,679m
			x		
			Energy in 1 barrel other petroleum)	5.67	
			=		
			Energy from other petroleum sold	*6,819m*	*9,518m*
			=		
			Total energy supplied (MMBtu)	15,221m	17,771m
			÷		
			Global per capita MMBtu use	68.80	
			=		
			Individuals reached by energy supply	221m	258m
			x		
			Averted outage cost	$100.00	
			=		
			Basic need impact	**$22,124m**	**$25,830m**

Basic needs met by oil and gas

The basic need dimension examines whether the product or service provides some basic need to the population. In the case of oil and gas, provision of oil and natural gas meets a basic need as oil and gas is fundamental for both societal industry and production, and household energy, heating, and transportation. Examining the elasticity of oil and gas demand cements this designation, given, historically, changes in oil and gas price have little influence over oil and gas demand.[229]

[229] Michael Morris. "Gasoline prices tend to have little effect on demand for car travel". *Today in Energy, US Energy Information Administration.* Published December 2014. Accessed May 2021.

Data on oil and gas energy produced and used

For oil and gas sales volumes, we refer to Company A and B's financial disclosures. For industry-wide assumptions on the amount of energy[230] in natural gas, gasoline, and other petroleum (kerosene), and average per capita global energy use[231] we refer to the US Energy Information Administration. To estimate the global per capita cost associated with lack of power, we multiply the global GDP by the associated cost of lack of power[232] and divide by the global population.

The impact estimate

We calculate the total energy supplied by Company A and B by multiplying the volume of natural gas, gasoline, and other petroleum sold by the associated conversion rate to energy in MMBtu and taking the sum. We then divide the total energy enabled by Company A and B by the average annual per capita energy consumption to estimate the number of individuals to which Company A and B provided energy. We multiply the number of individuals that Company A and B provided energy to by the averted global per capita cost associated with lack of power to estimate Company A and B's basic need impact.

12.7. Oil and gas: Optionality

The optionality dimension aims to capture the impact from consumers lacking freedom of choice when making a purchase, which we determine by examining whether the industry is monopolistic, whether the product or service is addictive, and whether there have been any information failures. We do not estimate an optionality impact for oil and gas companies since the industry is not monopolistic, the product is not addictive per medical guidance[233], and no information failures were identified for the consumer.

---

[230] "What are Ccf, Mcf, Btu, and therms? How do I convert natural gas prices in dollars per Ccf or Mcf to dollars per Btu or therm?" *US Energy Information Administration.* Updated June 2020. Accessed May 2021 at < https://www.eia.gov/tools/faqs/faq.php?id=45&t=8>.

[231] Ari Kahan. "EIA projects nearly 50% increase in world energy usage by 2050, led by growth in Asia". *Today in Energy, US Energy Information Administration.* Published September 2019. Accessed May 2021.

[232] *Global Energy Assessment – Toward a Sustainable Future,* Cambridge University Press, Cambridge, UK. Published 2012. Accessed May 2021 at International Institute for Applied Systems Analysis.

[233] Per the American Society of Addiction Medicine, "Addiction is a treatable, chronic medical disease involving complex interactions among brain circuits, genetics, the environment, and an individual's life experiences. People with addiction use

12.8. Oil and gas: Environmental use

TABLE 77

Environmental Usage Impact of Company A and B

Data		
Industry assumptions		
EIA	CO2 emitted per MCF of natural gas (tons)	0.06
	CO2 emitted per barrel of gasoline (tons)	0.41
	CO2 emitted per barrel of kerosene (tons)	0.46
IWAI	Cost per ton of carbon	$114

Estimation		
	A	**B**
(Natural gas sold (mcf)	4,027m	3,944m
	x	
CO2 per mcf natural gas)	0.06	
	+	
(Gasoline sold (barrels)	809m	797m
	x	
CO2 per barrel gasoline)	0.41	
	+	
(Other petroleum sold (barrels)	1,203m	1,679m
	x	
CO2 per barrel kerosene)	0.46	
	=	
Total CO2 emitted (tons)	1,126m	1,334m
	x	
Cost per ton of carbon	$114	
	=	
Environmental usage impact	**-$128,407m**	**-$152,084m**

Environmental usage in oil and gas

The environmental usage dimension aims to capture any environmental emissions, pollutants, or efficiencies produced from use of the service or product. For the oil and gas industry, we estimate the impact from the emissions generated from using natural gas, gasoline, and other petroleum sold.

Environmental usage data

We identify the volume of natural gas, gasoline, and petroleum sold from company financial disclosures. We refer to the US Energy Information Administration for estimates on the amount of CO2 emitted per unit of natural gas, gasoline, and other petroleum.[234] The cost associated with a metric ton of carbon is estimated in the environmental framework of the Impact-Weighted Accounts.[235]

The impact estimate

substances or engage in behaviors that become compulsive and often continue despite harmful consequences. Prevention efforts and treatment approaches for addiction are generally as successful as those for other chronic diseases."

[234] "How much carbon dioxide is produced when different fuels are burned?" *US Energy Information Administration.* Updated June 2020. Accessed May 2021 at < https://www.eia.gov/tools/faqs/faq.php?id=73&t=11>.

[235] David Freiberg, DG Park, George Serafeim, and T. Robert Zochowski. "Corporate Environmental Impact: Measurement, Data and Information". Harvard Business School Working Paper, No. 20-098. Published March 2020.

We estimate the emissions generated from product use by multiplying the volume of natural gas, gasoline, and other petroleum sold by the average volume of CO2 emissions per unit. We then multiply the sum of emissions from usage by the cost of emissions to estimate the environmental usage impact.

12.9. Oil and gas: End of life

The end-of-life dimension aims to measure the averted and created emissions from the end-of-life treatment of the product, as well as the associated volume of product associated with the end-of-life treatment. For the petroleum and natural gas product lines of oil and gas firms, the physical waste from use of the product are emissions and are captured in the environmental usage dimension. We thus do not estimate an end-of-life impact for these firms. This dimension would be especially important when estimating the product impact of petrochemicals.

CHAPTER 13
ANALYSIS OF PRODUCT IMPACT DATA

This application of the product framework not only indicates feasibility of estimating monetary product impacts, but also demonstrates the potential value of impact-weighted financial statement analysis. One potential analysis enabled is a comparability of the product impacts of different companies. Within a single industry, one can identify differences in how companies approach different product attributes, such as vehicle emissions or vehicle safety within the automobile manufacturing industry. Analyzing each dimension allows for a deeper understanding of the business strategies employed by each company. For example, a company that outperforms on recyclability is better positioned to compete in the circular economy while the company that provides more access to products is better positioned to compete in underserved markets. Beyond identifying differences in approach, impact-weighted financial statement analysis can also help investors and other stakeholders identify companies that are well-positioned to create additional impact in dimensions of interest.

13.1. Dataset construction

To provide a comprehensive example of the information enabled by impact-weighted financial statement analysis, we generated product impact estimates for companies within the automobile manufacturing, packaged foods, consumer finance, aviation, telecommunications, water utilities and oil and gas industries. These estimates allow us to identify competitive dimensions of product impact within different industries, company strategy and product impact performance over time, and overall industry leaders and laggards.

The dataset consists of product impact estimates for 61 leading firms across seven industries (automobile manufacturing, packaged foods, consumer finance, aviation, telecommunications, water utilities and oil and gas)[236] spanning 4 years, 2015 to 2018. The dataset

[236] The automobile manufacturers included in the dataset are BMW Group, Daimler, Fiat Chrysler Automobiles, Ford Motor Company, General Motors Company, Honda Motor Company, Hyundai Motor Company, Kia Motors, Mazda Motor Corporation, Nissan Motor Company, Groupe PSA, Subaru, Tesla, Toyota Motor Corporation, and Volkswagen Group. The consumer-packaged foods firms included in the dataset are Ajinomoto, Campbell's, ConAgra Brands, Danone, General Mills, The Hershey Company, Hormel Foods Corporation, The Kellogg Company, The Kraft Heinz Company, Mondelez International, and Nestlé. The consumer finance firms included in the dataset are The American Express Company, Capital One Financial Corporation, Discover Financial Services, and Synchrony Financial. The aviation firms included in this dataset are Alaska Airlines, American Airlines, Delta Air Lines, JetBlue Airways, Southwest Airlines, and United Airlines. The telecommunications firms included in this dataset are AT&T, BT Group, Deutsche Telekom, Nippon Telegraph and Telephone, Orange, Singapore Telecommunications, Swisscom, Telefónica, Telenor, Telstra, Telus Communications, and Verizon. The water utilities firms included in this dataset are American Water,

is limited to firms that are publicly traded in the US with over $2 billion dollars in revenue to ensure data availability. The resulting firms that meet these thresholds for inclusion are composed of 15 automobile manufacturers, 11 packaged foods manufacturers, and 4 consumer finance firms, 6 airlines, 12 telecommunications operators, 4 water utilities, and 9 oil and gas companies. Given data availability, product impact estimates for packaged foods manufacturers are limited to a single year, 2018.

Since the industry assumptions used for product impact monetization are firm-invariant, the product estimates are calculated by applying the industry-wide assumptions to the respective company-specific data points. Given product impact estimates likely vary as a proportion of firm size we scale all product impact estimates by a firm's earnings before interest, taxes, depreciation, and amortization (EBITDA). A user could also scale these estimates by revenue. In general, company datapoints reflect information found in the company's Form 10-K and annual sustainability reports which often disclose SASB and GRI metrics. This data is supplemented with metrics from relevant industry research firms and regulatory bodies, including the US Department of Transportation, the Food and Drug Administration, Nielsen, the Consumer Finance Protection Bureau, the National Transportation Safety Board, and the Bureau of Transportation Statistics.

For the affordability dimension, company-specific data for automobile manufacturers on vehicle price, maintenance cost, and fuel economy data comes from the technology firm, RGS. For data consistency purposes in estimating duration, we use the same industry average duration of 11.60 years for all automobile manufacturers regardless of maximum mileage. For packaged foods manufacturers, product categories and pricing data comes from the Nielsen Homescan Panel which tracks purchases of over 40,000 US households by UPC code with associated pricing, method of payment, and volume sold. For consumer finance firms, credit card fees, interest rates, and merchant fees come from firm marketing materials and financial disclosures. For airlines, company-specific pricing data comes from the Airline Data Project. For telecommunications firms, wireless and internet revenue per user come from firm marketing materials and financial disclosures. For the affordability benchmarks in automobile manufacturing, we determine luxury vehicles at the brand rather than product level. We note this is a simplification for companies such as Toyota which have luxury and non-luxury vehicle offerings. We designate BMW, Daimler, and

Sabesp, Severn Trent, and United Utilities. The oil and gas firms included in this dataset are BP, Chevron Corporation, Eni, Equinor, ExxonMobil, Petrobras, Repsol, Royal Dutch Shell, and TotalEnergies.

Tesla brands as luxury and these three companies therefore do not have vehicle price affordability impact, even though they might offer some non-luxury models in more competitive prices. For the affordability benchmarks in packaged foods, we estimate the industry average per calorie price for each Nielsen category. For consumer finance, we apply industry average rate and fee benchmarks from Federal Reserve data. As with automobile manufacturers, we determine luxury cards at the card-type level, designating reward and travel cards as luxury. For airlines, we also apply industry average pricing from the Airline Data Project.

To estimate the underserved impact of automobile manufacturers, we have collected data from public company disclosures on the markets in which they operate to apply emerging market sales as a proxy in identifying sales to underserved customers given public data availability does not allow for more granular identification. The value of enabled time savings comes from World Bank data on global net national income per capita[237]. For packaged foods manufacturers, we estimate food stamp sales by collecting data on the number of WIC-qualified products and WIC sales from Nielsen and company marketing materials. The value of these sales is estimated through averted health costs from reduced food insecurity attributable to food stamp program access (Mozaffarian 2018). For consumer finance firms, we collect data on cardholder FICO score profile from firm financial disclosures and annual reports. We apply the value of financial inclusion as estimated by personal finance firms.[238] For telecommunications firms, data on rural households, emerging market customers, and pre-paid customers comes from firm marketing materials and financial disclosures. For water utilities, we collect company-specific data on the percentage of sales with cost savings support and estimate the average cost savings associated with support from company annual reports and corporate responsibility disclosures. We note that the reporting of these figures varies across companies. For companies with incomplete data, we conservatively estimate these figures by identifying the minimum number of individuals reported to receive cost support and assume the minimum of cost savings enabled. For oil and gas firms, we collect company-specific data on emerging markets served from firm financial disclosures.

For the health and safety dimension, we collect recall and five-star safety rating data from the National Highway Traffic Safety Administration rather than company reporting to ensure consistency of methodology for automobile manufacturers. For packaged foods manufacturers we

[237] World Bank data on global net income per capita can be accessed here.
[238] Estimates of the average annual cost of being unbanked or solely reliant on cash can be found here.

collect recall data from the US Food & Drug Administration. Industry assumptions on the associated costs for food-borne illnesses comes from the United States Department of Agriculture Economic Research Service.[239] For consumer finance firms, we collect customer complaint data from the Consumer Finance Protection Bureau and estimate cardholder debt from financial disclosures. We apply mental health risk estimates associated with cardholder debt (Marshall, Kahana, Gallo, Stansbury and Thielke 2020) and associated outcome costs (Greenberg, Fournier, Sisitsky, Pike and Kessler 2014). We scale customer complaints by an estimate of occurrences of unreported issues for every complaint by VHT Marketing.[240] For airlines, company-specific data on accidents and incidents comes from the National Transportation Safety Board. For water utilities, the number of acute and non-acute health violations are from company annual reports. The population affected by such violation is provided from annual reports or estimated using company and country data about population demographics.

For the effectiveness dimension, we apply customer satisfaction rates as a proxy for product effectiveness for automobile manufacturers and consumer finance firms. Customer satisfaction for automobile manufacturers comes from the American Customer Satisfaction Index and customer satisfaction for consumer finance firms comes from J.D. Power. For packaged foods manufacturers, nutritional information comes from the United States Department of Agriculture Food Data Central database which provides nutrient content by product UPC code for over 250,000 branded products. Industry-wide assumptions on nutrition associated health outcomes come from meta-analyses of nutrition and health-focused studies. We apply risk associations between nutrient consumption and cardiovascular and coronary heart disease for fiber (McRae 2017), whole grains (Lee et al. 2019), sodium (Strazzullo et al. 2009), trans-fat (Mozaffarian et al. 2006), and added sugar (Harvard Health Publishing 2019). The associated costs for these health outcomes come from the estimates of the medical and productivity costs associated with cardiovascular and coronary heart disease (American Heart Association 2017). For airlines, company-specific data on delays and cancellations comes from the Bureau of Transportation Statistics. For telecommunications firms, wireless and broadband speeds come from company annual reports when available. We note that the decision to report on speed and the granularity of such reporting varies between companies. We thus also refer to secondary sources including press releases, news

[239] Cost estimates of foodborne illnesses can be found here.
[240] An estimate of unreported issues for every complaint can be found here.

media, and third-party speed test data.[241] We examine the resulting effectiveness estimates to ensure the two source types do not lead to skewed estimates. Based on the distribution of effectiveness estimates by both source types, we believe these secondary sources provide a reasonable and conservative estimate compared to self-reporting. However, as speed reporting data becomes more consistent, we expect future dataset construction to rely on a single data source type. For water utilities, system commodity loss and total water withdrawn are from company annual reports and corporate responsibility disclosures. Industry assumption estimates of the cost of water are country-specific and adjusted for water scarcity.[242]

For the basic need dimension, water utilities, telecommunications, and oil and gas firms in our dataset have a basic need impact. For automobile manufacturers, we assume that no sales occur in rural areas for consistent and conservative data collection. For packaged foods manufacturers, the packaged foods sold do not meet a conservative definition of staple foods. For consumer finance, the firms we examine do not provide broader access to financial services (i.e. banking), but simply access to credit, which does not meet a basic need. For telecommunications, the number of customers served comes from firm marketing materials and financial disclosures. For water utilities, the number of customers served comes from company annual reports and we apply the same industry assumptions provided in the examples with Companies A and B. For oil and gas firms, data on petroleum and natural gas volume sold comes from firm financial disclosures.

For the optionality dimension for consumer finance firms, we collect marketing complaint data[243] from the Consumer Finance Protection Bureau and scale by VHT Marketing's estimate of unreported issues per complaint. For airlines, estimates of passengers facing monopolistic gate control comes from the Bureau of Transportation Statistics.

For the environmental usage dimension, emissions data comes from the Environmental Protection Agency rather than company reporting to ensure consistency of methodology for automobile manufacturers. For packaged foods manufacturers, emissions data from cooking and storage reflects Form 10-K, sustainability disclosure, and Carbon Disclosure Project data. As discussed in Section 4, we do not estimate environmental usage impact for consumer finance firms.

---

[241] Examples of secondary sources include "Speedtest Ookla Insights" which aggregates consumer-initiated test data from over 30 billion users, "Opensignal Market Insights" which provides independent insights on mobile connectivity globally, and industry news media such as "Fierce Wireless" which provides breaking news and expert analysis of trends shaping wireless communications.

[242] DG Park, George Serafeim and Rob T. Zochowski. "Measuring the Cost of Corporate Water Usage", Harvard Business School. Accessed January 5, 2021.

[243] Complaint data from the Consumer Finance Protection Bureau can be accessed here.

For telecommunications firms, emissions from product use comes from company annual reports and corporate sustainability reporting where available. For firms that do not report their emissions from product use, we apply imputed emissions given the number of wireless customers and broadband customers. For oil and gas firms, emissions from product use are estimated from product volume sold as reported in firm marketing materials and financial disclosures.

For the end-of-life dimension, recyclability, recoverability, and curb weight data for automobile manufacturers is provided by Richmond Global Sciences. We note that the end-of-life dimension estimates assume that 50% of sold auto vehicles are recycled and recovered to ensure consistent treatment of companies given the limited information around recycling rates by market and geography. For packaged food manufacturers, emissions data from food waste and packaging also reflects Form 10-K, sustainability disclosure and Carbon Disclosure Project data. The cost associated with a ton of carbon emissions is estimated with 3% discount rate (Freiberg, Park, Serafeim and Zochowski 2020). For consumer finance firms, we assume no cards are recycled and apply an estimate of the cost of plastic waste (Beaumont et al. 2019). For telecommunications firms, the volume of e-waste generated is estimated through the number of wireless and broadband connections which comes from company annual reports. The volume of recycled e-waste from product use comes directly from corporate sustainability reporting where available. For most firms, this is estimated through the number of devices collected or taken back for recycling which comes from company corporate sustainability reporting.

13.2. Results

Table 78 shows summary statistics for all impact variables. The number of observations varies across the variables as for some companies we might be missing information necessary to calculate the impact estimates. Figure 2 shows the distribution of total product impact in the sample showing significant variation. While there are a sizeable number of firm-years (93 of 203) displaying positive impact, the distribution exhibits a negative mean. At the industry level, consumer finance and telecommunication firms exhibit a more positive mean and positive skew and packaged foods manufacturers and oil and gas firms exhibit a more negative mean and negative skew.

TABLE 78

Summary Statistics of Product Impact

	Impact Scaled by EBITDA		
Impact	N	Average	SD
Affordability Impact	203	11.13%	0.23
Underserved Impact	201	16.80%	0.44
Health and Safety Impact	201	-1.03%	0.24
Effectiveness Impact	198	-16.28%	0.66
Basic Need Impact	146	28.72%	0.65
Optionality Impact	203	-2.90%	0.06
Environmental Usage Impact	200	-84.48%	2.82
End of Life Treatment Impact	200	1.05%	0.03
Overall Product Impact	203	-53.56%	2.46

FIGURE 2

Distribution of Overall Product Impact Estimates Scaled by EBITDA

(Across All Firm Year Observations)

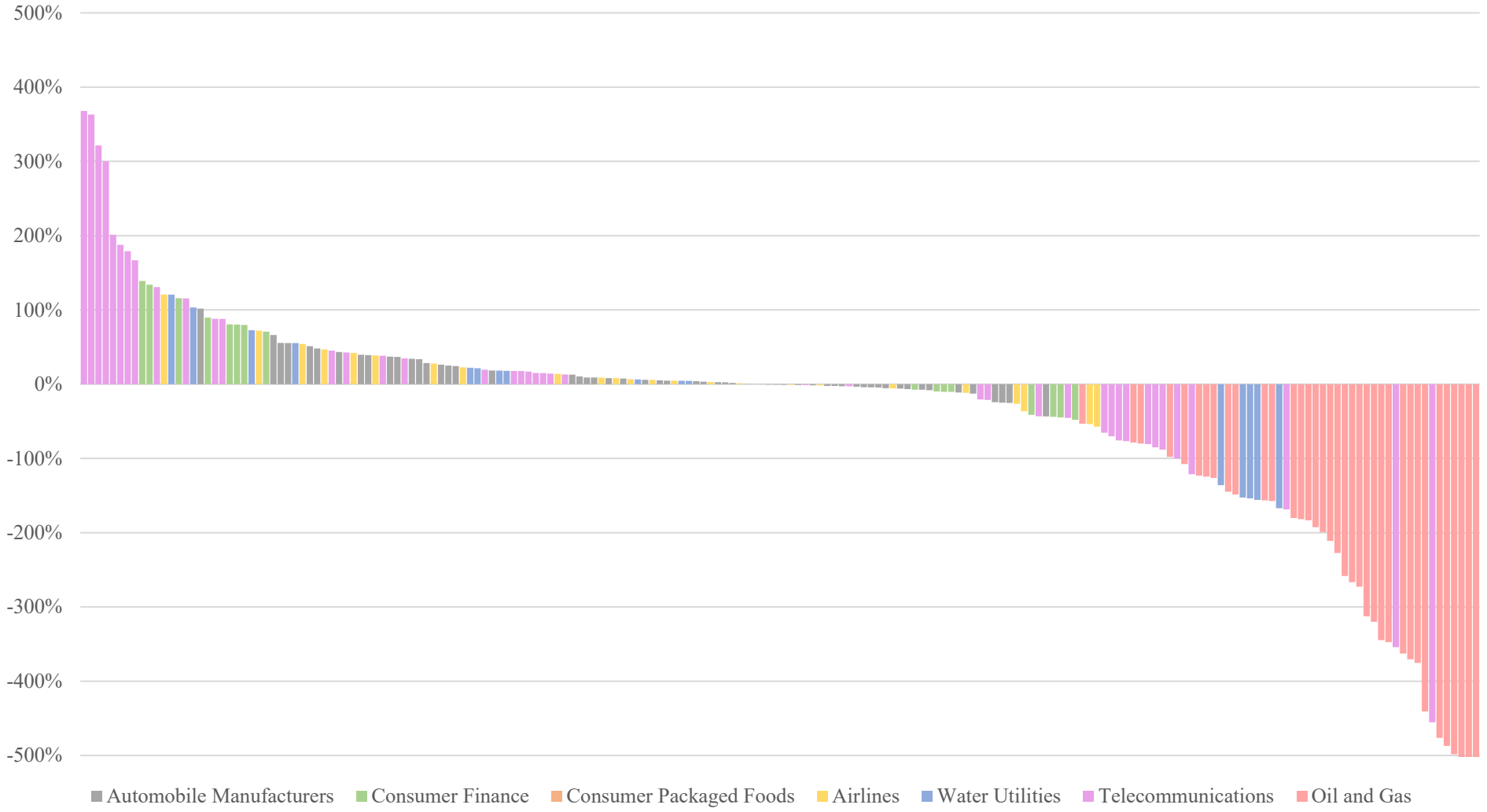
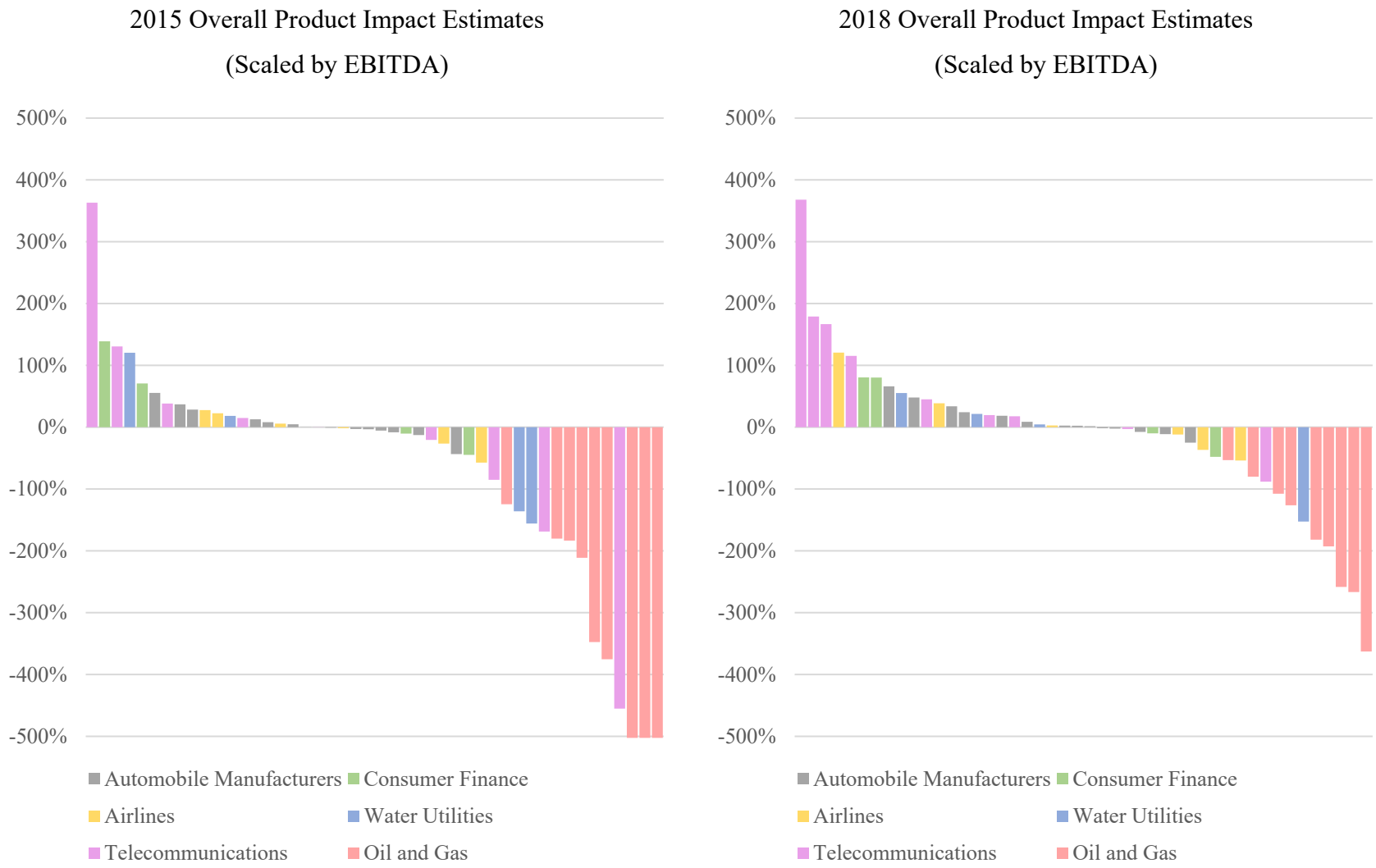


FIGURE 3


2015 Overall Product Impact Estimates
(Scaled by EBITDA)
500%
400%
300%
200%
100%
0%
-100%
-200%
-300%
-400%
-500%
Automobile Manufacturers
Consumer Finance
Airlines
Water Utilities
Telecommunications
Oil and Gas
2018 Overall Product Impact Estimates
(Scaled by EBITDA)
500%
400%
300%
200%
100%
0%
-100%
-200%
-300%
-400%
-500%
Automobile Manufacturers
Consumer Finance
Airlines
Water Utilities
Telecommunications
Oil and Gas

13.3. Discussion of insights enabled by impact-weighted financial statement analysis

The analysis of the product impact dataset consists of two components. We examine the distribution of product impact estimates to identify the most influential dimensions of product impact within each industry and trends in product impact performance over time. We also examine company-level product impact performance to identify leaders and laggards and trends in company performance.

Comparing the distribution of overall product impact estimates in 2015 and 2018 as provided in Figure 3 indicates improvement in the overall product impact performance of automobile manufacturers, telecommunications firms, water utilities and oil and gas firms. We note that for the oil and gas firms in the dataset, this change is not driven by a change in product impact performance, but by growth in EBITDA due to increasing oil and gas prices. For consumer finance firms and airlines, there has been minimal change in product impact delivered between 2015 and 2018. The number of companies with positive product impact has increased from eighteen to twenty-four in 2018. Firms with negative product impact have also seen a decrease in the magnitude of negative product impact delivered over this time frame.

Comparing the distribution of product impact by dimension across all years provides information on which dimensions are drivers of product impact within and across industries and how the dimensions influence overall product impact numbers. Figures 4, 5, 6 and 7 indicates the distribution of product impact for the aggregate access (affordability and underserved), quality (health and safety, effectiveness, and basic need), optionality, and environmental (environmental usage and recyclability) dimensions. While the access, quality, optionality and environmental dimensions are of comparable magnitude across industries, there are differences within industry. The magnitude of the environmental dimensions for automobile manufacturers and oil and gas firms suggests that environmental impact is a key driver of product impact within these two industries. Similarly, the magnitude of the quality dimension for packaged foods manufacturers, water utilities, and airlines suggests that quality is a key driver of product impact within these three industries. On the other hand, the magnitude of the optionality dimension suggests that while airlines, telecommunications, and consumer finance firms do have optionality impact, optionality is not a key driver of product impact compared to other dimensions. Lastly, the magnitude of the access dimension for telecommunications and consumer finance firms suggests that access is a key driver of product impact within these two industries. The variation of access, quality and

environmental impacts within and across industry also highlights that these dimensions are key points of differentiation within and across different industries.

FIGURE 4

Access Impact Estimates

(Across All Years, Scaled by EBITDA)

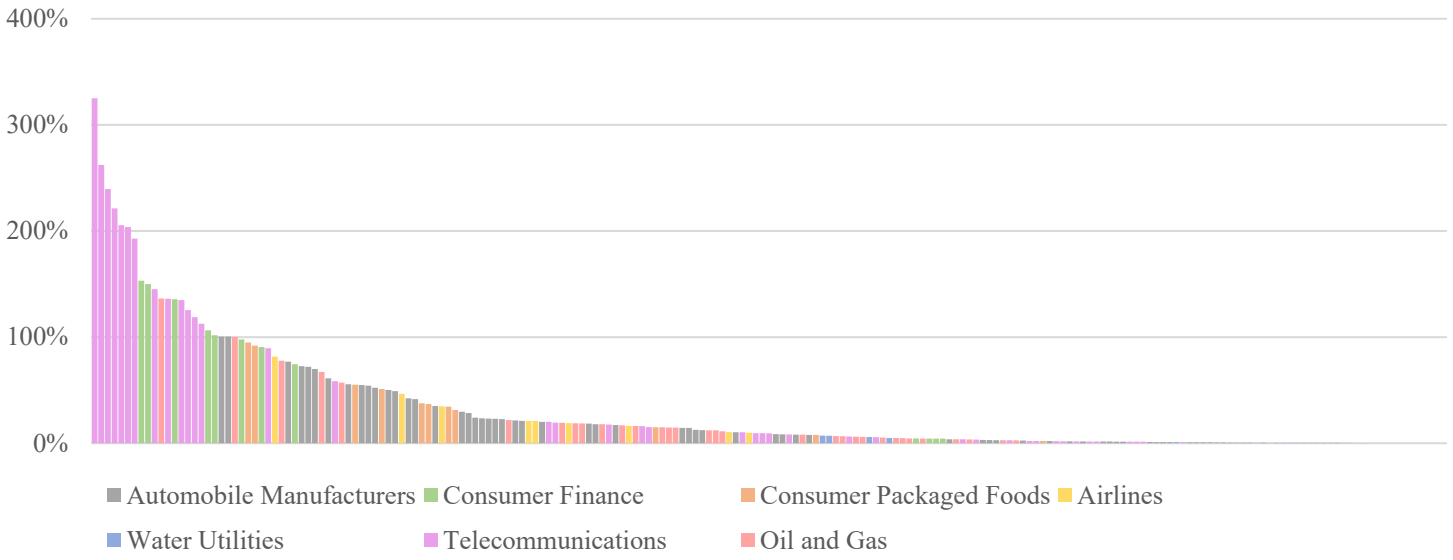


FIGURE 5

Quality Impact Estimates

(Across All Years, Scaled by EBITDA)

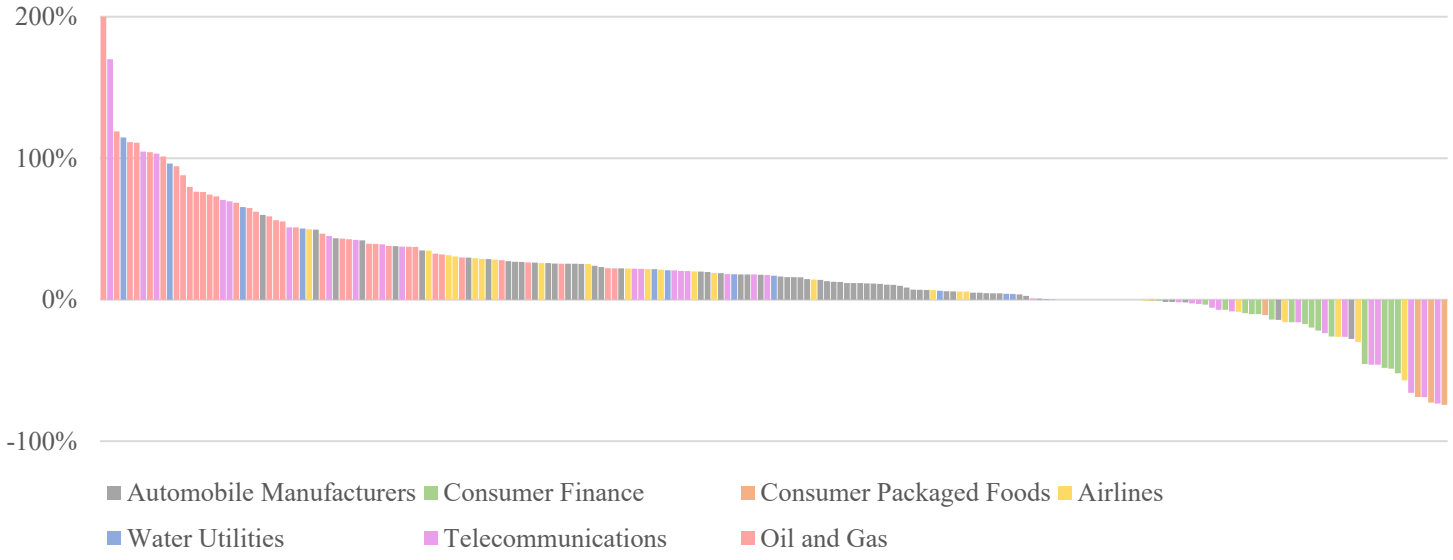


FIGURE 6

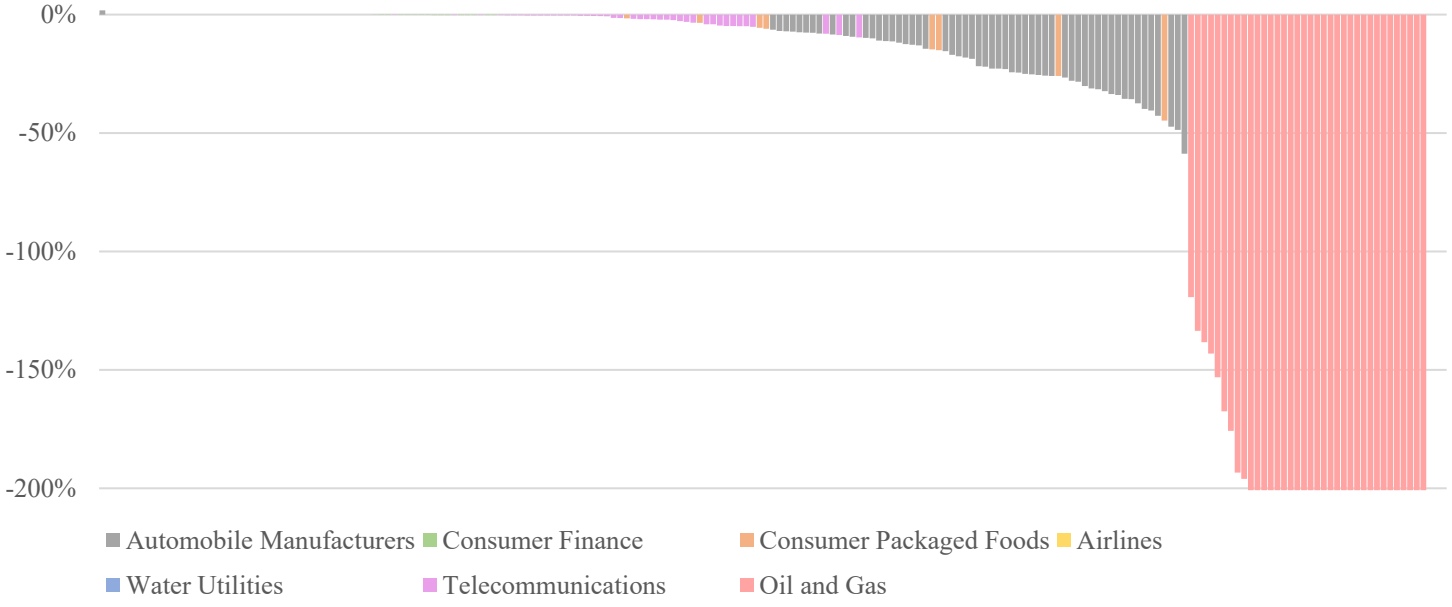
Optionality Impact Estimates

(Across All Years, Scaled by EBITDA)

FIGURE 7

Environmental Impact Estimates

(Across All Years, Scaled by EBITDA)



Examining the positioning of the individual companies provides information on industry leaders, laggards, and potentially future performance. The data suggests that Honda, Hyundai, Kia, General Mills, Discover, Capital One, Telefonica, Singtel, Alaska Airlines, JetBlue Airways, and Sabesp are product impact industry leaders. Examining performance over time, Ford, General Motors and Daimler have exhibited minimal improvement over time. In contrast, Fiat, Deutsche Telekom, BT Group, United Utilities and Alaska Airlines have shown significant improvement from 2015.

13.4. Hypotheses explaining industry-level variation

The application of the framework and methodologies allow us to examine the distribution of impact across companies within an industry and across industries. Observing systematic differences across industries in the relative frequency of positive or negative impact raises the question of why distributions might look different. For example, why for packaged foods firms do we observe a relatively negative concentration of values?

There are four hypotheses that can explain why we are observing generally negative product impact within the packaged foods industry. The first hypothesis is the *baseline case* in which the negative product impact estimated is consistent with and captures the impact of the industry. The second hypothesis is the *scope bias case* in which some positive impacts created by the packaged foods industry have not yet been estimated and included in the total product impact. The third hypothesis is the *measurement bias case* in which the benefits or costs are rightly scoped but incorrectly estimated, in this case benefits are underestimated, and costs overestimated. Finally, the fourth hypothesis is *sample selection bias* in which the companies selected in our sample are unrepresentative of the whole industry, in this case including product impact laggards and excluding product impact leaders.

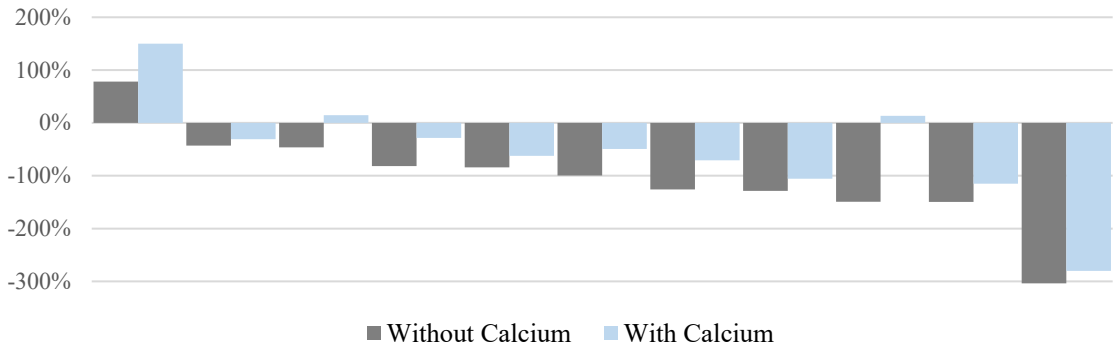
While the *baseline case* hypothesis aligns with concerns voiced by public health experts regarding nutrition, we also note that *scope bias* and *sample selection bias* may be influencing the extent of the negative product impact within the packaged foods industry. In this dataset, the effectiveness impact of packaged foods companies are estimated through five nutrients: fiber, whole grains, sodium, added sugar, and trans-fat. As the *scope bias case* indicates, the inclusion of other beneficial nutrients in this estimate could lead to a more positive overall product impact. Similarly, the inclusion of other harmful nutrients in this estimate could lead to a more negative overall product impact. We examine the marketing materials of packaged foods companies to

identify commonly mentioned nutrients that might be leading to *scope bias*. The two nutrients mentioned by multiple packaged foods companies are calcium and protein. We choose to examine how calcium influences the effectiveness impacts given the risk association between calcium and osteoporosis (Sunyecz 2008). Figure 8 shows how the distribution of overall product impact estimates for packaged foods manufacturers could shift with the inclusion of calcium in the effectiveness estimate.

FIGURE 8

Distribution of Overall Product Impact Estimates Scaled by EBITDA

(With and Without Calcium)



The overall product impact estimates without calcium are shown in gray. To the left of each overall product impact estimate without calcium is that company's respective overall product impact estimate with calcium included. By including calcium in the overall product impact estimate, the distribution of product impact estimates has become less negative with three companies now displaying positive product impact. The inclusion of calcium does not uniformly improve overall product impact estimates, with companies selling predominantly breakfast foods and dairy products demonstrating the most marked changes. While *scope bias* may be skewing the overall product impact estimates negative, it is important to note that there needs to be conservatism and care in selecting nutrients for inclusion in the effectiveness dimension to avoid a false view of the industry. This example with calcium in consumer-packaged foods highlights the biases that may arise with calculating impact within the effectiveness dimension. While effectiveness impacts rooted in customer satisfaction will have a distribution of positive and negative impacts observed across the industry, effectiveness impacts that are directly measured could lead to mostly positive

or negative estimates, as in the case with packaged foods. Systematic measurement across different industries and companies will enable us to test whether the measurement methodologies lead to systematic differences. For comparability, we focus this dataset on the five nutrients commonly found in packaged foods. Companies conducting their own impact-weighted accounts may find it informative to include additional nutrients as we have demonstrated with calcium.

Finally, the *sample selection bias* could skew the overall product impact estimates negative if the companies in this dataset are unrepresentative of the industry. This dataset consists of thirteen of the largest global packaged food conglomerates. It is possible that the product impact of packaged food conglomerates is unrepresentative of smaller independent packaged foods companies.

13.5. Product impact estimates and financial performance

An important analysis that impact measurement enables is understanding the relationship between product impact and financial performance. For example, do firms give up profitability to pursue more positive product impact? Or is it the case that pursuing more positive product impact leads to stronger financial performance? We categorize firms as "High-Impact" or "Low-Impact" based on their overall product impact across all years and then benchmarking within industry. Our "High-Impact" sample thus consists of 7 automobile manufacturers, 6 packaged foods manufacturers, 2 consumer finance firms, 3 airlines, 6 telecommunications firms, 2 water utilities, and 4 oil and gas firms and the same is the case for "Low Impact." We note that given the small sample we do not intend to assess statistical significance but rather to provide a blueprint of how financial analysis could be examined in the presence of more data. Moreover, our analysis presents associations rather than causal links between product impact and financial performance. Such analysis requires a significantly larger dataset of product impact estimates.

We ask three performance-related questions. First, are products with better impact selling more over time thereby high product impact firms exhibit higher sales growth? Second, are products with better impact enabling a company to exhibit higher profitability ratio in terms of return on assets (ROA)? Third, we decompose ROA to a profitability margin effect, in terms of return on sales (ROS), and an operating efficiency effect, in terms of asset turnover, to understand what might be driving differences in profitability, according to the equation:

$$ROA = ROS \times Asset\ Turnover = \frac{Operating\ Income}{Sales} \times \frac{Sales}{Assets}$$

We first compare year-over-year sales growth of "High-Impact" and "Low-Impact" firms to identify whether firms with higher product impact demonstrate higher sales growth. We calculate the median estimate within each group to avoid outliers from calculating the mean value. We find that "High-Impact" firms tend to display higher sales growth (Figure 9). In Figure 10, we examine return on assets to identify whether firms with higher product impact demonstrate higher profitability. We find that high-impact firms display similar or slightly higher profitability ratios (ROA), similar profitability ratios for three out of four years at around 4%.

FIGURE 9

Year-over-Year Sales Growth for
High and Low Product Impact Firms

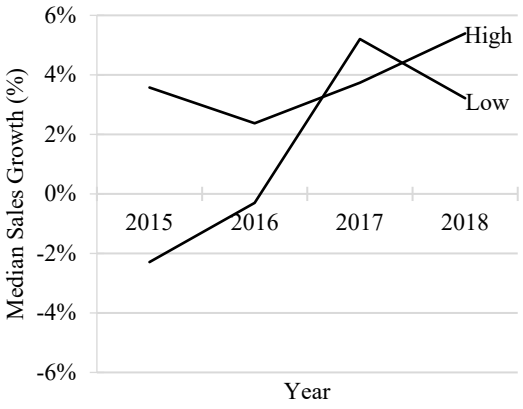
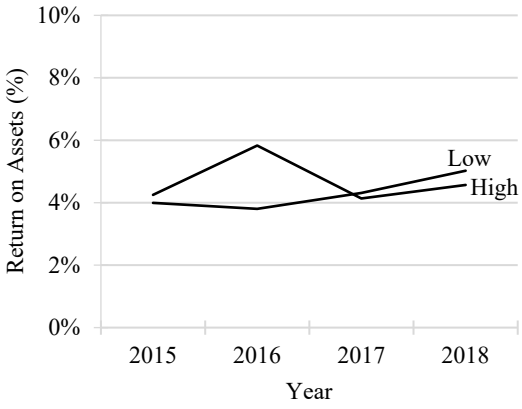


FIGURE 10

Return on Assets for
High and Low Product Impact Firms



Next, in Figures 11 and 12, we examine return on sales and asset turnover to determine how profitability margin and operating efficiency drive profitability ratios for "High-Impact" and "Low-Impact" firms. "High-Impact" firms achieve a higher return on sales for three out of four years. While affordability is a dimension of product impact and lower pricing could be characteristic of "High-Impact" firms, the lower pricing does not necessarily result in lower return on sales. "High-Impact" firms achieve a similar asset turnover ratio to "Low-Impact" firms at around 0.6

FIGURE 11

Return on Sales for
High and Low Product Impact Firms

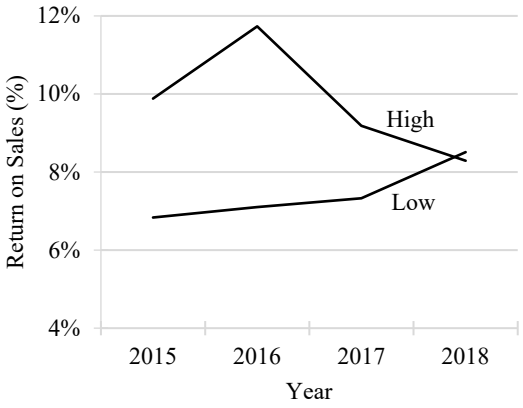
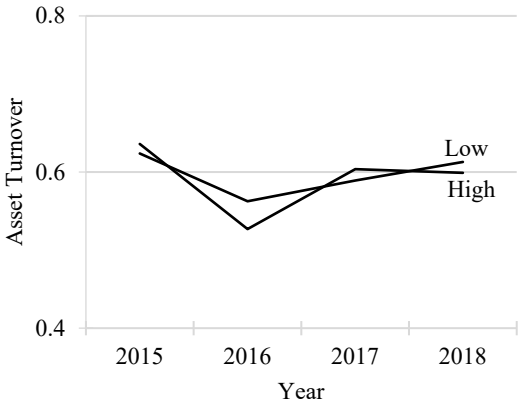


FIGURE 12

Asset Turnover for
High and Low Product Impact Firms



We recognize that with the available observations of product impact, it is difficult to determine clear associations with financial performance. As we expand the product impact framework applications to additional industries, we will continue to examine the relationship between a company's product impact and profitability.

CHAPTER 14
ACCOUNTING TREATMENT

As these identified product impacts are to be used in decision-making, the accounting treatment of these impacts needs to be considered. These considerations include where to recognize these impacts in financial statements and the timing of recognition.

In determining where to recognize product impacts, it is useful to identify where other product-related line items are recognized. For example, product sales are recognized in the income statement as revenue. Following the treatment of product sales, product impacts could likely be recognized as an adjustment to revenue. A company with overall negative product impacts would find their impact-weighted revenue lower than their financial revenue while a company with overall positive product impact would have a higher impact-weighted revenue than their financial revenue number. Although product impact is recognized in the income statement there needs to be consideration of potential balance sheet effects. While product impact in this case is not to be recognized as an asset or a liability, the positive or negative effect would flow to other comprehensive income. These impacts are non-cash flow items that can contribute to equity which is recorded in the balance sheet and amortized or impaired over time as the effects from product impact become obsolete.

With regards to the timing of impact recognition, product impact could be recognized when the actions influencing impact take place. This is preferable to recognizing impact at point of sale since the recognition should not be forward looking. For an automobile manufacturer, the timing of recognition for the dimensions of product impact can vary by when the action occurs. This is highlighted when one examines emissions and recyclability. With emissions, the impact would be recognized for the duration of expected product life since the vehicle is being used throughout product life and the emission particulates are being emitted during that usage. This is preferable to recognizing emissions impact at point of sale since the particulate emissions have not yet been created. On the other hand, their recyclability impact would be recognized at end of product life since that is when the vehicle is being recycled.

CONCLUSION

Although interest in ESG metrics has grown significantly, the focus has largely been around operational activities rather than impacts created through product use. Product impact has been difficult to systematically measure given the idiosyncratic nature of the impacts and the tendency to view products in broad categorizations of simply good or bad. This idiosyncrasy is highlighted in the efforts of the few companies, investors, and disclosure frameworks that identify product impact.

The creation of a product impact framework that captures a product's reach, accessibility, quality, optionality, environmental use emissions, and end-of-life recyclability allows for a systematic methodology that can be applied to different companies across a wide range of industries. This enables transparency, comparability, and scalability within product impact reporting. The identified standard dimensions on which product impact can be measured are rooted in existing measurement efforts, allowing publicly available data to be leveraged.

To ensure applicability, determine feasibility, and identify nuances within each dimension of product impact, the framework is tested on industries across most Global Industrial Classification Sectors (GICS) of the economy. The examples presented in this paper highlight the need for ongoing discussion and refinement of industry-accepted assumptions given new information and changes to industries and technology over time. Input from industry is crucial for the framework to be widely applicable. The examples also demonstrate how general estimates of impacts can become more precise when applying internal company data with more granularity within this framework.

Our hope is that this handbook shows the feasibility, scalability and value of product impact accounting and as a result seeds future efforts among academics, policy makers, investors, information intermediaries, NGOs, and corporate managers to build upon the framework and industry-specific models to provide impact transparency in the 21st century.

A1. Appendix: Packaged Foods Effectiveness

Data			
Company datapoints		**A**	**B**
Nielsen & USDA	Fiber sold (g)	65.7bn	32.5bn
	Sodium sold (mg)	7,321bn	2,494bn
	Trans fat sold (g)	3.0m	515.6m
	Sugar sold (g)	27.2bn	9.3bn
	Whole grains sold (g)	0.7bn	73.0bn
Industry assumptions			
NCBI	Fiber on reduced CHD risk	15.5%	
USDA	Annualized DV of fiber (g)	9,125	
BMJ	Sodium on CVD risk increase	17%	
PLoS Med	Excess sodium consumed (%)	32%	
	Individual excess consumed (mg)	401,500	
PLoS Med	Grains on reduced CHD risk	6.0%	
	Annual assoc. consumption	18,250	
Harvard School of Public Health	Trans fat on CHD risk increase	23.0%	
	Annual assoc. consumption	1,866	
Harvard Health Publ	Sugar on CVD risk	38%	
UCSF	Excess sugar consumed (%)	56%	
	Individual excess consumed (mg)	1446860%	
American Heart Association	Prevalence of CHD	5.23%	
	Medical cost of CHD	$5,297.62	
	Indirect cost of CHD	$5,892.86	
	Prevalence of CVD	41.50%	
	Medical cost of CVD	$3,096.40	
	Indirect cost of CVD	$2,307.69	

Estimation		
	A	**B**
Whole grains sold	715,488,000	72,955,896,645
	÷	
Annualized DV of grains	18,250	
	=	
Individuals reached	39,205	3,997,583
	x	
Grains on CHD risk	6.0%	
	x	
Prevalence of CHD	5.2%	
	x	
CHD costs	$11,190.48	
	=	
Whole grains impact	**$1,376,705**	**$140m**
Added sugar sold	27,183,839,440	9,265,585,300
	x	
Excess sugar sold (%)	55.7%	
	÷	
Annual excess consumption	14,469	
	=	
Individuals reached	1,046,897	356,834
	x	
Sugar on increased risk	38.0%	
	x	
Prevalence of CVD	41.5%	
	x	
CVD costs	$5,404.09	
Sodium impact	**-$892m**	**-$304m**
Trans fat sold	3,029,740	515,626,935
	÷	
Consumption for risk	1,866	
	=	
Individuals reached	1,624	276,393
	x	
Trans fat on CHD risk	23.0%	
	x	
Prevalence of CHD	5.2%	
	x	
CHD costs	$11,190.48	
Trans fat impact	**-$218,613**	**-$37m**

A2. Appendix: Telecommunications Effectiveness

Data

Company datapoints		A	B
Firm PR	High-speed internet offered	50.25	486.46
10-K	High-speed customers	13,729,000	6,100,000
Firm PR	Low-speed internet offered	2.88	6.08
10-K	Low-speed customers	20,000	861,000
Firm PR	Wireless speed	21.10	101.80

Industry assumptions		
FCC	Median internet speed	72.00
FCC	Cut-off speed for internet work-use	50.00
OOKLA	Average wireless download speed	27.33
Assumed	Maximum speed increase with value realized	150%
BLS	Annual seconds on internet for work	2,779,110
BLS	Annual seconds on internet for leisure	2,266,650
eMarketer	Annual seconds on wireless internet for multi	470,850
World Bank	Global hourly wage	$4.24
Pharmaco	Global hourly value of leisure	$1.11

Estimation

	A	B
(Low-speed internet speed	2.88	6.08
Activity affected by speed	*(Work)*	*(Work)*
	-	
Work internet speed)	50.00	
	=	
Speed differential (up to max)	-47.12	-43.92
	x	
Work seconds on internet	2,779,110	
	=	
Missing or gained megabytes	-131m	-122m
	÷	
Median internet speed	72.00	
	=	
Equivalent hours lost / gained	-505.3	-470.9
	x	
Low-speed internet customers	20,000	861,000
	=	
Total hours lost / gained	-10m	-405m
	x	
Value of hourly leisure	$4.24	
	=	
Low-speed effiency impact	**-$43m**	**-$1,720m**
Wireless speed	21.10	101.80
	-	
Median internet speed)	27.33	
	=	
Speed differential (up to max)	-6.23	13.67
	x	
Work seconds on internet	470,850	
	=	
Missing or gained megabytes	-3m	6m
	÷	
Median internet speed	27.33	
	=	
Equivalent hours lost / gained	-29.8	65.4
	x	
Wireless customers	171m	118m
	=	
Total hours lost / gained	-5,108m	7,717m
	x	
Value of hourly leisure	$1.11	
	=	
Wireless effiency impact	**-$5,677m**	**$8,576m**

Note: We assume rural areas are served by a single telecommunications company and exclude rural customers from the low-speed internet customers in the above calculation. For geographies in which a service provider is the sole-service provider, there is no benchmark for comparison as the average industry speed and company speed are the same.

A3. Appendix: Additional References Beyond Footnotes

A.H. Seddik, J. Branner, R. Helmy, D.A. Ostwald, S. Haut, *The Social Impact of Novartis Products: Two Case Studies from South Africa and Kenya.* Basel/Berlin/Darmstadt, August 2018.

ABN AMRO Group N.V., "Impact Report 2018", page 18. Accessed September 11, 2019.

Addy, C., Chorengel, M., Collins, M. and Etzel, M., 2019. Calculating the value of impact investing: An evidence-based way to estimate social and environmental returns. *Harvard Business Review*, 97(1), pp.102-109.

AkzoNobel, "AkzoNobel Report 2018", pages 155 – 157. Accessed September 16, 2019.

American Heart Association. Cardiovascular Disease: A Costly Burden for America. Published 2017. Accessed September 2020.

Andreyeva, T., Long, M.W. and Brownell, K.D., 2010. The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food. *American Journal of Public Health*, 100(2), pp.216-222.

Bain Capital Double Impact, "Year in Review." Published May 2019. Accessed September 18, 2019.

BASF, "BASF 2018 Report", pages 68 – 106. Accessed September 10, 2019.

Beaumont, N.J., Aanesen, M., Austen, M.C., Börger, T., Clark, J.R., Cole, M., Hooper, T., Lindeque, P.K., Pascoe, C. and Wyles, K.J., 2019. Global ecological, social and economic impacts of marine plastic. *Marine Pollution Bulletin*, 142, pp.189-195.

Blasco, J.L., King, A., McKenzie, M., Karn, M., 2017. "The road ahead: The KPMG Survey of Corporate Responsibility Reporting 2017," KPMG International, page 9. Accessed July 9, 2019.

Ciroth, A. and Franze, J. *LCA of an Ecolabeled Notebook: Consideration of Social and Environmental Impacts Along the Entire Life Cycle*. Berlin, 2011.

De Luca, A.I., Iofrida, N., Strano, A., Falcone, G. and Gulisano, G., 2015. Social life cycle assessment and participatory approaches: A methodological proposal applied to citrus farming in Southern Italy. *Integrated environmental assessment and management*, 11(3), pp.383-396.

Freiberg, D., Park, D.G., Serafeim, G. and Zochowski, R., 2020. Corporate Environmental Impact: Measurement, Data and Information. *Harvard Business School Impact-Weighted Accounts Research Report*, (20-098).

Global Sustainable Investment Alliance. 2018 Global Sustainable Investment Review. Downloaded from GSI-Alliance Website on July 9, 2019.

Gloria, T., Guinée, J., Kua, H.W., Singh, B. and Lifset, R., 2017. Charting the future of life cycle sustainability assessment: A special issue. *Journal of Industrial Ecology*, 21(6), pp.1449-1453.

Goedkoop, M.J. Indrane, D., de Beer, I.M., 2018. Product Social Impact Assessment Handbook - 2018, Amersfoort, Netherlands.

Greenberg, P.E., Fournier, A.A., Sisitsky, T., Pike, C.T. and Kessler, R.C., 2015. The economic burden of adults with major depressive disorder in the United States (2005 and 2010). *The Journal of Clinical Psychiatry*, 76(2), pp.155-162.

GRI, UN Global Compact, WBCSD. "SDG Compass – The guide for business action on the SDGs". Published 2015. Accessed December 2020.

Hebebrand, J., Albayrak, Ö., Adan, R., Antel, J., Dieguez, C., de Jong, J., Leng, G., Menzies, J., Mercer, J.G., Murphy, M. and van der Plasse, G., 2014. "Eating addiction", rather than "food addiction", better captures addictive-like eating behavior. *Neuroscience & Biobehavioral Reviews*, 47, pp.295-306.

KPMG International Cooperative, "KPMG True Value Case Study Safaricom Limited". Accessed September 17, 2019.

Lifset, R. and Boons, F., 2012. "Industrial ecology: Business management in a material world." In *The Oxford Handbook of Business and the Natural Environment*.

Marshall, G.L., Kahana, E., Gallo, W.T., Stansbury, K.L. and Thielke, S., 2020. The price of mental well-being in later life: the role of financial hardship and debt. *Aging & Mental Health*, pp.1-7.

Martínez-Blanco, J., Lehmann, A., Muñoz, P., Antón, A., Traverso, M., Rieradevall, J. and Finkbeiner, M., 2014. Application challenges for the social Life Cycle Assessment of fertilizers within life cycle sustainability assessment. *Journal of Cleaner Production*, 69, pp.34-48.

KKR, "2018 ESG, Impact, and Citizenship Report." Accessed September 18, 2019.

McRae, M.P., 2017. Dietary fiber is beneficial for the prevention of cardiovascular disease: an umbrella review of meta-analyses. *Journal of Chiropractic Medicine*, 16(4), pp.289-299.

Mozaffarian, D. 2018. "Food is Medicine: Why Healthier Eating Should be a Priority for Health Care Providers, Insurers and Government", National Association of Insurance Commissioners & The Center for Insurance Policy and Research.

Mozaffarian, D., Katan, M.B., Ascherio, A., Stampfer, M.J. and Willett, W.C., 2006. Trans fatty acids and cardiovascular disease. *New England Journal of Medicine*, 354(15), pp.1601-1613.

NS, "NS Annual Report 2018", pages 7 and 127. Accessed September 13, 2019.

Partnership for Carbon Accounting Financials. The Global GHG Accounting and Reporting Standard for the Financial Industry. Published November 18, 2020. Accessed December 2020.

Rischbieth, A., Serafeim, G. and Trinh, K., 2020. Accounting for Product Impact in the Consumer-Packaged Foods Industry. *Harvard Business School Impact-Weighted Accounts Research Report*, (21-051).

Serafeim, G. and Trinh, K., 2020. Accounting for Product Impact in the Consumer Finance Industry. *Harvard Business School Impact-Weighted Accounts Research Report*, (21-061).

Serafeim, G., Zochowski, TR., Downing J., 2019. “Impact-Weighted Financial Accounts: The Missing Piece for an Impact Economy”, Harvard Business School.

Strazzullo, P., D’Elia, L., Kandala, N.B. and Cappuccio, F.P., 2009. Salt intake, stroke, and cardiovascular disease: meta-analysis of prospective studies. *BMJ (Clinical Research Edition)*, 339, p.b4567.

Suckling, J.R. and Lee, J., 2017. Integrating environmental and social life cycle assessment: asking the right question. *Journal of Industrial Ecology*, 21(6), pp.1454-1463.

Sunyecz, J.A., 2008. The use of calcium and vitamin D in the management of osteoporosis. *Therapeutics and Clinical Risk Management*, 4(4), p.827.

The Carlyle Group, “Corporate Sustainability Report 2019.” Accessed September 18, 2019.

Vodafone Netherlands, “Environmental Profit and Loss Methodology and Results 2014/15”. Accessed September 17, 2019.

Volvo Construction Equipment, “Environmental Declaration Volvo Articulated Haulers”. Accessed September 12, 2019.

Yorkshire Water, “Our Annual Performance Report 2018/2019.” Published July 2019. Accessed September 16, 2019.