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Accounting for Product Impact in the Airlines Industry

George Serafeim, Katie Trinh*

Impact-Weighted Accounts Project Research Report

Abstract

We apply the product impact measurement framework of the Impact-Weighted Accounts Initiative (IWAI) in two competitor companies within the airlines industry. We design a monetization methodology that allows us to calculate monetary impact estimates of fare affordability, timeliness and gate control, among other factors. Our results indicate substantial differences in the impact that competitors have through their products. These differences demonstrate how impact reflects corporate strategy and informs decision-making on industry-specific areas, including airline route structure choices.

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1. Introduction

Although significant progress has been made in the environmental and social metrics disclosed by companies and prescribed by reporting standards, these mostly pertain to a company's operations and are still not embedded in financial statements. In contrast to employment or environmental impacts from operations, product impacts, which refer to the impacts that occur from usage of a product once a company has transferred control of the good or service, tend to be highly idiosyncratic limiting the ability to generalize and scale such measurements. As such, for companies that do measure 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 even more limited.

We have put forth a framework in which product impacts can be measured and monetized in a systematic and repeatable methodology across industries and have provided a sample application to the automobile manufacturing industry to address these issues.[1] Within any industry, the framework can be applied using a set of standard principles, industry assumptions and public data to estimate product impacts across the following seven dimensions.

FIGURE 1

Product Impact Framework Dimensions

Reach		**Dimensions of Customer Usage**			**Env Use**	**End of Life**
Quantity	Duration	Access	Quality	Optionality	Pollutants & efficiency	Recyclability
The magnitude of individuals reached	Length of time the product can be used, particularly for durables	Accessibility of product through pricing and efforts to provide for the underserved	Quality of product through health, safety, effectiveness, and inherent need or goodness	Ability to choose an alternative product with full information and free will	All pollutants and efficiencies enabled through customer usage	Projected product volume recycled at end of product life

In this paper we apply the framework to two competitor companies in the airlines industry. We then discuss potential data points and data sources for monetization and detail the decisions

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

behind assumptions made. Finally, we provide examples of insights specific to the aviation industry that can be derived from impact-weighted financial accounts and their analysis. The application of the product impact framework to the aviation industry demonstrates feasibility and actionability, while also providing guidance on the nuances and decision-making of applying the framework to other similar industries. The impacts derived demonstrate the potential for product impact measurement to inform strategic decision-making. 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.

2. Application of the product impact framework

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.

2.1 Data collection process

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 make use of existing data and metrics with the goal of incorporating publicly available data.

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.

3. Airline application of the product impact framework

3.1 Overall impacts estimated

TABLE 1

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	Monopoloy	Emissions	Recyclability
A	$8bn	$0.7bn	-$0.3bn	Passengers 42m Miles 51bn	$213m	-	-	$291m	-	-$112m	Captured in another IWAI pillar	To be represented as data is available
B	$44bn	$1.6bn	-$3.3bn	Passengers 192m Miles 225bn	-	-	-$2m	$1,614m	-	-$3,309m		

* 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[2]. Finally, current disclosure levels prevent estimation of the recyclability impact. Since both

[2] 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.

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.

3.2 Reach

TABLE 2

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

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

3.3 Access - Affordability

TABLE 3

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**	**-**

3.3.A 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.

3.3.B 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.[3] 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.

3.3.C The impact estimate

As shown in Table 3, 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 3 by identifying passenger miles flown and the relevant pricing for fare classes and routes of interest.

3.4 Access – Underserved

3.4.A 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

[3] 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>.

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.[4] 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.

3.5 Quality – Health and Safety

TABLE 4

Health and Safety of Company A and B

Data			
Company datapoints		**A**	**B**
NTSB	Individuals affected by accident	0	4
Industry assumptions			
BITRE	Accident costs	$525,821	

Estimation		
	A	**B**
Individuals affected by accident	0	4
	x	
Accident costs	$525,821.00	
	=	
Health and safety impact	**-**	**-$2m**

3.5.A 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

[4] 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>.

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 5 that estimates Company A's impact from averted criminal activity.

TABLE 5

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**

3.5.B 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[5]. The cost associated with trafficking applied in Table 5 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[6].

3.5.C 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.

[5] "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.

[6] 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.

3.6 Quality – Effectiveness

TABLE 6

Effectiveness Impact of Company A and B

Data			
Company datapoints		**A**	**B**
BTS	Arrival delay (%)	26.7%	13.7%
BTS	Cancellations (%)	2.1%	0.4%
	Cancellation fee	$25.00	$200.00
SASB	Average fare	$175.11	$182.03
ATCR	Baggage issues / 1000 passengers	1.39	1.20
ASCI	Customer satisfaction	79%	74%
Industry assumptions			
BTS	Industry arrival delay (%)	18.8%	
UMD	Cost per delayed passenger	$34.28	
BTS	Industry cancellations (%)	1.6%	
ACTR	Baggage issues / 1000 passengers	2.84	
Luglock	Cost of mishandling	$50.00	
ASCI	Customer satisfaction	73%	

Estimation		
	A	**B**
Industry delays (%)	18.8%	
	-	
Company delays (%)	26.7%	13.7%
	x	
Passengers	42m	192m
	x	
Cost of delay	$34.28	
Delay impact	**-$114m**	**$332m**
Industry cancellations (%)	1.6%	
	-	
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**

3.6.A 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.

3.6.B 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.[7] Industry and carrier baggage mishandling rates come from the Office of Aviation Enforcement and Proceedings' Air Travel Consumer Report.[8] Customer satisfaction data comes from the American Customer Satisfaction Index.[9] Industry assumptions regarding the cost to travelers from delay come from research reports by The National Center of Excellence for Aviation and Operations Research.[10] 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.

3.6.C 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

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

[8] "Air Travel Consumer Report". *The Office of Aviation Enforcement and Proceedings. Aviation Consumer Protection Division.* Published February 2019. Accessed November 2020.

[9] "Benchmarks by Industry – Airlines". The *American Customer Satisfaction Index.* Published 2019. Accessed November 2020.

[10] 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.

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 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.

3.7 Quality – Basic Need

3.7.A 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.[11] This further indicates that air travel is not a basic need.

3.8 Optionality

TABLE 7

Optionality Impact of Company A and B

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**

3.8.A 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. [12] 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.[13]

3.8.B 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.[14] 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

[11] 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.
[12] 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.
[13] "Airlines Sustainability Accounting Standard". *Sustainability Accounting Standards Board.* Published October 2018. Accessed November 2020.
[14] "Air Carriers: T-100 Domestic Market (All Carriers)". *Bureau of Transportation Statistics.* Published April 2020. Accessed November 2020.

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.[15] While contemporary literature estimates price premiums of both hub airports and low-cost carrier entry, we apply the estimate from the DOT and GAO given our goal is to apply an estimate that has been widely accepted by the industry.[16] As regulatory bodies adopt findings from contemporary literature, the assumptions applied in this example would be refined to reflect the new industry consensus.

3.8.C 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.

3.9 Environmental Usage Emissions

3.9.A Airline usage emissions

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.[17] 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.

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[15] 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.
[16] 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.
[17] 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.

3.10 End of Life Recyclability Impact

3.10.A Airline end of life recyclability impact

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.

TABLE 8

End of Life Recyclability Impact of Company A

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

4. Discussion

This application of the product framework to airlines not only indicates feasibility of estimating monetary product impacts within this industry, but also demonstrates the potential value of impact-weighted financial statement analysis. The product impact dimensions reflect an airline's strategic focus. Airlines that perform well on the affordability dimension are likely low-cost rather than full-service carriers. The optionality dimension can also indicate strategic decisions around operating models, with airlines performing well on the optionality dimension likely operating a point-to-point model rather than a hub-and-spoke model. The effectiveness dimension can indicate how these strategic choices and operating models influence timeliness.

Furthermore, the effectiveness dimension can highlight airlines that are outliers in on-time performance given their operating model.

Another potential analysis could compare the product impacts of different companies. Within a single industry, one can identify differences in how the two companies approach different product attributes. For example, our analysis suggests that Company A is more affordable and less monopolistic than Company B without sacrificing effectiveness. However, Company A's effectiveness is rooted in customer satisfaction while Company B has better on-time performance. Analyzing each dimension allows for a deeper understanding of the business strategies employed by each company.

Finally, the impact-weighted financial statement analysis indicates which dimensions are most material to product impact creation. In the airlines industry, the impact is driven mostly by dimensions that influence the quality of the product, most specifically, the effectiveness dimension, followed by affordability and optionality. This suggests that the variance in company performance on product impact in airlines is most dependent on timeliness and customer service.

4.1 Application of impact-weighted financial statement analysis

To provide a comprehensive example of the information enabled by impact-weighted financial statement analysis, we generated product impact estimates for other companies within the airlines industry. These estimates allow us to identify competitive dimensions of product impact within airlines and company strategy and product impact performance over time.

The dataset consists of product impact estimates across 4 years, 2015 to 2018, of the 6 leading publicly traded airlines in the United States with over $2 billion in revenue to ensure data availability and comparability. Given the industry assumptions used for monetizing product impact stay constant throughout the industry, the product estimates are calculated by applying the industry-wide assumptions to the respective company-specific data points as demonstrated with Companies A and B. For comparability, we examine the product estimates scaled by EBITDA and revenue.

For consistency of methodology, company-specific data on pricing comes from the Airline Data Project, company-specific data on accidents and incidents comes from the National Transportation Safety Board, company-specific data on delays and cancellations comes from the Bureau of Transportation Statistics, company-specific data on baggage mishandling comes from the Office of Aviation Enforcement and Proceedings, customer satisfaction data comes from the American Customer Satisfaction Index, and estimates of passengers facing monopolistic gate control comes from the Bureau of Transportation Statistics.

TABLE 9

Product Impact of Airlines

	Impact Scaled by EBITDA			Impact Scaled by Revenue		
Impact	N	Average	SD	N	Average	SD
Affordability Impact	24	10.87%	0.19	24	2.19%	0.04
Health and Safety Impact	24	-0.01%	0.00	24	0.00%	0.00
Effectiveness Impact	24	11.77%	0.24	24	2.54%	0.05
Optionality Impact	24	-10.87%	0.12	24	-2.02%	0.02
Overall Product Impact	24	11.76%	0.38	24	2.71%	0.07

Table 9 shows summary statistics for all impact variables. Examining the average impact scaled by EBITDA and revenue indicates that affordability, effectiveness, and optionality are significant drivers of product impact. Effectiveness is also characterized by a larger standard deviation, indicating variance in how firm strategy and decisions can influence effectiveness.

FIGURE 2

Distribution of Overall Product Impact Estimates Scaled by EBITDA

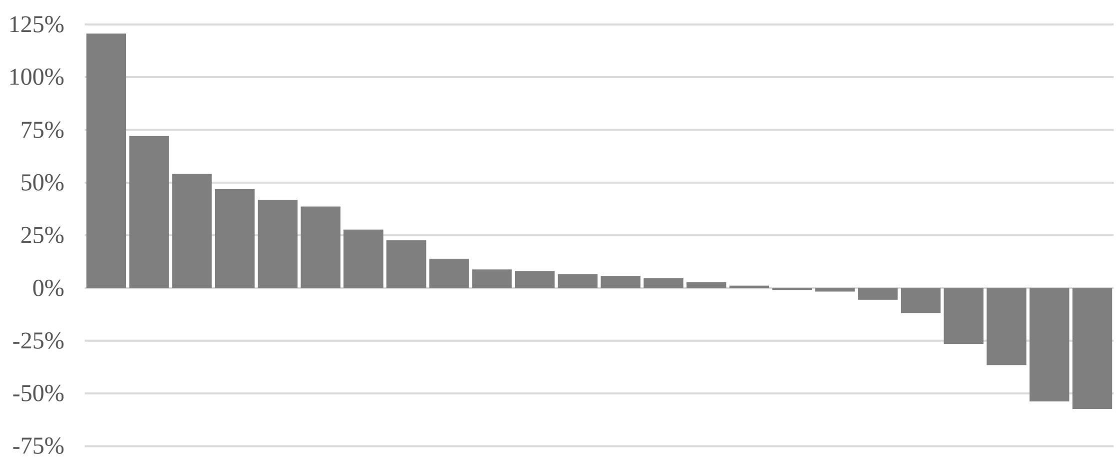


Figure 2 shows the distribution of total product impact in the sample showing significant variation. The distribution exhibits a slightly positive mean and skew, suggesting that the firms in our sample overall deliver more positive product impact.

4.2 Hypotheses explaining positive product impact estimates

There are four hypotheses that can explain the product impact we are observing within the airlines industry. The first hypothesis is the *baseline case* in which the product impact estimated is consistent with and captures the impact of the industry. The second hypothesis is the *scope bias case* in which some impacts created by the airlines 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. Finally, the fourth hypothesis is *sample selection bias* in which the companies selected in our sample are unrepresentative of the full industry.

We minimize issues of *scope bias* by estimating the impact of identified product impact issues raised in airline financial and sustainability disclosures. However, we note there may exist impacts which have not yet been estimated due to current data availability, such as averted or enabled criminal activity and recyclability innovations. To minimize the *measurement bias case*, we use commonly accepted industry research and guidance to estimate benefits and costs. Finally, given the list of firms that meet our criteria for data collection are all from one geography, it is possible that there is *sample selection bias* if this geography is unrepresentative of global airlines.

4.3 Discussion of insights enabled by impact-weighted financial statement analysis

Figure 3

2015 Overall Product Impact Estimates

(Scaled by EBITDA)

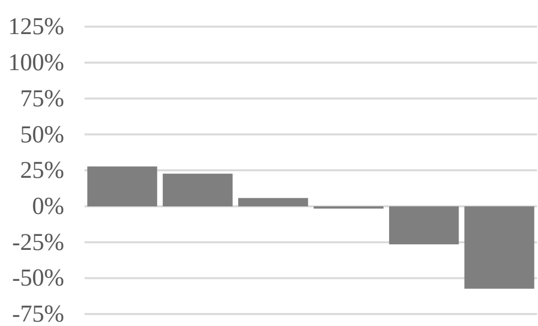
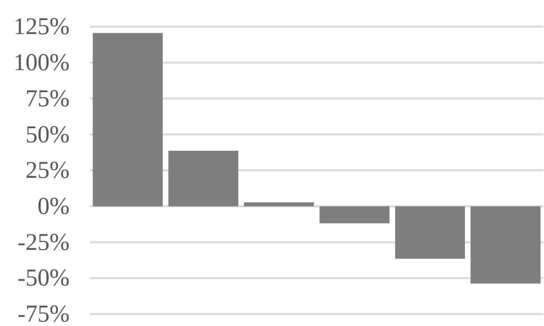


Figure 4

2018 Overall Product Impact Estimates

(Scaled by EBITDA)



Comparing the distribution of overall product impact estimates in 2015 and 2018 indicates greater dispersion in the overall product impact performance. Alaska Airlines and JetBlue, the two firm leaders, demonstrate significant improvement over time. Three firms demonstrate more negative product impact, and the industry laggard demonstrates consistent performance. In both years, there are three firms with positive product impact and three firms with negative product impact. We note that while the firm leader, Alaska, displayed improvement in affordability and effectiveness, the magnitude of impact in 2018 is more pronounced due to a significant decrease in EBITDA. We next examine the distribution of product impact estimates to identify dimensions of product impact that are most influential within airlines.

Figure 5

Affordability Impact Estimates

(Across All Years, Scaled by EBITDA)

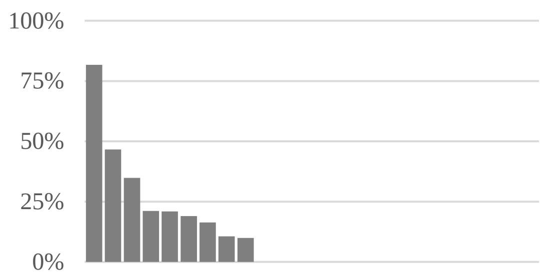


Figure 6

Health & Safety Impact Estimates

(Across All Years, Scaled by EBITDA)

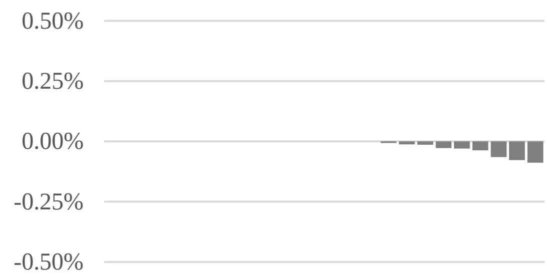


Figure 7

Effectiveness Impact Estimates

(Across All Years, Scaled by EBITDA)

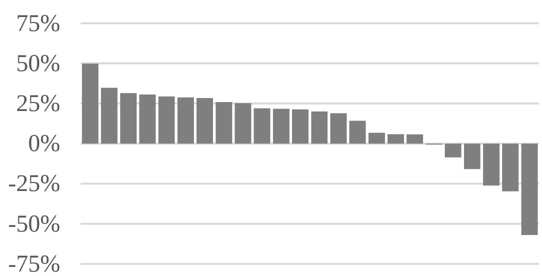
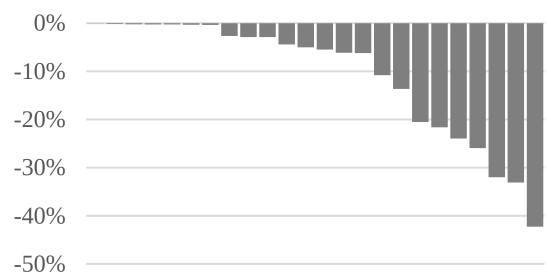


Figure 8

Optionality Impact Estimates

(Across All Years, Scaled by EBITDA)



Comparing the distribution of product impact by dimension provides information on which dimensions are drivers of product impact within airlines and how the dimensions influence overall product impact numbers.

The magnitude and distribution of the affordability dimension suggests that affordability is a key driver of product impact for firms with affordable travel offerings. Alaska Airlines and JetBlue lead the affordability dimension across all years observed.

The magnitude of the health and safety dimension suggests that the airlines observed in this dataset are relatively safe with few breaches to health and safety. Thus, health and safety is not a key driver of product impact for the airlines in this dataset but of course that would be different when examining airlines that might have had significant safety violations.

The magnitude and distribution of the effectiveness dimension suggests that effectiveness is a key driver of the observed variation in product impact across firms in the dataset. Both Alaska Airlines and Southwest Airlines have demonstrated improvement in effectiveness, moving from below average performance in 2015 to leading in effectiveness impact in 2018. JetBlue has consistently performed above average across the four years observed.

The magnitude and distribution of the optionality dimension suggests that optionality and gate control is an issue for all firms in the dataset. While all airlines in the dataset have minimal optionality issues in 2015 and 2016, the variation in performance increases drastically in 2017 and 2018 and could account for some of the observed dispersion in product impact estimates between 2015 and 2018. By 2018, the firms operating with a hub-and-spoke model exert monopolistic gate control in their hub airports affecting up to 30% of their customers.

Examining the relationship between product impact performance across different dimensions, we identify trade-offs in different operating and strategic decisions. While all firms in our dataset exhibit increasing monopolistic gate control over time, firms operating with a hub-and-spoke model in our dataset exhibit declining effectiveness due to timeliness while firms operating with a point-to-point model exhibit increasing effectiveness. This suggests some gate control may be conducive for effectiveness, up to a certain threshold.

Overall, examining the dimensions of product impact suggests that the increase in dispersion of product impact from 2015 to 2018 is driven by the improvement of leading firms in the affordability and effectiveness dimensions combined with an increase in magnitude of the optionality impact of laggard firms.

5. Conclusion

Although interest in ESG measurement continues to grow significantly, 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 and bad. The creation of a product impact framework 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 data that is publicly available to be leveraged.

To ensure applicability, determine feasibility, and identify nuances within each dimension of product impact, we examine applications of the framework to company pairs across each GICS sector. In this working paper, we provide a sample application to the airlines industry. We use publicly disclosed data and industry-wide assumptions to derive monetary estimates of a product's reach, accessibility, quality, optionality, environmental use emissions and end of life recyclability. While publicly disclosed data can provide meaningful insights, use of internal company data can further enable precision and support internal decision-making. This example also highlights the need for ongoing discussion and refinement of industry-accepted assumptions as contemporary literature leads to changing guidance over time.

This paper is one within the series of applications of the framework across each GICS sector, covering airlines in the transportation sector. Ultimately, the aspiration is to develop and provide a framework that enables more informed decisions which account for the many impacts created by products.