Estimates of Potential Harm to U.S. Small and Medium Sized Businesses from Proposed Antitrust Legislation Aimed at Large Digital Platforms

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Executive Summary

This report estimates conservatively that small and medium-sized retail businesses ("SMB Sellers") would lose roughly $500 billion in sales in just the first five years after the passage of the "Big Tech" antitrust legislation currently being considered by Congress (particularly S. 2992, the American Innovation and Choice Online Act, or AICOA, and its House equivalent, H.R. 3816) that essentially targets just Amazon, Apple, Meta (Facebook/Instagram/WhatsApp), and Alphabet (Google). Put differently, AICOA (if passed) would informally amount to a "regulatory tax" on SMB Sellers of 5.2% of their sales, or an average of $1,712 per SMB Seller per month. These losses would be secondary effects of the legislative proposals' direct impacts on, primarily, Amazon, Alphabet (Google), and Meta (Facebook, Instagram), as these firms provide fundamental advertising, marketing, and commerce services to several million SMB Sellers.

SMB Sellers, even those that have physical stores or wholesale their products, increasingly sell through digital channels.[1] Roughly 70% of SMB Sellers use either a web-based store or an online marketplace, with some using both and also selling through other digital technologies such as social media platforms and delivery apps. Web stores and online marketplaces drive about 35% of SMB Seller revenue nationally. If antitrust legislation directed at large digital platforms (particularly S. 2992 and H.R. 3816) becomes law as written today, there would be myriad unintended consequences for smaller businesses that use these platforms and the tools they provide, and also for the consumers who shop at these SMBs.

A recently published paper by Cameron Miller and Richard Wang identifies several ways that the proposed legislation would negatively impact digital platforms and SMBs, including SMB Sellers.[2] Miller and Wang describe how SMB Sellers and their customers would lose access to high-value and low-cost platform services, and their only options would be to forgo these services or use more costly and less effective substitutes. As a result, SMB Sellers would have more difficulty and expense reaching prospective customers, and consumers would find it more difficult and expensive to access SMB Sellers' products. Sales would decrease as a result.

The research presented here estimates five years of SMB Sellers' lost sales due to the legislation's negative impacts. To develop the estimate, the paper first estimates the amount in 2019 that SMB Sellers' sales increased due to the developments in information and communications technology (ICT) during the ICT revolution of the new millennium, and then estimates the portion of that ICT contribution to 2019 sales that would have been lost if the proposed legislation had then been law. Finally, assuming a January 1, 2023 effective legislative date, the research conservatively uses the 2019 estimated loss as the estimate of the lost sales in 2023, and then, again conservatively, assumes that the losses would continue for only an additional four years.[3] The AICOA itself designates a seven-year enforcement period for its inefficiency-creating restrictions of online platform providers that are designated as "covered platforms" under the Act.

The results are devastating: The model, which uses conservative assumptions to ensure that the lost sales are not overestimated, estimates that SMBs would lose about half a trillion dollars in sales in the first five years after the new laws take effect. The $500 billion in estimated lost SMB sales reflects the aggregate effects of higher costs for digital platform services and lost access to some of those services.

For each SMB Seller, we calculate the average monthly revenue loss – or some may consider this the monthly "tax" created by these legislative proposals – to be an estimated $1,712. This figure reflects that average 2019 monthly sales in the retail and food/beverage sectors are $32,917 (the "tax" is 5.2% of their sales).[4]

The most important reason that the paper's estimates are conservative is that it only estimates lost sales of SMB Sellers in the retail sector (NAICS 44-45) and the food services and drinking places industry (NAICS 722).[5] The loss in all SMB sales economy-wide (which would include sales of SMBs in all sectors of the economy) would be much greater than the amount estimated for retail and food services SMB Sellers, which constitute only about one-fifth of the over 31 million SMBs nationwide.[6] The estimate is also conservative because the estimate of annual harm is for 2019, while SMB use of e-commerce and digital marketing has increased since then, and because the disruption caused for digital platform services would most likely last for more than five years. If the proposed legislation passes and disrupts access to digital platforms and tools for SMB Sellers, our conservative estimates of the likely harm document that the proposed legislation creates a substantial risk for SMB Sellers.

To put the estimated harm into its context, first observe that the $500 billion is the present value of five years of annual harm at the level estimated for 2019 for the SMBs in retail and food services. That estimated harm for 2019 is $118.3 billion, which is 5.2% of the SMB sales in retail and food services and 1.9% of the total sales in retail and food services for 2019.[7] Since the employment in SMBs in retail and food services is 21.6% of employment of SMBs in the entire economy [8], the aggregate harm that the legislation would cause for SMBs throughout the entire economy could be between four and five times what we have estimated for the SMBs in retail and food services.

Introduction

On June 24, 2021, the U.S. House of Representatives Judiciary Committee in a bipartisan vote favorably reported out and sent six antitrust bills to the floor of the U.S. House of Representatives—H.R. 3843, the Merger Filing Fee Modernization Act of 2021; H.R. 3460, the State Antitrust Enforcement Venue Act of 2021; H.R. 3849, the Augmenting Compatibility and Competition by Enabling Service Switching (ACCESS) Act of 2021, H.R. 3826, the Platform Competition and Opportunity Act of 2021, H.R. 3816, the American Choice and Innovation Online Act, and H.R. 3825, the Ending Platform Monopolies Act.[9] On January 20, 2022, the U.S. Senate Judiciary Committee approved with bipartisan support and sent to the floor of the Senate the American Innovation and Choice Online Act (AICOA), "antitrust legislation forbidding the largest tech platforms from favoring their own products and services over competitors" (Tracy, 2022). The purpose of this white paper is to develop dollar figures of what the harm could be for the U.S. retail sector's small and medium sized businesses (SMBs) if Congress enacts the new antitrust legislation currently being considered as one way to regulate the behavior of dominant providers of digital platform services.

Goal and Rationale for Approach

DCI (2021b) has cataloged the ways that SMBs in the retail sector rely on digital tools to support their sales, and DCI (2021a) has identified the ways that provisions in the proposed antitrust legislation could harm the functioning of digital tools on which SMBs depend. This white paper develops, explains, and estimates a model that makes it possible to quantify that potential harm in dollars. The model developed tests the hypothesis that digital tools made available by the information and communications technology (ICT) revolution have supported and enabled the growth of sales for SMBs, and estimating the model provides support for the hypothesis. This paper uses the model's estimates to quantify in dollar terms the negative impact on SMB retailers' sales that would result if the market solutions that provide those tools were disrupted.

A DCI companion paper by Miller and Wang (2022) identifies the ways that the proposed legislation would negatively impact SMBs. Those negative impacts include both effects for developers operating in innovation ecosystems and effects for SMBs using transactional marketplaces.[10] Because of those negative impacts, SMBs and their customers would lose access to some services provided by digital platforms and/or be forced to use more costly and less effective substitute services. Customers would find it more difficult and expensive to access the products sold by SMBs, and as a result their sales would fall.

This paper estimates the loss in sales that the negative impacts of the legislation would cause. To develop the estimate, the paper first estimates what the new millennium's ICT has contributed to sales, and then the paper estimates the portion of the ICT contribution to sales that would be lost because of the legislation.

An alternative approach would be to estimate the dollar value of the harm associated with each of the negative impacts identified in Miller and Wang (2022). Although such an approach would in principle allow quantifying the costs of digital platform services' lost effectiveness for each of the several individual negative impacts, developing the data for the harm in dollars for each individual negative impact would at best be difficult, and at worst impossible, because there are many variables for each, and much new information must be developed.

As explained in Miller and Wang (2022), the firms targeted by the proposed legislation provide multiple digital platforms that serve different sets of SMB users. Developing the necessary data to quantify the harm in lost sales for each of the individual impacts would require interviews with appropriate points of contact among each of the various sets of SMB users and the providers of the platform services they use and then the development and administration of appropriate survey instruments for each of those sets of users and providers. Thus, developing and analyzing the data would not be completed in time to inform decisions about the legislation.

Instead, the approach used in this paper starts with the legislation's negative impacts on SMBs as those effects are identified in the companion paper (Miller and Wang, 2022). Because of those identified negative effects, SMBs will lose sales if the proposed legislation passes. This paper, using readily available data, estimates those lost sales.

Terminology

The White Paper uses specific terminology to describe retail sales resulting from the digital tools made available by the ICT revolution. "Sales at Risk" is the term used to describe retail sales above and beyond what would be predicted by demand and cost shifters in the counterfactual absence of the evolution of the availability of digital tools for retail as the ICT revolution took hold. These extra sales because of the increasing availability of digital tools from the ICT revolution are the sales at risk if the proposed new antitrust legislation becomes law. Of course, not all of the sales at risk would be lost if the new legislation disrupted the digital platform companies' provision of services to SMBs. The paper develops an estimate of the proportion of the sales at risk that would be lost—the "Lost Proportion" is the term used. The product of SMB "Sales at Risk" and the "Lost Proportion" is the estimate of the harm to SMBs that the proposed legislation would cause—termed "Harm to SMBs".

Results

This paper conservatively estimates that small and medium-sized retail businesses ("SMB Sellers") would lose roughly $500 billion in sales in just the first five years after the passage of the "Big Tech" antitrust legislation currently being considered by Congress (particularly S. 2992, the American Innovation and Choice Online Act, or AICOA, and its House equivalent, H.R. 3816) that essentially targets just Amazon, Apple, Meta (Facebook/Instagram/WhatsApp), and Alphabet (Google). Put differently, AICOA (if passed) would informally amount to a "regulatory tax" on SMB Sellers of 5.2% of their sales, or an average of $1,712 per SMB Seller per month. These losses would be secondary effects of the legislative proposals' direct impacts on, primarily, Amazon, Alphabet (Google), and Meta (Facebook, Instagram), as these firms provide fundamental advertising, marketing, and commerce services to several million SMB Sellers.

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The research presented here estimates five years of SMB Sellers' lost sales due to the legislation's negative impacts. To develop the estimate, the paper first estimates the amount in 2019 that SMB Sellers' sales increased due to the developments in information and communications technology (ICT) during the ICT revolution of the new millennium, and then estimates the portion of that ICT contribution to 2019 sales that would have been lost if the proposed legislation had then been law. Finally, assuming a January 1, 2023 legislative effective date, the research conservatively uses the 2019 estimated loss as the estimate of the lost sales in 2023, and then, again conservatively, assumes that the losses would continue for only an additional four years. It is noteworthy here that the AICOA itself designates a seven-year enforcement period for its inefficiency-creating restrictions of online platform providers that are designated as "covered platforms" under the Act.

The results are devastating: The model estimates that SMBs would lose about half a trillion dollars in sales in the first five years after the new laws take effect. The $500 billion in estimated lost SMB sales reflects the aggregate effects of higher costs for digital platform services and lost access to some of those services. For each SMB Seller, we calculate the average monthly revenue loss – or some may consider this the monthly "tax" created by these legislative proposals – to be an estimated $1,712. This figure reflects that average 2019 monthly sales in the retail and food/beverage sectors are $32,917 (the "tax" is 5.2% of their sales).[11]

The most important reason that the paper's estimates are conservative is that it only estimates lost sales of SMB Sellers in the retail sector (NAICS 44-45) and the food services and drinking places industry (NAICS 722).[12] The loss in all SMB sales economy-wide (which would include sales of SMBs in all sectors of the economy) would be much greater than the amount estimated for retail and food services SMB Sellers, which constitute only about one-fifth of the over 31 million SMBs nationwide.[13] The estimate is also conservative because the estimate of annual harm is for 2019, while SMB use of e-commerce and digital marketing has increased since then, and because the disruption caused for digital platform services would most likely last for more than five years. If the proposed legislation passes and disrupts access to digital platforms and tools for SMB Sellers, our conservative estimates of the likely harm document that the proposed legislation creates a substantial risk for SMB Sellers.

Harm to SMB Sellers was estimated for each of the 12 NAICS subsectors of the U.S. retail sector and for the NAICS 3-digit industry category for food services and drinking places, an industry category often considered together with the retail sector's three-digit industry categories when SMBs are discussed (see Table 1). Together, this grouping is an important representation of what we term "SMB Sellers" - SMBs that sell physical goods as all or part of their business, and in this case, the SMBs are retailers of those products. The estimate of the harm to SMBs that would be caused by the proposed legislation was derived in a five-step process, as follows.

Economic modeling of industry retail sales: First, following NAICS categories, a model of each industry's retail sales was generated. This model estimates how retail sales are affected by two kinds of forces: those that affect demand (e.g., consumers' purchasing power as indicated by their disposable income), and those that affect sellers' costs (e.g., costs to manufacture products; worker pay). The model also estimates the effect on the growth rate of retail sales provided by information and communications technology (ICT) above and beyond the sales that would be predicted by exogenous cost and demand shifters evolving over time. The availability of ICT infrastructure technology to both the retailers and their customers would be expected to affect the retailers' costs—lowering those costs per unit of retail services provided because the retailers can be more productive (i.e., provide a greater amount of retail goods for a given amount of the costs they incur, hence lowering costs per unit of retail output)—and to affect the customers' demand—increasing that demand (the quantity of the retail goods that the customers would want to purchase in a given period of time) given the customers' resources of purchasing power from income and time spent searching for and purchasing products.

Estimating "sales at risk" from loss of digital technologies: Second, the estimated model is used to determine "Sales at Risk" - retail sales above and beyond what would be predicted by demand and cost shifters in the absence of the evolution of the availability of digital tools for retail as the ICT revolution

took hold. The estimated Sales at Risk for each industry category is the estimate of the impact of the ICT revolution on each industry category's sales, calculated as the difference between (a) the actual retail sales for each industry category and (b) the model's prediction of those sales in the counterfactual scenario in which the ICT revolution had not improved retailers' sales via digital technologies. The result of multiplying the SMB employment share of each industry category (from Table 1) with the estimated Sales at Risk (which includes larger businesses) for each of the industry categories provides the SMB Seller Sales at Risk.[14]

The availability of the digital tools has enabled SMBs in specialized subsectors (including "nonstore" retailers) of the total retail sector to gain not only sales above and beyond the sales that would have been expected by the demand and cost conditions absent the digital tools, but also to gain sales at the expense of four subsectors where sales (indicated by the employment shares that are available at the requisite levels of disaggregation) [15] are overwhelmingly from very large retailers: general merchandise stores (e.g., Walmart, Target) where SMBs had only 1.4% of the employment in 2015, electronics and appliance stores (e.g., Best Buy, Lowe's) where SMBs had 35.4% of the employment in 2015, building material and garden equipment dealers (e.g., The Home Depot, Lowe's) where SMBs had 36.8% of the employment in 2015, and health and personal care stores (e.g., Walgreens, CVS) where SMBs had 31.2% of the employment in 2015. In the specialized sub sectors of the retail sector, SMBs using the digital tools provided by the ICT revolution gain sales for some of the products sold by large retailers in the industry categories where sales are lost.

Estimating the "lost proportion" of "sales at risk" due to legislation: Third, if the proposed new antitrust legislation became law and disrupted digital platforms and tools, it would disrupt some SMB retail sales made possible by these platforms and tools, but (of course) not all of them. Therefore, we developed an estimate of the proportion of the Sales at Risk that would be lost (between 0% and 100%), which we term the "Lost Proportion." This figure was estimated by analyzing the effect of two Congressional actions - namely, (a) the U.S. Senate Judiciary Committee approving with bipartisan support and sending to the floor of the Senate the American Innovation and Choice Online Act (AICOA), and (b) the U.S. House of Representatives Judiciary Committee in a bipartisan vote favorably reporting out and sending six antitrust bills to the floor of the U.S. House of Representatives - on the companies targeted by the legislation, Google, Apple, Facebook, Amazon, and Microsoft ("GAFAM"). Amazon's stock price was used as the least "diluted" metric because its main business segments are likely to see effects of the legislation relative to other companies in the group, and thus changes in the firm's stock price better reflect the potential legislative effect as seen by equities traders.[16] For Amazon, we expect to be able to observe the effect of an event that increases the probability that the proposed antitrust legislation will become law, and the Lost Proportion was estimated to be 0.1645 (16.45%).[17]

Calculating "harm to SMBs" by industry: Fourth, the product of SMB "Sales at Risk" and the "Lost Proportion" is the estimate of the harm to SMBs that the proposed legislation would cause ("Harm to SMBs"), calculated as dollars of sales that would be lost in one year. Table 1 indicates negative values, by enclosing the values in parentheses, for the Harm to SMBs in the four sub sectors (see discussion above about estimating "sales at risk") where the disruption of digital platforms would to an extent reverse the loss in sales to SMBs in other categories.

Calculating "Harm to SMBs" across all SMB Sellers: Finally, for the year 2019 (the most recent year for which appropriate data are available prior to the economic disruptions caused by the COVID-19 pandemic), Harm to SMBs as annual sales lost is estimated to be $118.3 billion for the NAICS industries for retail plus food services and drinking places. This $118.3 billion is a conservative estimate of current and future annual harm potentially caused by legislation, because the reliance of SMB Sellers on digital platforms and tools has grown since 2019 (particularly during the COVID-19 pandemic (Connected Commerce Council, 2021). Also, the estimate is in dollars of 2019, and so going forward the estimate for each year in the dollars of that future year would be higher because of inflation. Thus, if one conservatively assumes that disruption due to the legislation would last for only five years after the passage of the legislation, for retail plus food services and drinking places the total estimated Harm to SMBs is $499.1 billion. The amount is what the present discounted value would be in 2019 dollars, at the time the legislation became law, for five successive years of annual Harm to SMBs at the estimated level for 2019.[18]

Table 1. Estimating Harm To SMB Sellers Due To Legislation [19]

Type of SMB	NAICS Code	Number of U.S. SMB Sellers with Paid Employees [20]	Proportion of U.S. SMB Sellers in Industry [21]	Number of U.S. SMB Seller Employees	Proportion of the U.S. Industry's Employment Taken by U.S. SMB Sellers [22]	Estimated Harm to SMB Sellers in Annual Sales Lost in 2019 [23]
Motor vehicle and parts dealers	441	80,571	0.998	1,366,727	0.695	$73.3 billion
Furniture and home furnishings stores	442	32,668	0.998	233,652	0.495	$2.6 billion
Electronics and appliance stores	443	24,693	0.998	170,691	0.354	($4.7 billion)
Building material and garden equipment and supplies dealers	444	48,996	0.999	499,007	0.368	($12.1 billion)
Food and beverage stores	445	115,905	0.998	983,662	0.300	$6.0 billion
Health and personal care stores	446	43,027	0.999	342,409	0.312	($4.4 billion)
Gasoline stations	447	64,425	0.998	520,360	0.570	$11.2 billion
Clothing and clothing accessories stores	448	56,959	0.997	355,063	0.184	$0.4 billion
Sporting goods, hobby, musical instrument, and book stores	451	30,628	0.998	201,067	0.308	$0.8 billion
General merchandise stores	452	7,992	0.994	44,374	0.014	($0.7 billion)
Miscellaneous store retailers	453	81,179	0.999	460,359	0.594	$6.1 billion
Nonstore retailers	454	59,120	0.998	387,422	0.656	$22.6 billion
Retail sector (sum of the above)	44-45	646,163	0.998	5,564,793	0.333	$101.1 billion
Food services and drinking places	722	461,482	0.997	7,188,176	0.632	$17.2 billion
Total SMB Sellers (Retail sector + Food services and drinking places)						$118.3 billion

To put the estimated harm into its context, first observe that the $499.1 billion is the present value of five years of annual harm at the level estimated for 2019 for the SMBs in retail and food services. That estimated harm for 2019 is $118.3 billion, which is 5.2% of the SMB sales in retail and food services and 1.9% of the total sales in retail and food services for 2019.[24] Since the employment in SMBs in retail and food services is 21.6% of employment of SMBs in the entire economy [25], the aggregate harm that the legislation would cause for SMBs throughout the entire economy could be between four and five times more than what we have estimated for the SMBs in retail and food services.

If the proposed legislation passes and disrupts the provision of digital platform services to SMBs, the estimates of the harm that could be caused support the view that the proposed legislation creates a substantial risk for SMB retailers, for SMBs in general, and for the U.S. economy.[26]

Methodology

The model to be estimated

When we study the retail sector and its subsectors, we are looking at collections of markets, and so our explanation for what we see at the sector level is grounded in an understanding of the product markets and their geographic markets that underlie the aggregated, macroeconomic time series for the retail sector and its subsectors. Thus, the time series for retail sales reflects a mix of different product markets and a mix of different geographic markets for those products, with various market structures for the sellers competing in the markets. Because the time series studied are made up of underlying markets, the microeconomic analysis of markets can inform our empirical work, and that is the basis for the model used in this paper.

Retail sales over time will be modeled as the outcomes of the equilibria over time as the supply and demand conditions change because of changes in the costs of retailers and changes in the purchasing power of their customers. The modeled outcomes have two parts. First, there are the outcomes that at the outset of the information and communications technology (ICT) revolution would have been expected from the changing conditions for supply and demand. Second, additionally, a growth rate in sales above and beyond what at the outset of the ICT revolution would have been predicted—predicted from the evolving purchasing power of customers and the evolving costs of suppliers over the years if that revolution had not advanced—is modeled as a function of the advance of the ICT revolution that enabled the new digital tools now used by retailers.

That second modeled outcome—an outcome resulting from the impact on retail sales of the advance of the new ICT digital tools now available to retailers and their customers—considers the ICT revolution to be a change in the infrastructure technology available to retailers and their customers. The year 2000 is used in the estimated model as the date for the onset of the ICT revolution with its development of the digital tools provided to retailers and their customers.[27] The availability of ICT infrastructure technology to the retailers and to their customers would be expected to affect the retailers' costs—lowering those costs per unit of retail services provided because the retailers can be more productive (i.e., provide a greater amount of retailed goods and services for a given amount of the costs they incur, hence lowering costs

per unit of retail output)—and to affect the customers' demand—increasing that demand (the quantity of the retail goods that the customers would want to purchase in a given period of time) given the customers' resources of purchasing power from income and time spent searching and purchasing retail products.

In sum, the model to be used is an estimable model of the retail sector's sales over time in the new millennium, with the sales evolving over time since the outset of the ICT revolution and determined by the evolution in the usual cost and demand shifters that affect the equilibrium retail sales, and also determined by the development of the digital tools and their availability—the evolution of the tools and their availability determining the growth rate in retail sales above and beyond what would be predicted by the evolving situation for the usual cost and demand shifters. (Appendix A provides a detailed discussion of the exact form for the estimated model.)

Introduction to the estimation

The model was estimated for each of the North American Industry Classification System (NAICS) 3-digit subsectors of the U.S retail sector and also for the NAICS 3-digit industry for food services and drinking places (often considered along with the retail subsectors when SMBs are examined). The results of the estimated models will be presented and discussed, with a focus on the estimated impact of the evolving availability of the digital tools on the growth rate in the retail sales after control for forces affecting cost (the retailers' cost of labor and other inputs) and forces affecting demand (such as customers' disposable personal income).

SMB enterprises make up over 99% of the total number of enterprises in each of the subsectors of the U.S. retail sector, but measured by the employment in the enterprises, the percentage of total employment taken by the employment in SMBs in each of the subsectors ranges from 1.4% for general merchandise stores to 69.5% for motor vehicles and parts dealers. For the retail sector as a whole, the number of SMBs is 99.8% of the total number of enterprises, while SMBs' share of retail trade employment is 33.3%. Table 2 shows the percentage of the total number of enterprises and the percentage of the total employment that SMBs take in each of the retail sector's subsectors and for food services and drinking places.

The hypothesis that digital tools have supported and enabled the growth of sales for SMBs suggests that (1) the impact of the digital tools on the growth rate of retail sales would be positive; and, moreover, (2) the effect on the growth rate would be greater for subsectors of the retail sector that have a larger proportion of the sales (which would reflect the SMB employment percentages in Table 2 rather than the establishment percentages) made by SMBs that are hypothesized to be especially dependent on the digital tools for their success. To study those expectations, the estimated effects of the ICT revolution's digital tools for the retail subsectors will be estimated and the results will be compared with the relative importance of SMBs in the subsectors. Additionally, the estimated models will be used to provide a measure of the potential harm—measured in dollars of lost sales—to SMBs if the proposed new antitrust legislation were enacted and disrupted the productivity of the digital tools that the ICT revolution has made available to SMBs and their customers.

Table 2.SMBs' Proportion of Total Enterprises and Total Employment for Subsectors of the U.S. Retail Sector and for Food Services and Drinking Places in 2015

Type of SMB	NAICS Code	Number of U.S. SMB Sellers with Paid Employees [28]	Total Number of Enterprises	SMB Proportion of Total Enterprises [29]	Employment in SMBs	Total Employment	SMB Proportion of Total Employment [30]
Motor vehicle and parts dealers	441	80,571	80,766	0.998	1,366,727	1,967,718	0.695
Furniture and home furnishings stores	442	32,668	32,735	0.998	233,652	471,572	0.495
Electronics and appliance stores	443	24,693	24,732	0.998	170,691	481,551	0.354
Building material and garden equipment and supplies dealers	444	48,996	49,060	0.999	499,007	1,357,086	0.368
Food and beverage stores	445	115,905	116,184	0.998	983,662	3,279,028	0.300
Health and personal care stores	446	43,027	43,068	0.999	342,409	1,096,372	0.312
Gasoline stations	447	64,425	64,543	0.998	520,360	913,526	0.570
Clothing and clothing accessories stores	448	56,959	57,149	0.997	355,063	1,929,920	0.184
Sporting goods, hobby, musical instrument, and book stores	451	30,628	30,674	0.998	201,067	652,108	0.308
General merchandise stores	452	7,992	8,040	0.994	44,374	3,218,983	0.014
Miscellaneous store retailers	453	81,179	81,284	0.999	460,359	774,769	0.594
Nonstore retailers	454	59,120	59,219	0.998	387,422	590,172	0.656
Retail sector (sum of the above)	44-45	646,163	647,454	0.998	5,564,793	16,732,805	0.333
Food services and drinking places	722	461,482	462,914	0.997	7,188,176	11,366,779	0.632

Variables for the Estimated Models for Subsectors of the U.S. Retail Sector

Table D.1 in Appendix D shows the variables used in the estimated models of the NAICS 3-digit industries for the U.S. retail sector and for food services and drinking places, providing the variable names, their definitions, and their sources. Nominal dollar values are converted to dollars of constant purchasing power so that dollar amounts are in constant dollars of 2012. Because the retail sector as a whole includes many different types of products, each subsector model estimated in "Extended Methodology and Modeling: Estimated Models for the Subsectors of the U.S. Retail Sector" and Appendix C will use a selection of the explanatory variables that is attuned to the circumstances underlying demand and cost for the subsector. Because we work with the 21 annual observations of the new millennium, there is the need to use a limited number of explanatory variables to conserve degrees of freedom while having enough explanatory variables to capture underlying forces of demand and cost for each subsector.

The dependent variables in the 13 models, one for each NAICS 3-digit industry, estimated in "Extended Methodology and Modeling: Estimated Models for the Subsectors of the U.S. Retail Sector" and Appendix C are the natural logarithms of annual retail sales for the subsector.

Qualitative 0-1 variables are used to control for years during which there was a recession, and for the year in the sample that was a pandemic year.

The demand shifters include the natural logarithms of disposable personal income, households' net worth, the personal loan rate, the auto loan rate, and expected inflation.

The cost shifters, listed in the order that they appear among selected sets of them used in the subsector modes, include the natural logarithms of weekly earnings for workers, durable manufacturing cost of materials, nondurable manufacturing cost of materials, manufacturing sector cost of materials, computer and electronic products cost of materials, food and beverage and tobacco products cost of materials, combined input costs for pharmaceutical and medicine manufacturing, crude oil price, apparel and leather and applied products cost of materials, and paper products cost of materials. A natural candidate for cost shifters would be the producer price index (PPI) for the manufactured goods upstream from each retail subsector where those goods are sold at retail. However, when suitable PPIs are available, they are available only as far back as 2009 and are therefore not useful for our study of the evolution of the digital tools in the ICT revolution over the period from 2000 through 2020. For that reason, for our cost-shifters other than the cost of labor, we go further upstream to measures of input costs, using various series for cost of materials, for the producers' goods that ultimately are sold in the retail sector.

The variable time counts the 21 years from 2000 through 2020 and captures any trend in the subsector's retail sales.

For ICTinfra (denoting the available ICT infrastructure as introduced in Appendix A), the variable used is Internet, the proportion of U.S. adults who use the internet, a variable that will reflect both the development of the digital tools and the ability of retailers to use those tools provided by the evolution of ICT infrastructure over the first two decades of the new millennium. The variable Internet rises from 0.52 in 2000 to 0.93 in 2021.

For evaluating the results of the models estimated in "Extended Methodology and Modeling: Estimated Models for the Subsectors of the U.S. Retail Sector" and Appendix C, remember that cost shifters can have opposite signs because they may be relevant in different markets of the subsector being studied, and in those different markets, the elasticities of demand may differ. More generally, remember that the variables can have different effects, hence different estimated coefficients, in different subsectors and in different markets of the same subsector, and so since the estimated models are for entire retail subsectors and estimate effects for variables that may influence retail sales differently in the underlying geographic and product markets, we do not expect the significance of the estimated coefficients to be as strong as would be the case if the models focused on explaining just one market's retail sales, i.e., just one market within the subsector.

Despite what is arguably a less than ideal set of variables for the cost shifters and despite the pooling of different geographic and product markets within the subsectors, the estimated models for the subsectors predict the actual retail sales for the subsectors quite well. For each subsector of the U.S. retail market, the following section on "Extended Methodology" plus Appendix C compare the time series for the dependent variable and for the subsector's model's prediction of that variable and show the upper and lower bounds for the 95% confidence interval of the model's prediction, providing visual evidence that the estimated models do a good job reflecting the forces determining retail sales.

How the Sales at Risk Are Estimated

If the ICT revolution had not made it possible for retailers to improve their use of digital tools to grow their sales, how would the picture of retail sector sales look? In the "Extended Methodology" and Appendix C, we use the estimated models for each subsector to provide an answer. Once the subsector's model of retail sales is estimated, we substitute for the actual data the counterfactual data about the situation without the development of the ICT infrastructure technology and ask what the estimated model would predict in the counterfactual circumstances. In place of the actual time series for the proportion of U.S. adults using the internet—a time series that captures, in a way relevant for understanding the extent to which retailers could improve their use of digital tools, the development of the ICT revolution over time, with the proportion being 0.52 in 2000 and growing over time to 0.93 in 2021—we substitute a counterfactual time series that keeps the proportion of U.S. adults using the internet at its level in 2000.

Thus, using the counterfactual data with the estimated model for a subsector's retail sales, in the "Extended Methodology" and Appendix C, we can estimate the prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. We compare the actual retail sales for each subsector and the model's prediction of those sales in the counterfactual scenario in which the ICT revolution had not made possible the improvement in the retailers' use of digital tools. The difference between the actual sales and the counterfactual sales is our estimate of the impact of the ICT revolution on the subsector's sales, and that difference is our Sales at Risk for the subsector.

We want an estimate of the potential Harm to SMBs that could result if the proposed new antitrust legislation became law, and, of course, the proposed legislation would not cause a loss in all the SMB sales that resulted from the availability of digital tools for retailing. Just a portion of the expected Sales at Risk would be lost. What do we expect that Lost Proportion of Sales at Risk to be? We turn to that question next.

Estimation of the Lost Proportion

To estimate the proportion of sales at risk that would be lost if the proposed new antitrust legislation became law, we use an event study analysis of the daily stock price for Amazon around the time, June 24, 2021, that the U.S. House of Representatives' proposed new legislation was sent to the floor of the House for consideration, and also around the time, January 20, 2022, that the U.S. Senate's proposed new legislation was sent to the floor of the Senate. We use Amazon because it is the one company of the group, Google, Apple, Facebook, Amazon, and Microsoft (GAFAM), for which all its main business segments are exposed to major damage because of the House and Senate bills.[31] For an event study such as the one we use, it is important that the event's effect on the firm's stock price is not diluted because the effect is for just a small subset of the firm's business activities. For Amazon, we expect to be able to observe the effect of an event that increases the probability that the proposed antitrust legislation will become law.

For the event study analysis, we define y_t as the daily percentage change, measured as a proportion, in Amazon's stock price; thus, denoting the stock's closing price on day t as P_t, $y_t = (P_t - P_{t-1})/P_t$. The variable NASDAQ is the daily percentage change, measured as a proportion, in the NASDAQ composite index, using the daily close for the index.[32] The variable event1day is a qualitative 0-1 variable that is defined to = 1 on the day of the event, and zero otherwise. Thus, for the June 24th, 2021, event, event1day takes the value 1 on that day, and it equals zero for all the other days observed. The variable event3day is defined to be 1 the day of the event and also equals 1 the day before the event and the day after the event, and it is zero otherwise. The variable event2day is defined to be 1 the day of the event and also equals 1 the day after the event, and it is zero otherwise. The alternative definitions of the qualitative variable for the event allows us to use a crude check to see if there is any evidence that the stock market anticipated the announcement before the day of the event, and also to check if the market took an extra trading day to assimilate the information about the event and incorporate its implications for future profits into the stock price. A version of the event qualitative variable that considered just the day before and the day of the event for the period when the information about the event was processed by the market was never as significant as the other three versions of the "event window" and so we do not present that version of the model here.

For the event of the House legislation reaching the House floor and for the event of the Senate legislation reaching the Senate floor, the event study analysis uses the daily stock prices over a couple of months centered on the date of the event. For the June 24, 2021, event, we examine the 43 trading days from May 24, 2021, through July 3, 2021, with 42 trading days observed after creating the percentage change, as proportions, variables. The results of estimating the three models with the alternative event windows are shown in Appendix B.

For the January 20, 2022, event, we examine the 42 trading days from December 22, 2021, through February 22, 2022, with 41 trading days observed after creating the percentage change, as proportions, variables. The results of estimating the three models with the alternative event windows are shown in Appendix B.

If Amazon's stock value was based 100% on the stream of returns from providing digital platform services to support SMB retail sales, then the percentage drop in value measured by the coefficient on the event variable reflects the percentage drop in the efficacy of those services supporting SMB retail sales. Note well: with the variables y_t and $NASDAQ_t$ measuring the percentage change as a proportion, our percentage drop in value as measured by the estimated coefficient is the coefficient multiplied by 100. For example, if the coefficient on the event qualitative variable is 0.02, that connotes a 2% drop in the value of the stock.

Because less than 100% of Amazon's value is from providing services supporting the SMB sales, the percentage drop in Amazon's stock price relative to the portion of value from providing SMB support services would be greater than what is indicated by the estimated coefficient. We have estimated Δ(Stock Price)/(Stock Price), and the numerator, i.e., the change in the price reflects the drop in value from providing services supporting SMBs, but the denominator is the stock price value reflecting all of Amazon's business, and of course not all of it is providing platform services to SMBs. If the legislation disrupts the digital platform services that SMB retail sales rely on, what would be the percentage of SMB retail sales at risk that would be lost?

The sales at risk are those sales relying on the digital tools that have evolved as the ICT revolution has progressed, and the coefficient that we have estimated in the event study models of Amazon's daily stock price tells us the proportion of those sales at risk that would be lost if Amazon's only business was providing the platform services to SMBs. Thus, if 100% of the stream of returns to investors that is the basis for the Amazon stock value were from sales of SMBs on the platform, then the coefficient on the event in the model that shows the percentage of value lost would be the percentage needed for the multiplier to go from the SMB sales at risk to the lost value because of the legislation. The estimated coefficient would measure the percentage decline in the efficacy of Amazon's provision of platform services to SMBs.

However, by the end of 2018, 53% of sales on Amazon's digital platform were from third party sellers (Dayton, 2022). By the end of 2021, that percentage had risen to 56% (Coppola, 2022). Thus, an estimate of the proportion of SMB retail sales at risk that would be lost would be the estimated coefficient divided by 0.56, because the coefficient shows the change in stock price relative to 100% of Amazon's business, and we want the estimate of that drop in value (because the legislation would disrupt third-party platform services) relative to the value of the third-party services. Thus, for example, if the coefficient on the event variable was estimated to be 0.02, the percentage lost from the value of the platform services to third-party sellers would be 0.02/0.56 = 0.0357 or a 3.57%. For several reasons, that estimate is an underestimate of the percentage of the SMBs sales-at-risk that would be lost if the proposed legislation becomes law.

The first reason that the estimate is an underestimate is that not all of the third-party sellers using Amazon's digital platform are SMBs, and we expect that disrupting the digital platform services will harm SMB third-party sellers more than larger sellers.[33] Our estimated percentage, obtained by dividing by the proportion of third-party sellers in sales, is a conservative estimate of the Lost Proportion for SMB Sales at Risk. We have found the correct proportion for all of the third-party sellers, but if disrupting digital platform services will harm SMB sellers more than the larger third-party sellers, then our estimate of the Lost Proportion is an underestimate for the SMB sellers.

The second reason we have an underestimate of the percentage of SMB sales at risk that would be lost is that our estimated coefficients in the event study models do not reflect all of the impact of the legislation on the stock price. For one thing, some of the effect of the event will have been factored into the stock price prior to the event because the event will have been anticipated to occur with some probability. Once the event did occur, that probability is 1 and an effect on stock price is observed, but some of the effect of the event will already have been incorporated in the price. For another thing, not all the legislation's impact is seen in the estimated coefficient because the events that we have modeled are the event of sending proposed legislation to the floor of the House and the event of sending proposed legislation to the floor of the Senate. The effect on the expected profit stream from which the stock price change results would be the effect of the legislation if it should pass multiplied by the increase in the probability that the legislation would pass—an increase in probability triggered by the two events that we have observed.

Additionally, our percentage is underestimated because the coefficient on the event qualitative variable shows an effect after we have controlled for the percentage changes in the NASDAQ composite index, and in part those changes reflect effects of the legislation on the big platform companies and on other tech companies listed on NASDAQ. So, the effect we capture in the estimated coefficient is an effect after such changes captured by the movement of NASDAQ stock prices as a group.

From the list of reasons that we have underestimated the percentage of sales at risk that would be lost if the legislation passes, there is one that we can include in our calculations. Namely, the events we have observed are not the actual passage of the bills, so the estimated effect shown by a coefficient on the event variable is an effect given that investors use the information provided by the event to increase their expectations of the probability that the bills will be passed, but that probability is less than 1.0. So, for example, if prior to the event investors considered the probability of passage was zero, and the event caused them to raise that probability to 0.5, then the expected earnings reduction that drives the estimated coefficient on the event variable is the product of 0.5 and the investors' expectation of lost earnings because of reduced efficacy—that would be caused by the passage of the legislation—of platform services for third-party sellers. Thus, the impact expected if the legislation actually passed, or if the probability of it passing was thought to be 1.0, would be twice the impact observed with the analysis of the event.

At the time of writing, observers on Capitol Hill place the probability of passage of the new antitrust legislation in some form at between 40% and 60%. Combining that probability of 0.5 with the assumption that the two events—sending bills to the House and the Senate—each contributed 0.25 to the current probability of 0.5 implies that for the first event, the estimated effect is the result of an expected reduction in the stream of returns that is one-fourth of what the reduction caused by the legislation would be. With each new event that raises the probability that the legislation will pass, we have another chance to observe the percentage of sales at risk that would be lost if the legislation passes. For example, for our second event, the January 20, 2022, event, the estimated effect if the information of the event causes investors to think the probability of the legislation passing jumps from 0.25 to 0.5, increasing by 0.25, we would see an impact on the stock price that reflected an increase in the expected reduction in future earnings by the amount of 0.25 times the reduction should the legislation pass. Thus, the estimated coefficient for each event reflects an expectation of a drop in earnings just one-quarter of what would be expected if the legislation became law. Hence, continuing our example with an estimated coefficient of

0.02 for the first event, our estimate of the percentage of sales at risk that would be lost if the legislation passed is (1/.25)*(.02/.56 = 0.0357) = 0.143 or 14.3%. If the estimated coefficient for the second event was again 0.02, we would have another observation that implied 14.3% as the percentage of sales at risk that would be lost if the legislation passed.

Turning now to our coefficient estimates rather than the illustrative example for a coefficient equal to 0.02, inspection of the alternative models estimated shows that the most significant model for both the June 24, 2021, and the January 20, 2022, events is the one with the two-day event window. The coefficient for the June 24, 2021, model is − 0.0195, and the coefficient for the January 20, 2022, model is − 0.0266. Thus, for the first event, the estimated coefficient implies that the percentage reduction in the sales at risk would be (1/.25)*(.0195/.56) = 0.139 or 13.9% if the legislation passes. The second event provides another estimate of the percentage, and the estimate is (1/.25)*(.0266/.56) = 0.19 or 19%.

For each event, these expected reductions in sales are determined by the expected reductions in the stream of returns from which stock value is formed, and we expect sales to be proportional to the expected stream of returns. For each event that changes investors' expectation about the probability, the market provides us another estimate of what the right percentage of sales at risk will be to determine the harm to SMB retailers if the legislation passes. Of course, one might expect the expected harm to grow over time as digital tools develop further and SMB retailers become more dependent on them. If we use the average of the predictions from the two events, the evaluation of the event analyses implies that if the legislation passes, the expected reduction in the SMB sales at risk, i.e., the sales that have resulted because of the availability of the digital tools, is (13.9% + 19%)/2 = 16.45%.

In summary, from our work with the event analysis of Amazon's stock price the expected percentage of Sales at Risk that would be lost if the legislation passes is estimated to be 16.45%.

It will be helpful to recapitulate the argument that supports the use of 16.45% as the "Lost Proportion". To estimate the percentage of SMB Sales at Risk that would be lost if the legislation passes, we estimated the percentage change in Amazon's stock value when investors receive information that increases their expected probability of the legislation passing. From that percentage change, we then estimated the percentage change in the part of Amazon's stock value coming from third-party users of Amazon's services (i.e., businesses other than Amazon itself that use either or both the Amazon marketplace and Amazon Web Services, where customers of Amazon and customers of the third-party businesses can, because of Amazon's digital platform services, access the goods and services of the sellers). Thus, we estimated the percentage change in the part of Amazon's stock value derived from the services it provides to third-party businesses, and the percentage change occurred because of an event that changed investors' beliefs about the probability that the proposed legislation will become law.

The part of the stock value that is because of Amazon's business with the third parties is the present value of the expected stream of profits for Amazon because of the third-party business services it provides. The third-party businesses use the Amazon services, creating profits for Amazon, because Amazon's services create sales and associated profits for the third-party businesses. The legislation would reduce Amazon's ability to provide those services that provide the third-party businesses with sales and profits, and they in turn would reduce their use of Amazon's services and the stream of profits for Amazon from the third-party business users would fall, and hence, Amazon's stock price would fall.

Among the major providers of digital platform services important to SMBs, Amazon is unique in that all of its business segments are used to a significant extent by SMBs. Amazon's three business segments—its two segments (North American and International) for the marketplace for retail sales, and its Amazon Web Services—are used by the third-party businesses, and the drop in Amazon's profit stream if the legislation passes and reduces their use of the Amazon services would cause a drop in the value of Amazon's stock that we can reasonably expect would not be lost in swings in the stock price because of effects of other things on Amazon's expected stream of profits. Thus, an event that increases investors' expected probability of the legislation passing will increase the probability of a reduction in Amazon's profit stream and hence cause a detectable decrease in Amazon's stock price because that price is based on the expected stream of profits. The proportional decrease in the part of the stock price based on the profits from the third-party sellers thus reflects the proportional decrease in the sales of the third-party sellers—sales that generate their profits and hence make them want to use Amazon's services which generates a profit stream for Amazon.

Importantly observe that we have an estimate of the proportional decrease in the sales of the third-party sellers because of the disruption to digital platform services that the legislation would cause. The estimate is derived from observing Amazon's stock price, but it should be a good indication of the effect of the legislation on the sales of the business users of digital platform services more generally. If the business segments of the other digital services providers were as focused as Amazon's on the services important to the third-party sellers, we would expect to detect a similar proportional effect in the stock price changes for those other digital services providers.

Importantly too, the drop in Amazon's stock price observed is because of the loss in business from the third-party sellers, not from damage to Amazon's own use of its own marketplace services itself to provide retail services directly. Indeed, we expect that the lost profits from the business of third-party sellers, as we have observed those lost profits in the change in Amazon's stock price, may be understated. This is because when those sellers have less access to Amazon's services or have to pay more for those services, Amazon would be expected to make more of its own retail sales through its marketplace because third-party sellers will be less effective competitors for the sale of those products. Amazon's services for third-party businesses help those businesses compete for retail sales, and a loss in those services would be expected to decrease their sales. An unintended consequence of the legislation could be that not only would third-party business at Amazon decline and Amazon's own retailing of products be a larger percentage of its business, but Amazon's own retail sales might grow, picking up sales that would have gone to third-party sellers as they face greater costs and restricted access to digital platform services and become less competitive in retail sales.

In all, we expect that the 0.1645 or 16.45% estimate of the "Lost Proportion" is a conservative estimate because as discussed above in detail (1) the estimate is for all of Amazon's third-party sellers and we expect that disrupting digital platform services will harm SMB sellers more than the larger third-party sellers, (2) investors will to some extent have anticipated the events precipitating the stock price changes and then to some extent the change will not be completely observed during the "event window", (3) the estimated effect is the effect after control for the percentage changes in the NASDAQ composite index, and in part those changes reflect effects of the legislation on the big platform companies and on other tech companies listed on NASDAQ, and (4) the drop in Amazon's stock price that we have observed in the event analysis would be an understatement of the drop induced because of an anticipated decrease in

third-party use of the services and consequent reduction in Amazon's profit stream (because the anticipated drop in profits would be offset to some extent by anticipation that Amazon's profits from its own use of its digital platform services to support its own retail sales would be expected to increase as third-party sellers face higher prices and restricted access to digital platform services and their retail sales fall).

Extended Methodology and Modeling: Estimated Models for the Subsectors of the U.S. Retail Sector

Motor Vehicle and Parts Dealers

Model for NAICS 3-digit Category 441, Motor Vehicle and Parts Dealers

Table C.1 in Appendix C shows the estimated model for the subsector, motor vehicle and parts dealers. [34] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a positive and statistically significant effect on the growth rate of sales.

For evaluating the results of all of the estimated models, remember the discussion in "Variables for the Estimated Models for Subsectors of the U.S. Retail Sector" observing that the estimated models are for entire retail subsectors and estimate effects for variables that may influence retail sales differently in the underlying geographic and product markets. Cost shifters can have opposite signs because they may be relevant in different markets of the subsector being studied, and in those different markets, the elasticities of demand may differ. Thus, the cost shifters may have different signs because the various measures are particularly important for different product and geographic markets within the subsector and the price elasticity of demand differs for those underlying markets. Moreover, the estimated coefficient for a cost-shifter may have a sign insignificantly different from zero because the variable is important in different markets where some have elastic demand and some have inelastic demand and hence the cost shifter's negative and positive effects on sales offset, or alternatively, the cost-shifter's estimated impact on sales could be zero because it is important in markets with unitary price elasticity of demand (hence, as costs change and the price and output combination on the demand curve changes, sales remain the same).

Figure C.1 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.1 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

If the ICT revolution had not made it possible for retailers to use digital tools to grow their sales, how would the picture of retail sector sales look? We can use the model to provide an answer. In place of the actual time series for the proportion of U.S. adults using the internet, a time series that captures, in a way relevant for understanding the extent to which retailers can use digital tools, the development of the ICT revolution over time, with the proportion being 0.52 in 2000 and growing over time to 0.93 in 2021, we can substitute a counterfactual time series that keeps the proportion of U.S. adults using the internet at its level in 2000. Figure C.2 in Appendix C shows the impact of the model's prediction for sales if the

proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.2 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for motor vehicle and parts dealers, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.2 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales in the absence of the development of internet use that enabled retailers' successful use of digital tools; that prediction is our estimate of Sales at Risk. The model's prediction of the Sales at Risk, i.e. annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $575,580 million or $575.6 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between $16.3 billion and $849.7 billion, with the expected value of the loss being $575.6 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $640.9 billion, with the 95% confidence interval from a loss of $18.2 billion to a loss of $946.2 billion. These losses are estimated for the entire subsector NAICS 441, and from Table 2 we know that SMBs' share of the subsector's employment is 69.5%, so the expected loss in sales is roughly estimated at 0.695*$640.9 billion = $445.4 billion for SMBs. While on one hand the SMB employment share could overestimate the SMB share of sales when the larger firms are more capital intensive, on the other hand the estimate is conservative in the sense that we expect that the digital tools are especially important for SMBs sales, an expectation that will receive support from our complete set of models when we see that the importance of the ICT revolution is greatest in the subsectors where SMBs have larger proportions of employment in the subsector.[35]

Estimated harm for NAICS 3-digit Category 441, Motor Vehicle and Parts Dealers

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB motor vehicles and parts dealers if the proposed changes to antitrust law are passed is 16.45% of $445.4 billion, the sales at risk estimated above. Thus, the estimated harm is $73.3 billion.

Furniture and Home Furnishings Stores

Model for NAICS 3-digit Category 442, Furniture and Home Furnishings Stores

Table C.2 in Appendix C shows the estimated model for furniture and home furnishing stores.[36] The estimated model's results are discussed there in the Appendix, including the result that the proportion of

U.S. adults using the internet has a positive and statistically significant effect on the growth rate of sales.

Figure C.3 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.3 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.4 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.4 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for furniture and home furnishings stores, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.4 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk—in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $28,403.7 million or $28.4 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between $3.59 billion and $47.3 billion, with the expected value of the loss being $28.4 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $31.6 billion, with the 95% confidence interval from a loss of $4.00 billion to a loss of $52.7 billion. These losses are estimated for the entire subsector NAICS 442, and from Table 2 we know that SMBs' share of the subsector's employment is 49.5%, so the expected loss in sales is roughly estimated at 0.495*$31.6 billion = $15.6 billion for SMBs.

Estimated harm for NAICS 3-digit Category 442, Furniture and Home Furnishings Stores

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB furniture and home furnishing stores if the proposed changes to antitrust law are passed is 16.45% of $15.6 billion, the sales at risk estimated above. Thus, the estimated harm is $2.6 billion.

Electronics and Appliance Stores

Model for NAICS 3-digit Category 443, Electronics and Appliance Stores

Table C.3 in Appendix C shows the estimated model for electronics and appliance stores.[37] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a negative and statistically significant effect on the growth rate of sales.

Figure C.5 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.5 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.6 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.6 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for electronics and appliance stores, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.6 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk—in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is −$72,964 million or −$73.0 billion. In other words, a gain in sales is expected in the counterfactual scenario because NAICS 3-digit industry 443 is one that lost sales to firms in specialized retail subsectors that could, as the ICT revolution enabled their use of digital tools, sell more of some of the products also sold by the giant retailers such as Best Buy, Lowes, and Home Depot in NAICS 3-digit industry 443. The 95% confidence interval for the gained sales using the very conservative standard error of the forecast is for a gain between $46,985 million or $47.0 billion and $104,203 million or $104.2 billion, with the expected value of the gain being $73.0 billion. Those values for the gain in sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected gain in sales in 2019 is $81.3 billion, with the 95% confidence interval from a gain of $52.3 billion to a gain of $116 billion. These gains are estimated for the entire subsector NAICS 443, and from Table 2 we know that SMBs' share of the subsector's employment is 35.4%, so the expected gain in sales is roughly estimated at 0.354*$81.3 billion = $28.8 billion for SMBs.

Estimated harm for NAICS 3-digit Category 443, Electronics and Appliance Stores

NAICS 3-digit industry 443, Electronics and Appliance Stores, is a retailing subsector that has lost sales to other subsectors as the ICT revolution made digital tools increasingly available; hence, the subsector's Sales at Risk are negative, i.e. if the legislation made it more difficult for SMBs in specialized subsectors to sell products that are also sold by electronics and appliance stores, then the subsector for electronics and appliance stores would actually gain sales. Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB electronics and appliance stores if the proposed changes to antitrust law are passed is 16.45% of negative $28.8 billion, the sales at risk estimated above. Thus, the estimated harm is negative $4.7 billion, a gain that would come at the expense of SMBs in other subsectors such as nonstore retailers.

Building Material and Garden Equipment and Supplies Dealers

Model for NAICS 3-digit Category 444, Building Material and Garden Equipment and Supplies Dealers

Table C.4 in Appendix C shows the estimated model for building material and garden equipment and supplies dealers.[38] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a negative effect, statistically significant at the 12% level, on the growth rate of sales.

Figure C.7 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.7 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.8 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.8 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for building material and garden equipment and supplies dealers, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.8 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk—in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is −$178,884 million or −$178.9

billion. In other words, a gain in sales is expected in the counterfactual scenario because NAICS 3-digit industry 444 is one that lost sales to firms in specialized retail subsectors that could, as the ICT revolution enabled their use of digital tools, sell more of some of the products also sold by the giant retailers such as Lowes and Home Depot in NAICS 3-digit industry 444. The 95% confidence interval, using the conservative standard error of the forecast, for the change in sales if the ICT revolution had not provided the digital tools covers from a loss of $21,747 million or $21.7 billion to a gain of $508,226 million or $508.2 billion, with the expected value of the gain being $178.9 billion. Those values for the gain in sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected gain in sales in 2019 is $199.2 billion, with the 95% confidence interval from a loss of $24.2 billion to a gain of $565.9 billion. These changes in sales are estimated for the entire subsector NAICS 444, and from Table 2 we know that SMBs' share of the subsector's employment is 36.8%, so the expected gain in sales for SMBs in the sector is roughly estimated at 0.368*$199.2 billion = $73.3 billion for SMBs.

Estimated harm for NAICS 3-digit Category 444, Building Material and Garden Equipment and Supplies Dealers

NAICS 3-digit industry 444, Building Material and Garden Equipment and Supplies Dealers, is a retailing subsector that has lost sales to other subsectors as the ICT revolution made digital tools increasingly available; hence, the subsector's Sales at Risk are negative, i.e. if the legislation made it more difficult for SMBs in specialized subsectors to sell products that are also sold by building material and garden equipment and supplies dealers, then the subsector for building material and garden equipment and supplies dealers would actually gain sales. Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB building material and garden equipment and supplies dealers if the proposed changes to antitrust law are passed is 16.45% of negative $73.3 billion, the sales at risk estimated above. Thus, the estimated harm is negative $12.1 billion.

Food and Beverage Stores

Model for NAICS 3-digit Category 445, Food and Beverage Stores

Table C.5 in Appendix C shows the estimated model for food and beverage stores.[39] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a positive, statistically significant effect on the growth rate of sales.

Figure C.9 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.9 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.10 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.10 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for food and beverage stores, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the

counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.10 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $109,808 million or $109.8 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between $62,647 million or $62.6 billion and $ 153,455 million or $153.5 billion, with the expected value of the loss being $109.8 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $122.3 billion, with the 95% confidence interval from a loss of $69.7 billion to a loss of $170.9 billion. These losses are estimated for the entire subsector NAICS 445, and from Table 2 we know that SMBs' share of the subsector's employment is 30.0%, so the expected loss in sales is roughly estimated at 0.300*$122.3 billion = $36.7 billion for SMBs.

Estimated harm for NAICS 3-digit Category 445, Food and Beverage Stores

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB food and beverage stores if the proposed changes to antitrust law are passed is 16.45% of $36.7 billion, the sales at risk estimated above. Thus, the estimated harm is $6.0 billion.

Health and Personal Care Stores

Model for NAICS 3-digit Category 446, Health and Personal Care Stores

Table C.6 in Appendix C shows the estimated model for health and personal care stores.[40] The stores include drug stores and pharmacies, cosmetics, beauty supplies and perfume stores, optical goods stores, food (health) supplement stores, and health appliance stores. The variable for combined input costs for pharmaceutical and medicine manufacturing did not have an observation for 2020, and so for this model there are only 20 observations. The estimated model's results are discussed with Table C.6 in the Appendix C, including the result that the proportion of U.S. adults using the internet has a negative, statistically significant effect on the growth rate of sales.

Figure C.11 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.11 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.12 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.12 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for health and personal care stores, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.12 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is −$77,772 million or −$77.7 billion. In other words, a gain in sales is expected in the counterfactual scenario because NAICS 3-digit industry 446 is one that lost sales to firms in specialized retail subsectors that could, as the ICT revolution enabled their use of digital tools, sell more of some of the products also sold by the giant retailers such as CVS and Walgreens in NAICS 3-digit industry 446. The 95% confidence interval for the gained sales using the very conservative standard error of the forecast is for a gain between $18,306 million or $18.3 billion and $148,083 million or $148.1 billion, with the expected value of the gain being $77.7 billion. Those values for the gain in sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected gain in sales in 2019 is $86.5 billion, with the 95% confidence interval from a gain of $20.4 billion to a gain of $164.9 billion. These gains are estimated for the entire subsector NAICS 446, and from Table 2 we know that SMBs' share of the subsector's employment is 31.2%, so the expected gain in sales is roughly estimated at 0.312*$86.5 billion = $27.0 billion for SMBs. Note the attribution of the SMB employment share of the 3-digit category's negative Sales at Risk to the category's SMBs imparts a conservative bias to our overall estimate of the Harm to SMBs because the products of the mega-retailers like CVS and Walgreens that are also sold by retailers in other retail 3-digit industry categories are not sold, or at least less likely to be sold, by the SMB health and personal care stores.

Estimated harm for NAICS 3-digit Category 446, Health and Personal Care Stores

NAICS 3-digit industry 446, Health and Personal Care Stores, is a retailing subsector that has lost sales to other subsectors as the ICT revolution made digital tools increasingly available; hence, the subsector's Sales at Risk are negative, i.e. if the legislation made it more difficult for SMBs in specialized subsectors to sell products that are also sold by health and personal care stores, then the subsector for health and personal care stores would actually gain sales. Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB health and personal care stores if the proposed changes to antitrust law are passed is 16.45% of negative $27.0 billion, the sales at risk estimated above. Thus, the estimated harm is negative $4.4 billion.

Gasoline Stations

Model for NAICS 3-digit Category 447, Gasoline Stations

Table C.7 in Appendix C shows the estimated model for gasoline stations.[41] The estimated model's results are discussed there in the Appendix C, including the result that the proportion of U.S. adults using the internet has a positive and statistically significant effect on the growth rate of sales.

Figure C.13 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.13 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.14 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.14 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for gasoline stations, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the standard error of the fitted values for the observations' covariate pattern in the counterfactual scenario.

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.14 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $106,883 million or $106.9 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between $58,808 million or $58.8 billion and $149,196 million or $149.2 billion, with the expected value of the loss being $106.9 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $119.0 billion, with the 95% confidence interval from a loss of $65.5 billion to a loss of $166.1 billion. These losses are estimated for the entire subsector NAICS 447, and from Table 2 we knowthat SMBs' share of the subsector's employment is 57.0%, so the expected loss in sales is roughly estimated at 0.570*$119.0 billion = $67.8 billion for SMBs.

Estimated harm for NAICS 3-digit Category 447, Gasoline Stations

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB gasoline stations if the proposed changes to antitrust law are passed is 16.45% of

$67.8 billion, the sales at risk estimated above. Thus, the estimated harm is $11.2 billion.

Clothing and Clothing Accessories Stores

Model for NAICS 3-digit Category 448, Clothing and Clothing Accessories Stores

Table C.8 in Appendix C shows the estimated model for clothing and clothing accessories.[42] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a positive but not statistically significant effect on the growth rate of sales.

Figure C.15 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.15 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.16 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.16 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for clothing and clothing accessories stores, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.16 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $11,550 million or $11.6 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between −$36,360 million or −$36.4 billion and $51,193 million or $51.2 billion, with the expected value of the loss being $11.6 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $12.9 billion, with the 95% confidence interval from a loss of −$40.5 billion to a loss of $57.0 billion. These losses are estimated for the entire subsector NAICS 448, and from Table 2 we know that SMBs' share of the subsector's employment is 18.4%, so the expected loss in sales is roughly estimated at 0.184*$12.9 billion = $2.4 billion for SMBs.

Estimated harm for NAICS 3-digit Category 448, Clothing and Clothing Accessories Stores

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB clothing and clothing accessories stores if the proposed changes to antitrust law are passed is 16.45% of $2.4 billion, the sales at risk estimated above. Thus, the estimated harm is $0.4 billion.

Sporting Goods, Hobby, Musical Instrument, and Book Stores

Model for NAICS 3-digit Category 451, Sporting Goods, Hobby, Musical Instrument, and Book Stores

Table C.9 in Appendix C shows the estimated model for sporting goods, hobby, musical instrument, and book stores.[43] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a positive effect on the growth rate of sales, statistically significant at the 15% level.

Figure C.17 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.17 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.18 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.18 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for sporting goods, hobby, musical instrument, and book stores, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.18 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $13,769 million or $13.8 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between −$5,659 million or −$5.7 billion and $28,369 million or $28.4 billion, with the expected value of the loss being $13.8 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is

$15.4 billion, with the 95% confidence interval from a loss of −$6.3 billion to a loss of $31.6 billion. These losses are estimated for the entire subsector NAICS 451, and from Table 2 we know that SMBs' share of the subsector's employment is 30.8%, so the expected loss in sales is roughly estimated at 0.308*$15.4 billion = $4.7 billion for SMBs.

Estimated harm for NAICS 3-digit Category 451, Sporting Goods, Hobby, Musical Instrument, and Book Stores

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB sporting goods, hobby, musical instrument, and book stores if the proposed changes to antitrust law are passed is 16.45% of $4.7 billion, the sales at risk estimated above. Thus, the estimated harm is $0.8 billion.

General Merchandise Stores

Model for NAICS 3-digit Category 452, General Merchandise Stores

Table C.10 in Appendix C shows the estimated model for general merchandise stores.[44] The estimated model's results are discussed there in the Appendix C, including the result that the proportion of U.S. adults using the internet has a negative, statistically significant effect on the growth rate of sales.

Figure C.19 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.19 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.20 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.20 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for general merchandise stores, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.20 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is −$255,722 million or −$255.7

billion. In other words, a gain in sales is expected in the counterfactual scenario because NAICS 3-digit industry 452 is one that lost sales to firms in specialized retail subsectors that could, as the ICT revolution enabled their use of digital tools, sell more of some of the products also sold by the giant retailers such as Walmart and Target in NAICS 3-digit industry 452. The 95% confidence interval for the gained sales using the very conservative standard error of the forecast is for a gain between $151,766 million or $151.8 billion and $373,277 million or $373.3 billion, with the expected value of the gain being $255,722 million or $255.7 billion. Those values for the gain in sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected gain in sales in 2019 is $284.7 billion, with the 95% confidence interval from a gain of $169.0 billion to a gain of $415.7 billion. These gains are estimated for the entire subsector NAICS 452, and from Table 2 we know that SMBs' share of the subsector's employment is 1.4%, so the expected gain in sales is roughly estimated at 0.014*$284.7 billion = $4.0 billion for SMBs.

Estimated harm for NAICS 3-digit Category 452, General Merchandise Stores

NAICS 3-digit industry 452, General Merchandise Stores, is a retailing subsector that has lost sales to other subsectors as the ICT revolution made digital tools increasingly available; hence, the subsector's Sales at Risk are negative, i.e., if the legislation made it more difficult for SMBs in specialized subsectors to sell products that are also sold by general merchandise stores, then the subsector for general merchandise stores would actually gain sales. Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB general merchandise stories if the proposed changes to antitrust law are passed is 16.45% of negative $4.0 billion, the sales at risk estimated above. Thus, the estimated harm to SMBs in 3-digit industry 452 is negative $0.7 billion.

Miscellaneous Store Retailers

Model for NAICS 3-digit Category 453, Miscellaneous Store Retailers

Table C.11 in Appendix C shows the estimated model for miscellaneous store retailers.[45] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a positive and statistically significant effect on the growth rate of sales.

Figure C.21 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.21 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.22 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.22 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for miscellaneous store retailers, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.22 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $55,855 million or $55.9 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between $45,196 million or $45.2 billion and $64,957 million or $65.0 billion, with the expected value of the loss being $55.9 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $62.2 billion, with the 95% confidence interval from a loss of $50.3 billion to a loss of $72.4 billion. These losses are estimated for the entire subsector NAICS 453, and from Table 2 we know that SMBs' share of the subsector's employment is 59.4%, so the expected loss in sales is roughly estimated at 0.594*$62.2 billion = $36.9 billion for SMBs.

Estimated harm for NAICS 3-digit Category 453, Miscellaneous Store Retailers

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB miscellaneous store retailers if the proposed changes to antitrust law are passed is 16.45% of $36.9 billion, the sales at risk estimated above. Thus, the estimated harm is $6.1 billion.

Nonstore Retailers

Model for NAICS 3-digit Category 454, Nonstore Retailers

Table C.12 in Appendix C shows the estimated model for nonstore retailers.[46] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a positive and statistically significant effect on the growth rate of sales.

Figure C.23 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.23 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.24 in Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.24 shows the time series for the natural logarithm of the actual retail sales in millions of dollars for nonstore retailers, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the

counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.24 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $187,808 million or $187.8 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between $100,106 million or $100.1 billion and $262,341 million or $262.3 billion, with the expected value of the loss being $187.8 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $209.1 billion, with the 95% confidence interval from a loss of $111.5 billion to a loss of $292.1 billion. These losses are estimated for the entire subsector NAICS 454, and from Table 2 we know that SMBs' share of the subsector's employment is 65.6%, so the expected loss in sales is roughly estimated at 0.656*$209.1 billion = $137.2 billion for SMBs.

Estimated harm for NAICS 3-digit Category 454, Nonstore Retailers

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB nonstore retailers if the proposed changes to antitrust law are passed is 16.45% of $137.2 billion, the sales at risk estimated above. Thus, the estimated harm is $22.6 billion.

Food Services and Drinking Places

Model for NAICS 3-digit Category 722, Food Services and Drinking Places

Table C.13 in Appendix C shows the estimated model for food services and drinking places.[47] The estimated model's results are discussed in Appendix C, including the result that the proportion of U.S. adults using the internet has a positive and statistically significant effect on the growth rate of sales.

Figure C.25 in Appendix C compares the time series for the dependent variable and for the model's prediction of that variable. Figure C.25 also shows the upper and lower bounds for the 95% confidence interval of the model's prediction using the standard error of the fitted values, providing visual evidence that the model does a good job reflecting the forces determining retail sales.

Figure C.26 of Appendix C shows the impact of the model's prediction for sales if the proportion of U.S. adults using the internet had remained at its level in 2000. Figure C.26 shows the time series for the

natural logarithm of the actual retail sales in millions of dollars for food services and drinking places, the model's prediction of that variable in the counterfactual scenario in which the ICT revolution had not made possible improvement in the retailers' use of digital tools, and the upper and lower bounds for the counterfactual prediction's 95% confidence interval using the conservative standard error of the forecast values (which by definition exceeds the standard error of the fitted values).

Without the estimated impact of the increase in households' access to the internet over the first two decades of the new millennium, an increase that enables retailers' use of digital tools to increase sales, Figure C.26 illustrates the retail sales that would have been lost if the digital tools of the ICT revolution had not been available to the retailers. We can calculate the predicted lost annual sales—the Sales at Risk —in the absence of the development of customers' internet use that enabled retailers' successful use of digital tools. The model's prediction of Sales at Risk, i.e., annual sales that, without the development of successful use of digital tools, would have been lost in 2019, the last year before the COVID-19 pandemic, is as follows.

Converting the natural logarithms for the actual retail sales and for the predicted sales in the counterfactual scenario into sales, the expected value of the lost sales is $149,049 million or $149.0 billion. The 95% confidence interval for the lost sales using the very conservative standard error of the forecast is for a loss between $22,476 million or $22.5 billion and $251,788 million or $251.8 billion, with the expected value of the loss being $149.0 billion. Those values for the lost sales are in the constant dollars of 2012. Converting to the dollars of 2019 using the Consumer Price Index, the expected loss in sales in 2019 is $165.9 billion, with the 95% confidence interval from a loss of $25.1 billion to a loss of $280.4 billion. These losses are estimated for the entire subsector NAICS 722, and from Table 2 we know that SMBs' share of the subsector's employment is 63.2%, so the expected loss in sales is roughly estimated at 0.632*$165.9 billion = $104.8 billion for SMBs.

Estimated harm for NAICS 3-digit Category 722, Food Services and Drinking Places

Using the estimate of the Lost Proportion derived in "Estimation of the Lost Proportion," the estimated harm for the SMB food services and drinking places if the proposed changes to antitrust law are passed is 16.45% of $104.8 billion, the sales at risk estimated above. Thus, the estimated harm is $17.2 billion.

Extended Methodology and Modeling: Further Discussion of the Positive Correlation between SMB Share of Subsector and Growth in Sales Induced by the ICT Revolution

As seen in Table 1 ("Results"), the estimated Harm to SMBs in terms of annual sales lost if the proposed new antitrust legislation became law would have been $101.1 billion for the retail sector in 2019, the last year before the pandemic. For the retail sector plus food services and drinking places, the estimated harm for that year would have been $118.3 billion. The section titled "Extended Methodology and Modeling: Estimated Models for the Subsectors of the U.S. Retail Sector" develops these results in detail and provides 95% confidence intervals for the predictions of the model for each subsector. The models are

very well estimated, and the expected harm estimated for 2019 provides a conservative estimate of the annual harm that the proposed new antitrust legislation would cause for SMB retailers going forward because the reliance of the retail sector on digital platform services has continued to develop.

In this further discussion of the results, we observe that the impact of the ICT revolution on the growth of sales for the subsectors of the U.S. retail sector is positively correlated with SMB employment share in subsector employment. Table 3 shows for each NAICS 3-digit industry the estimated coefficient for the variable Internet x time, which is the estimated model's implementation of (ICTinfra)*time shown in Equation (5) in Appendix A. From Equation (2) (also in Appendix A), we know that the estimated coefficient in the estimated model for Equation (5) is the impact of the ICT infrastructure technology on the growth rate of retail sales. In our estimation, for example, if the estimated coefficient is 0.02, that tells us that the annual growth rate in sales increases by 2% per unit change in the variable Internet, the proportion of U.S. adults who use the internet. Thus, if Internet increased from 0.50 to 1.0, i.e., if the proportion of people using the internet increased from 50% to 100%, the annual growth rate in sales would increase by 1 full percentage point (e.g., if the growth rate was 3% per year, it would increase to 4% per year). For the 13 observations for the 3-digit industries, the correlation coefficient for the SMB employment proportion and the estimated impact of the ICT revolution on the growth rate of retail sales is 0.667, significant at better than the 2% level (the p-value is 0.0127).

Table 3. The SMB Employment Proportion and the ICT impact of Growth Rate of Sales

Type of SMB	NAICS Code	ICT Impact on Growth Rate (Estimated Coefficient on Internet x Time)	SMB Proportion of Total Employment
Motor vehicle and parts dealers	441	0.0920357	0.695
Furniture and home furnishings stores	442	0.0435138	0.495
Electronics and appliance stores	443	− 0.0847917	0.354
Building material and garden equipment and supplies dealers	444	− 0.0555376	0.368
Food and beverage stores	445	0.022872	0.300
Health and personal care stores	446	− 0.0268929	0.312
Gasoline stations	447	0.0328728	0.570
Clothing and clothing accessories stores	448	0.0069121	0.184
Sporting goods, hobby, musical instrument, and book stores	451	0.0288182	0.308
General merchandise stores	452	− 0.0441421	0.014
Miscellaneous store retailers	453	0.085096	0.594
Nonstore retailers	454	0.0412516	0.656
Food services and drinking places	722	0.0325643	0.632

As shown in the subsector estimations of Appendix C, the availability of the digital tools has enabled SMBs in specialized subsectors (including "nonstore" retailers) of the total retail sector to gain not only sales above and beyond the sales that would have been expected by the demand and cost conditions absent the digital tools, but also to gain sales at the expense of four subsectors where sales are overwhelmingly from very large retailers. The four subsectors are: general merchandise stores where SMBs had only 1.4% of the employment in 2015 and there are large retailers such as Walmart and Target; electronics and appliance stores where SMBs had 35.4% of the employment in 2015 and there are large retailers such as Best Buy and Lowes and The Home Depot; building material and garden equipment dealers where SMBs had 36.8% of the employment in 2015 and there are large retailers such as The Home Depot and Lowes; and health and personal care stores where SMBs had 31.2% of the employment in 2015 and there are large retailers such as Walgreens and CVS. In the specialized subsectors of the retail sector, SMBs using the digital tools provided by the ICT revolution gain sales for some of the products sold by large retailers in the subsectors where sales are lost.

About the Author

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Endnotes

[1] Data Catalyst Institute (DCI), "Super Selling: How Contemporary Small Businesses Reach Customers and Sell Products, U.S. Research Report," Fall 2021b, available at https://datacatalyst.org/wp-content/uploads/2021/12/Super-Sellers-Fall-2021-FINAL2.pdf.

[2] Cameron D. Miller and Richard D. Wang, "A New Economic Lens for Exploring the Negative Effects of Digital Platform Antitrust Legislation on American Small Businesses," Data Catalyst Institute (DCI), White Paper, May 2022, available at https://datacatalyst.org/reports/a-new-economic-lens-for-exploring-the-negative-effects-of-digital-platform-antitrust-legislation-on-american-small-businesses/.

[3] An alternative approach would be to estimate the dollar value of the lost sales associated with each of the nine negative impacts identified in the Miller and Wang (2022) companion paper. In theory this granular approach would be more useful, but although such an approach would in principle allow quantifying the costs of digital platform services' lost effectiveness for each of the several individual negative impacts, developing the lost sales data for the harm in dollars for each individual negative impact would at best be difficult, and at worst impossible, because there are many variables for each, and so much new information would have to be developed. As explained in Miller and Wang (2022), the firms targeted by the proposed legislation provide multiple digital platforms that serve different sets of SMB users. Developing the necessary data to quantify lost sales in dollars because of the harm for each of the individual impacts would require interviews with appropriate points of contact among each of the various sets of SMB users and the providers of the platform services they use, and then the development and administration of appropriate survey instruments for each of those sets of users and providers. Thus, developing and analyzing the data would not be possible to complete in time to inform decisions about the legislation. Instead, the approach used in this paper starts with the legislation's negative impacts on SMBs and SMB Sellers as those effects are identified in the companion paper by Miller and Wang (2022). Because of those identified negative effects, the SMBs and SMB Sellers will lose sales if the proposed legislation passes. This paper, using readily available data, estimates those lost sales.

[4] First, the $500 billion is the present value of five years of harm in the annual amount estimated for 2019. The estimated harm for 2019 is $118.3 billion in lost SMB sales for the SMBs in the retail sector and the food services industry. Thus, the monthly harm measured as the lost sales each month, in constant dollars of 2019, whether for each month of 2019 or for each month of the five years of lost sales at the rate estimated for 2019, is $118.3 billion/12 = (5*$118.3 billion)/(5*12) = $9.86 billion for all of the SMBs in the retail sector and the food services industry. Sales by SMBs for retail and food services in 2019 were approximately $2,291 billion (0.333*$5,411 billion + 0.632*$773.5 billion, where the proportions are the SMB shares, total 2019 sales for retail (NAICS 44-45) services are $5,411 billion, and total 2019 sales for food services (NAICS 722) are $773.5 billion), or about $2,291 billion/12 = $190.9 billion per month. Thus, for the SMBs in the retail sector and food services industry, the lost sales are 5.2% of sales (using either the annual ($118.3 billion/$2,291 billion) or monthly ($9.86 billion/$190.9 billion) lost sales divided by total sales). Second, if we think of the $500 billion calculated harm to SMBs as a tax taken from their monthly sales, what would be the amount of the monthly tax for the SMB with monthly sales equal to the average for the SMBs in the retail sector and food services? The total number of SMBs in the retail sector and food services industry is about 5.8 million. Thus, monthly sales for the SMB with average annual sales is then (($2,291,000 million)/(5.8 million))/12 or about $32,917. The monthly lost sales would be 5.2% of that amount or $1,712.

[5] The firms in the retail sector and the firms in the food services and drinking places industry are often discussed together, and data about their sales are often presented together. See https://www.census.gov/retail/mrts/historic_releases.html, Monthly Retail Trade Survey Historical Data, Retail and Food Service Sales: Excel (1992-present): https://www.census.gov/retail/mrts/www/mrtssales92-present.xls, accessed and downloaded January 22, 2022.

[6] Selected Statistics by Enterprise Industry Classification, Enterprise Employment Size, and Enterprise Industry Specialization: 2015, us_payroll_2015.xlsx, accessed and downloaded January 23, 2022, https://www.census.gov/data/tables/2015/econ/susb/2015-susb-enterprise.html. Data from a recent March-April 2022 DCI survey show that 22% of all U.S. SMBs sell only physical products, 41% sell a mix of physical products and services, and 37% sell only services. See https://datacatalyst.org/wp-content/uploads/2022/05/National-SMB-Leader-Survey-Select-Toplines-May-2022-FINAL.pdf.

[7] To estimate the SMB sales in retail and food services, the employment proportions in Table 1 of the White Paper were used with the sales data from https://www.census.gov/retail/mrts/historic_releases.html, Monthly Retail Trade Survey Historical Data, Retail and Food Service Sales: Excel (1992-present): https://www.census.gov/retail/mrts/www/mrtssales92-present.xls, accessed and downloaded January 22, 2022.

[8] https://www.census.gov/data/tables/2015/econ/susb/2015-susb-enterprise.html, Selected Statistics by Enterprise Industry Classification, Enterprise Employment Size, and Enterprise Industry Specialization: 2015, us_payroll_2015.xlsx, accessed and downloaded January 23, 2022.

[9] See U.S. House of Representatives (2021).

[10] See Table 3 and Table 4 in Miller and Wang (2022) and the discussion of the tables.

[11] First, the $500 billion is the present value of five years of harm in the annual amount estimated for 2019. The estimated harm for 2019 is $118.3 billion in lost SMB sales for the SMBs in the retail sector and the food services industry. Thus, the monthly harm measured as the lost sales each month, in constant dollars of 2019, whether for each month of 2019 or for each month of the five years of lost sales at the rate estimated for 2019, is $118.3 billion/12 = (5*$118.3 billion)/(5*12) = $9.86 billion for all of the SMBs in the retail sector and the food services industry. Sales by SMBs for retail and food services in 2019 were approximately $2,291 billion (0.333*$5,411 billion + 0.632*$773.5 billion, where the proportions are the SMB shares, total 2019 sales for retail (NAICS 44-45) services are $5,411 billion, and total 2019 sales for food services (NAICS 722) are $773.5 billion), or about $2,291 billion/12 = $190.9 billion per month. Thus, for the SMBs in the retail sector and food services industry, the lost sales are 5.2% of sales (using either the annual ($118.3 billion/$2,291 billion) or monthly ($9.86 billion/$190.9 billion) lost sales divided by total sales). Second, if we think of the $500 billion calculated harm to SMBs as a tax taken from their monthly sales, what would be the amount of the monthly tax for the SMB with monthly sales equal to the average for the SMBs in the retail sector and food services? The total number of SMBs in the retail sector and food services industry is about 5.8 million. Thus, monthly sales for the SMB with average annual sales is then (($2,291,000 million)/(5.8 million))/12 or about $32,917. The monthly lost sales would be 5.2% of that amount or $1,712.

[12] The firms in the retail sector and the firms in the food services and drinking places industry are often discussed together, and data about their sales are often presented together. See https://www.census.gov/retail/mrts/historic_releases.html, Monthly Retail Trade Survey Historical Data, Retail and Food Service Sales: Excel (1992-present): https://www.census.gov/retail/mrts/www/mrtssales92-present.xls, accessed and downloaded January 22, 2022.

[13] Selected Statistics by Enterprise Industry Classification, Enterprise Employment Size, and Enterprise Industry Specialization: 2015, us_payroll_2015.xlsx, accessed and downloaded January 23, 2022, https://www.census.gov/data/tables/2015/econ/susb/2015-susb-enterprise.html. Data from a recent March-April 2022 DCI survey show that 22% of all U.S. SMBs sell only physical products, 41% sell a mix of physical products and services, and 37% sell only services. See https://datacatalyst.org/wp-content/uploads/2022/05/National-SMB-Leader-Survey-Select-Toplines-May-2022-FINAL.pdf.

[14] The employment proportions are good predictors of the sales proportions that we want for the analysis. Employment and sales proportions for SMBs in NAICS 44-45 are available from the 2012 Census (https://data.census.gov/cedsci/table?q=EC1244&tid=ECNLINES2012.EC1244SLLS1, Economic Census, 2012: ECN Core Statistics Economic Census US Lines Data, EC1244SLLS1 Retail Trade: Subject Series - Product Lines: Product Lines Statistics by Industry for the U.S. and States: 2012, accessed April 29, 2022). For NAICS 44-45, in 2012, the proportion that SMBs take in the number of enterprises is 0.9982, the proportion that SMBs take in employment is 0.3692, and the proportion that SMBs take in sales is 0.4106. Using just SMBs that operated for the entire year, the numbers are 0.9979 for the proportion of enterprises, 0.3615 for the proportion of employment, and 0.4044 for the proportion of sales. Thus, the employment proportions that we use to get the SMB part of the sales at risk are good estimates of the sales proportions (which are not available at the level of disaggregation needed and provided by the employment proportions), and in fact the evidence suggests they underestimate them somewhat—a good thing since it makes our estimates of harm more conservative.

[15] See the discussion in the preceding note. The employment statistics are for the enterprises in each subsector.

[16] To estimate the percentage of SMB Sales at Risk that would be lost if the legislation passes, we estimated the percentage change in Amazon's stock value when investors receive information that increases their expected probability of the legislation passing. From that percentage change, we then estimated the percentage change in the part of Amazon's stock value coming from third-party users of Amazon's services (i.e., businesses other than Amazon itself that use either or both the Amazon marketplace and Amazon Web Services, where customers of Amazon and customers of the third-party businesses can, because of Amazon's digital platform services, access the goods and services of the sellers). Thus, we estimated the percentage change in the part of Amazon's stock value derived from the services it provides to third-party businesses, and the percentage change occurred because of an event that changed investors' beliefs about the probability that the proposed legislation will become law. The part of the stock value that is because of Amazon's business with the third parties is the present value of the expected stream of profits for Amazon because of the third-party business services it provides. The third-party businesses use the Amazon services, creating profits for Amazon, because Amazon's services create sales and associated profits for the third-party businesses. The legislation would reduce Amazon's ability to provide those services that provide the third-party businesses with sales and profits, and they in turn would reduce their use of Amazon's services and the stream of profits for Amazon from the third-party business users would fall, and hence, Amazon's stock price would fall.

[17] The 16.45% estimate of the "Lost Proportion" is a conservative estimate because (1) the estimate is for all of Amazon's third-party sellers and we expect that disrupting digital platform services will harm SMB sellers more than the larger third-party sellers, (2) investors will to some extent have anticipated the events precipitating the stock price changes and then to some extent the change will not be completely observed during the "event window", (3) the estimated effect is the effect after control for the percentage changes in the NASDAQ composite index, and in part those changes reflect effects of the legislation on the big platform companies and on other tech companies listed on NASDAQ, and (4) the drop in Amazon's stock price that we have observed in the event analysis would be an understatement of the drop induced because of an anticipated decrease in third-party use of the services and consequent reduction in Amazon's profit stream (because the anticipated drop in profits would be offset to some extent by anticipation that Amazon's profits from its own use of its digital platform services to support its own retail sales would be expected to increase as third-party sellers face higher prices and restricted access to digital platform services and their retail sales fall). As explained in "Estimation of the Lost Proportion," the estimate is derived from observing Amazon's stock price, but it should be a good indication of the effect of the legislation on the sales of the business users of digital platform services more generally. If the business segments of the other digital services providers were as focused as Amazon's on the services important to the third-party sellers, we would expect to detect a similar proportional effect in the stock price changes for those other digital services providers.

[18] See Appendix E for the detailed calculation of the present value.

[19] Source for employment statistics: 2015 SUSB (Statistics of U.S. Businesses) Annual Data Tables by Enterprise Industry, January 2018, https://www.census.gov/data/tables/2015/econ/susb/2015-susb-enterprise.html, Selected Statistics by Enterprise Industry Classification, Enterprise Employment Size, and Enterprise Industry Specialization: 2015, us_payroll_2015.xlsx, accessed and downloaded January 23, 2022.

[20] In addition to the retail sector's and food services industry's roughly 1.1 million SBMs with paid employees, there are another roughly 4.7 million SMBs in those industries that do not have paid employees at some time during the year. The Census data for firms' and their establishments' employment and payroll consider an establishment with 0 employment to be an establishment with no paid employees in the mid-March pay period but with paid employees at some time during the year (https://www.census.gov/data/tables/2019/econ/susb/2019-susb-annual.html, accessed June 4, 2022). Thus, not counted among the number of SMB enterprises in the payroll and employment statistics for firms are SMBs among the 81% of small businesses in the U.S. that have no employees. Of the 31.7 million small businesses in the U.S. in 2022, only 19% or about 6 million have paid employees (https://www.simplyinsurance.com/how-many-small-businesses-are-there-in-america/, accessed June 4, 2022). Thus, the 1.1 million SMBs in the Census employment and payroll statistics for NAICS 44-45 and 722 (646,163 for NAICS 44-45, plus 461,482 for NAICS 722 = 1,107,645 or about 1.1 million) constitute roughly 19% of the total SMBs in those industries. Hence, the total number of SMBs in the retail sector and food services industry is about 5.8 million (0.19 of the total equals 1.1 million, so the total is 1.1/0.19 = 5.8 million).

[21] Observe that the proportions are essentially the same—over 99%--even when the retail sector's and food services' additional 4.7 million SMBs that do not have paid employees are used to obtain the proportions. For example, using the Census payroll and employment data for the retail sector and food services, the proportion of enterprises taken by SBMs in NAICS 44-45 & 722 is (646163 + 461482)/(647454 + 462914) = 0.9975. Adding in the "missing" SMBs, and the proportion is (646163 + 461482 + 4700000)/(647454 + 462914 + 4700000) = 0.9995.

[22] These proportions are the same whether or not the "missing" 4.7 million SMBs are considered, because when they are considered, because they do not have any paid employees, 0 is added to both the numerator and the denominator of the proportion.

[23] These estimates of lost sales include all SMB sales lost--including the sales lost by SMBs that do not have paid employees—because the estimates are derived from all of the sales for each of the subsectors, including the sales of SMBs without employees (https://www.census.gov/retail/mrts/how_surveys_are_collected.html).

[24] To estimate the SMB sales in retail and food services, the employment proportions in Table 1 were used with the sales data from https://www.census.gov/retail/mrts/historic_releases.html, Monthly Retail Trade Survey Historical Data, Retail and Food Service Sales: Excel (1992-present): https://www.census.gov/retail/mrts/www/mrtssales92-present.xls, accessed and downloaded January 22, 2022.

[25] https://www.census.gov/data/tables/2015/econ/susb/2015-susb-enterprise.html, Selected Statistics by Enterprise Industry Classification, Enterprise Employment Size, and Enterprise Industry Specialization: 2015, us_payroll_2015.xlsx, accessed and downloaded January 23, 2022.

[26] The results presented in this paper parallel the results in an independent study by Dippon and Hoelle (2021, 2022) which estimated $319 billion in harm, measured as additional costs for the providers of digital platform services, costs that would be passed on to consumer and business users if the legislation passed Congress. The difference between the two estimates is that whereas the $319 billion is "additional costs that would put upward pricing pressure on already elevated retail prices," this study estimates the harm as approximately $500 billion in lost sales to SMBs in the retail sector and in the food services industry. The NERA estimates and those here are estimates of different but related types of harm that would be caused by the proposed legislation. The two studies are complementary, and the NERA study only serves to bolster our conclusion that the legislation would have myriad harmful effects on SMBs in the retail marketplace.

[27] Hobbs et al. (2017, p. 500) consider the era of the information and communications technology (ICT) revolution to be the new millennium and observe that the "… dating of the start of the so-called ICT revolution as being after 2000 is not at odds with OECD data on the growth of total communication access paths in OECD countries as a group and in the USA. See, http://www.oecd.org/internet/broadband/oecdkeyictindicators.htm. See also Table 2.6 at: http://www.oecd.org/sti/deo-tables-2015.htm."

[28] In addition to the retail sector's and food services industry's roughly 1.1 million SBMs with paid employees, there are another roughly 4.7 million SMBs in those industries that do not have paid employees at some time during the year. The Census data for firms' and their establishments' employment and payroll consider an establishment with 0 employment to be an establishment with no paid employees in the mid-March pay period but with paid employees at some time during the year (https://www.census.gov/data/tables/2019/econ/susb/2019-susb-annual.html, accessed June 4, 2022). Thus, not counted among the number of SMB enterprises in the payroll and employment statistics for firms are SMBs among the 81% of small businesses in the U.S. that have no employees. Of the 31.7 million small businesses in the U.S. in 2022, only 19% or about 6 million have paid employees (https://www.simplyinsurance.com/how-many-small-businesses-are-there-in-america/, accessed June 4, 2022). Thus, the 1.1 million SMBs in the Census employment and payroll statistics for NAICS 44-45 and 722 (646,163 for NAICS 44-45, plus 461,482 for NAICS 722 = 1,107,645 or about 1.1 million) constitute roughly 19% of the total SMBs in those industries. Hence, the total number of SMBs in the retail sector and food services industry is about 5.8 million (0.19 of the total equals 1.1 million, so the total is 1.1/0.19 = 5.8 million).

[29] Observe that the proportions are essentially the same—over 99%--even when the retail sector's and food services' additional 4.7 million SMBs that do not have paid employees are used to obtain the proportions. For example, using the Census payroll and employment data for the retail sector and food services, the proportion of enterprises taken by SBMs in NAICS 44-45 & 722 is (646163 + 461482)/(647454 + 462914) = 0.9975. Adding in the "missing" SMBs, and the proportion is (646163 + 461482 + 4700000)/(647454 + 462914 + 4700000) = 0.9995.

[30] These proportions are the same whether or not the "missing" 4.7 million SMBs are considered, because when they are considered, because they do not have any paid employees, 0 is added to both the numerator and the denominator of the proportion.

[31] Amazon's business segments are the North America segment (primarily retail sales of consumer products including those from third-party sellers and including subscriptions through North America-focused online and physical stores and including export sales from those online stores), the International segment (primarily retail sales of consumer products including those from third-party sellers and subscriptions through internationally-focused online stores, including export sales from those internationally focused online stores other than export sales from the North America-focused online stores, and the AWS {Amazon Web Services) segment (amounts earned from global sales of computer, storage, database, and other service offerings for start-ups, enterprises, government agencies, and academic institutions). United States Securities and Exchange Commission, Form 10-K, Annual Report Pursuant to Section 13 or 15(d) of the Securities and Exchange Act of 1934, For the fiscal year ended December 31, 2019, Commission File no. 000-22513, AMAZON.COM, INC, p. 67.

[32] Daily stock prices for Amazon, https://www.nasdaq.com/market-activity/stocks/amzn/historical, and for the Nasdaq composite index, https://www.nasdaq.com/market-activity/index/comp/historical, were accessed and downloaded on April 4, 2022.

[33] In his annual letter to shareholders, April 18, 2018, (https://www.sec.gov/Archives/edgar/data/1018724/000119312518121161/d456916dex991.htm, accessed April 12, 2022) Jeff Bezos reported, "In 2017, for the first time in our history, more than half of the units sold on Amazon worldwide were from our third-party sellers, including small and medium-sized businesses (SMBs). Over 300,000 U.S.-based SMBs started selling on Amazon in 2017, and Fulfillment by Amazon shipped billions of items for SMBs worldwide. Customers ordered more than 40 million items from SMBs worldwide during Prime Day 2017, growing their sales by more than 60 percent over Prime Day 2016. Our Global Selling program (enabling SMBs to sell products across national borders) grew by over 50% in 2017 and cross-border ecommerce by SMBs now represents more than 25% of total third-party sales." See also Bain (2018).

[34] The U.S. Bureau of Labor Statistics reports: "Industries in the Motor Vehicle and Parts Dealers subsector retail motor vehicles and parts from fixed point-of-sale locations. Establishments in this subsector typically operate from a showroom and/or an open lot where the vehicles are on display. The display of vehicles and the related parts require little by way of display equipment. The personnel generally include both the sales and sales support staff familiar with the requirements for registering and financing a vehicle as well as a staff of parts experts and mechanics trained to provide repair and maintenance services for the vehicles. Specific industries have been included in this subsector to identify the type of vehicle being retailed." https://www.bls.gov/iag/tgs/iag441.htm.

[35] The employment proportions are good predictors of the sales proportions that we want for the analysis. Employment and sales proportions for SMBs in NAICS 44-45 are available from the 2012 Census (https://data.census.gov/cedsci/table?q=EC1244&tid=ECNLINES2012.EC1244SLLS1, Economic Census, 2012: ECN Core Statistics Economic Census US Lines Data, EC1244SLLS1 Retail Trade: Subject Series - Product Lines: Product Lines Statistics by Industry for the U.S. and States: 2012, accessed April 29, 2022). For NAICS 44-45, in 2012, the proportion that SMBs take in the number of enterprises is 0.9982, the proportion that SMBs take in employment is 0.3692, and the proportion that SMBs take in sales is 0.4106. Using just SMBs that operated for the entire year, the numbers are 0.9979 for the proportion of enterprises, 0.3615 for the proportion of employment, and 0.4044 for the proportion of sales. Thus, the employment proportions that we use to get the SMB part of the sales at risk are good estimates of the sales proportions (which are not available at the level of disaggregation needed and provided by the employment proportions), and in fact the evidence suggests they underestimate them somewhat—a good thing since it makes our estimates of harm more conservative.

[36] The U.S. Bureau of Labor Statistics reports: "Industries in the Furniture and Home Furnishings Stores subsector retail new furniture and home furnishings from fixed point-of-sale locations. Establishments in this subsector usually operate from showrooms and have substantial areas for the presentation of their products. Many offer interior decorating services in addition to the sale of products." https://www.bls.gov/iag/tgs/iag442.htm

[37] The U.S. Bureau of Labor Statistics reports: "Industries in the Electronics and Appliance Stores subsector retail new electronics and appliances from point-of-sale locations. Establishments in this subsector often operate from locations that have special provisions for floor displays requiring special electrical capacity to accommodate the proper demonstration of the products. The staff includes sales personnel knowledgeable in the characteristics and warranties of the line of goods retailed and may also include trained repair persons to handle the maintenance and repair of the electronic equipment and appliances. The classifications within this subsector are made principally on the type of product and knowledge required to operate each type of store." https://www.bls.gov/iag/tgs/iag443.htm

[38] The U.S. Bureau of Labor Statistics reports: "Industries in the Building Material and Garden Equipment and Supplies Dealers subsector retail new building material and garden equipment and supplies from fixed point-of-sale locations. Establishments in this subsector have display equipment designed to handle lumber and related products and garden equipment and supplies that may be kept either indoors or outdoors under covered areas. The staff is usually knowledgeable in the use of the specific products being retailed in the construction, repair, and maintenance of the home and associated grounds."
https://www.bls.gov/iag/tgs/iag444.htm

[39] The U.S. Bureau of Labor Statistics reports: "Industries in the Food and Beverage Stores subsector usually retail food and beverages merchandise from fixed point-of-sale locations. Establishments in this subsector have special equipment (e.g., freezers, refrigerated display cases, refrigerators) for displaying food and beverage goods. They have staff trained in the processing of food products to guarantee the proper storage and sanitary conditions required by regulatory authority."
https://www.bls.gov/iag/tgs/iag445.htm

[40] The U.S. Bureau of Labor Statistics reports: "Industries in the Health and Personal Care Stores subsector retail health and personal care merchandise from fixed point-of-sale locations. Establishments in this subsector are characterized principally by the products they retail, and some health and personal care stores may have specialized staff trained in dealing with the products. Staff may include pharmacists, opticians, and other professionals engaged in retailing, advising customers, and/or fitting the product sold to the customer's needs." https://www.bls.gov/iag/tgs/iag446.htm

[41] The U.S. Bureau of Labor Statistics reports: "Industries in the Gasoline Stations subsector retail automotive fuels (e.g., gasoline, diesel fuel, gasohol) and automotive oils or retail these products in combination with convenience store items. These establishments have specialized equipment for the storage and dispensing of automotive fuels."
https://www.bls.gov/iag/tgs/iag447.htm

[42] The U.S. Bureau of Labor Statistics reports: "Industries in the Clothing and Clothing Accessories Stores subsector retail new clothing and clothing accessories merchandise from fixed point-of-sale locations. Establishments in this subsector have similar display equipment and staff that is knowledgeable regarding fashion trends and the proper match of styles, colors, and combinations of clothing and accessories to the characteristics and tastes of the customer."
https://www.bls.gov/iag/tgs/iag448.htm

[43] The U.S. Bureau of Labor Statistics reports: "Industries in the Sporting Goods, Hobby, Book, and Music Stores subsector are engaged in retailing and providing expertise on use of sporting equipment or other specific leisure activities, such as needlework and musical instruments. Book stores are also included in this subsector." https://www.bls.gov/iag/tgs/iag451.htm

[44] The U.S. Bureau of Labor Statistics reports: "Industries in the General Merchandise Stores subsector retail new general merchandise from fixed point-of-sale locations. Establishments in this subsector are unique in that they have the equipment and staff capable of retailing a large variety of goods from a single location. This includes a variety of display equipment and staff trained to provide information on many lines of products." https://www.bls.gov/iag/tgs/iag452.htm

[45] The U.S. Bureau of Labor Statistics reports: "Industries in the Miscellaneous Store Retailers subsector retail merchandise from fixed point-of-sale locations (except new or used motor vehicles and parts; new furniture and home furnishings; new appliances and electronic products; new building materials and garden equipment and supplies; food and beverages; health and personal care goods; gasoline; new clothing and accessories; and new sporting goods, hobby goods, books, and music). Establishments in this subsector include stores with unique characteristics like florists, used merchandise stores, and pet and pet supply stores as well as other store retailers." https://www.bls.gov/iag/tgs/iag453.htm

[46] The U.S. Bureau of Labor Statistics reports: "Industries in the Nonstore Retailers subsector retail merchandise using methods, such as the broadcasting of infomercials, the broadcasting and publishing of direct-response advertising, the publishing of paper and electronic catalogs, door-to-door solicitation, in-home demonstration, selling from portable stalls and distribution through vending machines. Establishments in this subsector include mail-order houses, vending machine operators, home delivery sales, door-to-door sales, party plan sales, electronic shopping, and sales through portable stalls (e.g., street vendors, except food). Establishments engaged in the direct sale (i.e., nonstore) of products, such as home heating oil dealers and newspaper delivery service providers are included in this subsector." https://www.bls.gov/iag/tgs/iag454.htm

[47] The U.S. Bureau of Labor Statistics reports: "Industries in the Food Services and Drinking Places subsector prepare meals, snacks, and beverages to customer order for immediate on-premises and off-premises consumption. There is a wide range of establishments in these industries. Some provide food and drink only; while others provide various combinations of seating space, waiter/waitress services and incidental amenities, such as limited entertainment. The industries in the subsector are grouped based on the type and level of services provided. The industry groups are full-service restaurants; limited-service eating places; special food services, such as food service contractors, caterers, and mobile food services; and drinking places." https://www.bls.gov/iag/tgs/iag722.htm

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Technical Report Appendix

For additional details about the data and methodology underlying the results presented here, please refer to this accompanying Technical Report Appendix.