

E-Commerce Measurement Challenges in the U.S. Service Sector

E-Commerce Statistics Pre- and Post- COVID-19 Pandemic

United States Census Bureau

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The opinions presented in this paper are those of the authors and represent neither the opinions nor the positions of the U.S. Census Bureau.

Introduction

While it is a generally universally accepted notion that the pandemic transformed the e-commerce universe, the actual measurement of the impact is a bit more complicated. In fact, as of the writing of this paper there is little to suggest a concerted effort to collect data on e-commerce activity with the intent to study how much its recent increase is attributable directly to the pandemic. The “pandemic effect” has been assessed, however through measurement of actual e-commerce activity against pre-pandemic expectations of its increase. The U.S. Census Bureau conducted the Small Business Pulse Survey starting in April 2020 to measure the effect of changing business conditions during the pandemic and from this were able to infer some insight into the effect of the pandemic on the overall economic activity in the U.S., including e-commerce. This paper will highlight some evidence, statistical and anecdotal, describing in what ways the Census Bureau has addressed the pandemic effect on e-commerce, as well as present an overview of the overall changes the Census Bureau has enacted in terms of collecting and publishing e-commerce data since 2017, when the topic was last presented.

Past Voorburg Meetings

The most recent paper presented to the Voorburg Group by the U.S. Census Bureau on e-commerce was in 2017, authored by Mr. John Burns Murphy, and Mr. Andrew Baer¹. A quick reflection of “where we were” in e-commerce measurement efforts at that time highlighted the need for additional research around the collection, publication, and ultimate usefulness of e-commerce data. At the most organic level, the very definition and measurement of e-commerce differed among firms engaged in the activity, as well as across different sectors for which data were collected and published. Uneven levels of firms’ understanding of e-commerce lent itself to confusion, especially when firms simultaneously participated in both electronic and traditional commerce methods. Even within the Census Bureau, the definition of e-commerce activity was varied across different economic sectors’ surveys. Although there was awareness of potential additional respondent burden to capture the differences in measuring both electronic and in-store transactions, just how much was unknown.

The paper underscored the issues faced and questions asked in the quest to enhance the collection and publication efforts of e-commerce data during that time.

E-Commerce Status for Services

E-Commerce vs. Revenue from Electronic Sources

In 2018, the Census Bureau modified the e-commerce question for the 2017 Service Annual Survey (SAS). The term, “e-commerce” was eliminated and replaced with “revenues from electronic sources” (RES), and the question expanded from one part to three parts in an aim to

¹ Murphy, J., & Baer, A. (2017). Overview of E-Commerce Statistics United States Census Bureau [Paper presentation]. 32nd Meeting of the Voorburg Group on Service Statistics, New Delhi, India. <https://www.voorburggroup.org/papers-eng.htm>

distinguish the different ways customers might record their sources of electronic revenue.² Descriptive statements were provided to assist respondents in their understanding of what the Census Bureau considered in-scope and out-of-scope e-commerce activity.

The major goal in redeveloping the SAS e-commerce question in 2018 was to elicit a higher level of response, as it was suspected there was widespread underreporting from respondents. After redesigning the e-commerce question, its unit response rate increased by approximately ten percent between survey years 2016 and 2017. It's important to note that the e-commerce time series was broken in survey year 2017 with this change. So, although the intention of both questions was to capture the same activity of businesses, they are not comparable. Although not comparable, total revenues for this activity appear to be much higher in 2017 compared to 2016 after collecting these data as RES. Further, RES appears to have accounted for a higher portion of total revenue as evidenced in published estimates.

NAICS Description	2016 ^{1,3}		2017 ^{2, 3}	
	Revenue	E-Commerce	Revenue	Revenue from Electronic Sources
Services Total	14,591,111	608,718	15,314,582	1,004,250
22 - Utilities	570,054	4,382	579,413	S
48-49 - Transportation and Warehousing	875,642	113,880	917,458	182,271
51 - Information	1,497,831	165,237	1,533,690	294,553
52 - Finance and Insurance	4,268,985	142,782	4,498,127	187,818
53 - Real Estate and Rental and Leasing	632,565	27,987	663,749	45,869
54 - Professional, Scientific, and Technical Services	1,726,542	47,009	1,832,281	51,403
56 - Administrative and Support and Waste Management and Remediation Services	872,729	31,648	929,684	60,150
61 - Educational Services	64,306	7,508	67,753	10,809
62 - Health Care and Social Assistance	2,427,731	1,828	2,541,261	8,635
71 - Arts, Entertainment, and Recreation	250,250	10,931	265,506	24,145
72 - Accommodation and Food Services	886,463	40,592	929,087	72,785
81 - Other Services (except Public Administration)	518,013	14,934	556,573	31,559

¹2016 Service Annual Survey: Table 9. Estimated E-Commerce Revenue for Employer Firms: 2011 Through 2016

²2017 Service Annual Survey: Table 9. Estimated Revenue from Electronic Sources for Employer Firms: 2015 Through 2017

³All estimates are presented in millions of U.S. dollars (\$)

S – Estimate does not meet publication standards because of high sampling variability, poor response quality, or other concerns about the estimate's quality.

Data not adjusted for price changes. Differences in revenue estimates may be attributed to sampling or nonsampling error, rather than underlying economic conditions. Caution should be used in drawing conclusions from the estimates and comparisons shown.

Additional information on survey methodology, including sampling and nonsampling error, sample design, and confidentiality protection can be found at <https://www.census.gov/programs-surveys/sas/technical-documentation/methodology.html>.

(Approval IDs: CBDRB-FY18-054, CBDRB-FY18-327)

² See Appendix A for more information on this content change.

Despite these apparent improvements, struggles remain especially in particularly concentrated industries where the aggregated industry total is heavily influenced by the accuracy and compliance from only a handful of companies.

Existing Challenges

A struggle the Census Bureau has fought repeatedly is finding the balance between catering the RES question to a specific industry and being able to compare responses across very different types of businesses (e.g., Hydroelectric Power Generation and Grantmaking Foundations).

On top of this challenge hovers a massive initiative at the Census Bureau to consolidate the survey content and collection of data across seven surveys into the Annual Integrated Economic Survey (AIES). Since this integration is only a couple of years away, there's an obligation to not only standardize the wording of questions within the services trades but across the manufacturing, retail, and wholesale trades as well. Additionally, any plans to significantly modify this question further have been temporarily paused.

Analysts for the SAS regularly encounter evidence of respondents misinterpreting the question. Many large companies with a pattern for consistently reporting RES will suddenly report zero dollars for this item, presumably because it was thought to be inapplicable. In addition, analysts find that respondents in certain industries appear to struggle with this question more than others since many companies don't keep record of their sales using the RES/non-RES distinction. This also makes it difficult for analysts attempting to validate questionable reporting. In fact, at the aggregate level, company reporting in this item for 2020 was deemed questionable enough for the SAS to suppress a handful of publication levels.

In the wake of these recent data quality questions, even the fundamental question of whether collecting e-commerce data at all on the SAS was discussed. Some of the comments solicited from other offices within the Census Bureau included concerns that many service businesses don't track e-commerce orders in a way to answer the question and that reporting RES at the company level by NAICS (North American Industry Classification System) was not a viable way to measure that business activity.

COVID-19 Pandemic Measurement

Small Business Pulse Survey

In April of 2020, the U.S. Census Bureau began administering the Small Business Pulse Survey (SBPS)³ as an experimental data product to “produce crucial data in near real-time on the challenges small businesses were facing due to the Coronavirus pandemic.”⁴ Although the

³ U.S. Census Bureau. (2022). *Small Business Pulse Survey: Tracking Changes During The Coronavirus Pandemic*. <https://www.census.gov/data/experimental-data-products/small-business-pulse-survey.html>

⁴ U.S. Census Bureau. (2022). *Small Business Pulse Survey: Summary*. <https://portal.census.gov/pulse/data>

questions⁵ posed in this survey were qualitative and therefore did not provide measurable data for analysis, it allowed data users to link a business' behavior directly to the COVID-19 pandemic.

The SBPS served an important role for the Census Bureau in its ability to capture the behavior (including e-commerce-related behavior) of businesses responding to the challenges they faced with the COVID-19 pandemic. Comprised of eight phases, each approximately nine weeks long, the SBPS solicited participation from over 90,000 small businesses (between 1 and 499 employees) per phase⁶. The questions on the SBPS were adjusted slightly throughout all of the eight phases but questions touching on a business's plan to either "Develop online sales or websites" or "Adopt or expand use of digital technologies" were introduced during phase two. Additionally, the questionnaire for phases two and three explicitly asked respondents, "Since March 13, 2020, has there been an increase in this business's use of online platforms to offer goods or services?" Results from this question can be seen below.

Small Business Pulse Survey - Phases 2 and 3				
Q. Since March 13, 2020, has there been an increase in this business's use of online platforms to offer goods and services?				
Category		Percentage of Businesses		
		Yes	No	This business does not use online platforms to offer goods or services.
Phase 2	08/09/2020 to 08/15/2020	24.7	29.6	45.7
	08/16/2020 to 08/22/2020	24.3	30.4	45.3
	08/23/2020 to 08/29/2020	24.5	30.3	45.1
	08/30/2020 to 09/05/2020	23.9	29.9	46.2
	09/06/2020 to 09/12/2020	24.0	30.5	45.5
	09/13/2020 to 09/19/2020	24.3	30.5	45.3
	09/20/2020 to 09/26/2020	23.7	30.6	45.7
	09/27/2020 to 10/03/2020	23.8	30.6	45.6
	10/04/2020 to 10/12/2020	24.3	30.4	45.4
Phase 3	11/09/2020 to 11/15/2020	24.4	30.3	45.3
	11/16/2020 to 11/22/2020	24.5	29.7	45.8
	11/23/2020 to 11/29/2020	24.4	28.9	46.6
	11/30/2020 to 12/06/2020	24.2	29.2	46.7
	12/07/2020 to 12/13/2020	24.5	29.6	45.9
	12/14/2020 to 12/20/2020	24.4	29.2	46.4
	12/21/2020 to 12/27/2020	23.3	30.4	46.3
	12/28/2020 to 01/03/2021	23.9	29.8	46.4
	01/04/2021 to 01/10/2021	24.8	29.7	45.5

Small Business Pulse Survey: Phases 2 and 3

(Approval ID: CBDRB-FY20-259, CBDRB-FY20-357, CBDRB-FY21-113, CBDRB-FY21-292)

⁵ See Appendix B for more information on these questions.

⁶ U.S. Census Bureau. (2022). *Small Business Pulse Survey: Summary*. <https://portal.census.gov/pulse/data>

Interestingly, in every week across of phases two and three of the SBPS almost a quarter of respondents answered, “Yes,” indicating an increase in e-commerce activity.

Importance of Existing Time Series

As interesting and helpful as the information gleaned from these questions was, data users are still unable to fully quantify the impact of the COVID-19 pandemic on e-commerce activity in terms of output in dollars. The Census Bureau’s commitment to time series, which entails maintaining stability when it comes to changing questionnaire content, provides a valuable opportunity for SAS to publish data which can be used to study the “before-, during-, and after-pandemic” estimates of e-commerce/RES as more post-COVID years’ data become available. With that data, users of the SAS data can deduce the year-to-year impact of the COVID-19 pandemic based on many of the published estimates across select service sectors. To preserve the time series, the question asked of respondents’ RES activity remains the same since its last modification in survey year 2017.

Although no changes occurred to the RES item during the pandemic, other parts of the SAS questionnaire underwent some minor modifications. Most notably, the addition of a “Revenues from Telemedicine Services” question was added to three different questionnaires within the health care sector for the 2020 survey.⁷ It will be interesting to see how estimates for this already growing service change over time given the impact of the COVID-19 pandemic on the health care industries.

SAS Revenues from Electronic Sources

The chart below is an excerpt from Table 9 of the 2020 Service Annual Survey publication. Although some estimates of RES have been suppressed at the two-digit NAICS sector level due to quality concerns, data users are able to infer how the COVID-19 pandemic impacted this activity by comparing 2020 estimates to prior year figures. At the “Services Total” level, total revenue decreased 1.9 percent from 2019 to 2020 while RES increased 0.9 percent⁸. However, this pattern was not seen in all sectors. Some sectors experienced a decrease in revenue and RES while others weathered a challenging 2020 for businesses by finishing with increases in both items. The Census Bureau is eager to see how these trends change in future publications with an ever-changing economic landscape due to the many influences of the COVID-19 pandemic.

⁷ See Appendix C for more information on this content change.

⁸ Not statistically significant

NAICS Description	2019 ³		2020 ³	
	Revenue	Revenue from Electronic Sources	Revenue	Revenue from Electronic Sources
Services Total	16,999,369	1,350,529	16,668,151	1,362,639
22 - Utilities	599,220	S	580,647	S
48-49 - Transportation and Warehousing	1,070,520	192,627	919,668	120,181
51 - Information	1,755,214	479,850	1,791,438	525,031
52 - Finance and Insurance	4,854,315	247,297	4,959,947	S
53 - Real Estate and Rental and Leasing	756,268	54,127	730,742	57,700
54 - Professional, Scientific, and Technical Services	2,077,668	80,929	2,143,768	116,797
56 - Administrative and Support and Waste Management and Remediation Services	1,090,944	70,668	1,042,582	51,463
61 - Educational Services	72,812	S	67,793	14,731
62 - Health Care and Social Assistance	2,786,127	S	2,828,912	S
71 - Arts, Entertainment, and Recreation	296,444	42,413	210,185	23,646
72 - Accommodation and Food Services	1,040,970	124,621	807,086	126,063
81 - Other Services (except Public Administration)	598,867	37,047	585,383	36,822

2020 Service Annual Survey: Table 9. Estimated Revenue from Electronic Sources for Employer Firms: 2015 Through 2020

³All estimates are presented in millions of U.S. dollars (\$)

S – Estimate does not meet publication standards because of high sampling variability, poor response quality, or other concerns about the estimate's quality.

Data not adjusted for price changes. Differences in revenue estimates may be attributed to sampling or nonsampling error, rather than underlying economic conditions. Caution should be used in drawing conclusions from the estimates and comparisons shown. Additional information on survey methodology, including sampling and nonsampling error, sample design, and confidentiality protection can be found at <https://www.census.gov/programs-surveys/sas/technical-documentation/methodology.html>.

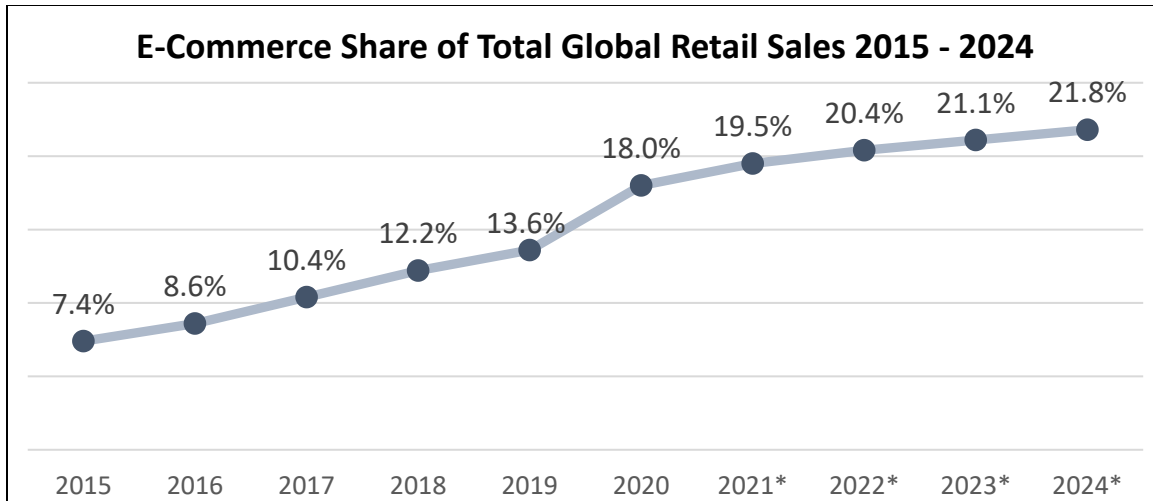
(Approval ID: CBDRB-FY21-256)

Pandemic Related E-Commerce Findings from Other Sources

As stated in the International Trade Administration article, Impact of COVID Pandemic on eCommerce, “The COVID pandemic crisis has forced many small businesses to reassess the decades-old traditional business models or face closing permanently. New and existing technologies are thrust to the forefront of every business toolkit, and forward-looking businesses are addressing talent questions that arise from these new digital business skillsets.”

The graph below shows a forecasted increase in online retail sales because of the paradigm shift that COVID disruptions have brought to business, according to the published article.⁹

⁹ International Trade Administration. (2022). *Impact of COVID Pandemic on eCommerce*. <https://www.trade.gov/impact-covid-pandemic-ecommerce>



* - Forecasted at time of publication

International Trade Administration. Impact of COVID Pandemic on eCommerce. <https://www.trade.gov/impact-covid-pandemic-ecommerce>

According to an article published by Insider Intelligence online research magazine in May 2021, U.S. retail e-commerce sales were expected to reach \$647.9 billion in 2020, an increase of 12.9 percent from 2019 retail sales of \$598.0 billion. However, consumers actually spent \$799.2 billion in 2020 according to their data, an increase of 33.6 percent. The authors attribute the difference between the forecasted increase and actual increase to the pandemic. Their pre-pandemic forecast for U.S. e-commerce sales in 2021 was a growth of 12.8 percent; they now expect that growth to be 13.7 percent.¹⁰

These references as well as others published that assess the impact of the pandemic on the economy highlight the approach used by many industry analysts, which is to compare the pre-pandemic forecast to the actual data and attribute the difference to the pandemic. This underscores the predicament data providers, including the U.S. Census Bureau, face in trying to capture the effect of an unexpected event, after the fact, and with little time to coalesce around a tested methodology. Future data will reveal whether this trend is short-lived, or if the increase in e-commerce activity resulting from the pandemic has created an enduring dependence. If the latter is the case, perhaps in time businesses will change their record-keeping practices in ways which will enable the data collection methodology needed to produce robust and meaningful e-commerce data.

¹⁰ Droesch, B. (2021, May 17). *How will the pandemic affect US ecommerce sales in 2021?* Insider Intelligence. <https://www.insiderintelligence.com/content/how-will-pandemic-affect-us-ecommerce-sales-2021>

Final Thoughts

It can be said anecdotally that COVID-19, with its worldwide impact and length of endurance, has served as a catalyst in the accelerated adoption and increased proficiency of e-commerce. Even if its acceleration slows somewhat after the boom of 2020 and 2021, there are several reasons to believe e-commerce activity will continue its upward trajectory, among them being:

- The increase in customer demand due to the peace-of-mind factor of receiving goods at home,
- The increase of e-commerce savviness of segments of the population not expected to participate in e-commerce, pre-pandemic, and
- The increase of businesses which specialize in e-commerce search engine optimization (SEO) to assist other businesses with their e-commerce efforts

There is room and opportunity to innovate and adapt to the increased interest in e-commerce and explore data which will track and trend this segment of the economy. But tapping into the correct data demands is critical. Among the questions to consider when deciding whether to change the current collection and publication activities are:

- Will the increase in business participation of e-commerce translate into better reporting?
- Will the current confusion over e-commerce definitions and in-scope vs. out-of-scope activities lessen with the increase in e-commerce savviness?
- What data will best inform stakeholders and data users? What would they find most useful?
- Are there new or emerging economic frontiers which would benefit from the collection and publication of e-commerce data?
- How can we merge e-commerce business data with demographic data to present the most comprehensive understanding of e-commerce?

Appendix A: Service Annual Survey Item 8 Changes 2016 to 2017

E-Commerce question for the 2016 Service Annual Survey

8 E-COMMERCE

E-commerce is the sale of goods and services where the buyer places an order, or the price and terms of the sale are negotiated, over an Internet, mobile device (M-Commerce), extranet, EDI network, electronic mail, or other comparable online system. Payment may or may not be made online.

A. Did this firm have any e-commerce revenue in 2016 or 2015?

Yes

No - Go to **14**

B. What was the total e-commerce revenue in 2016 and 2015?

2016				2015			
\$ Bil.	Mil.	Thou.	Dol.	\$ Bil.	Mil.	Thou.	Dol.

Revenues from Electronic Sources question for the 2017 Service Annual Survey

8 REVENUES FROM ELECTRONIC SOURCES

A. Did this firm have any revenues from customers entering orders directly on the firm's websites or mobile applications in 2017?

0040 Yes

No

B. Did this firm have any revenues from customers entering orders directly on third-party websites or mobile applications in 2017?

0041 Yes

No

C. Did this firm have any revenues from customers entering orders via any other electronic systems (such as private networks, dedicated lines, kiosks, etc.) in 2017?

0042 Yes

No

D. Of the total 2017 revenues reported in **3, what was the dollar amount (or percentage) that was from the revenues identified in A-C above? Please provide an estimate if exact figures are not available.** 2500

2017			
\$ Bil.	Mil.	Thou.	Dol.

OR 2501

2017	
Percent	%

Appendix B: Relevant Questions from Small Business Pulse Survey of U.S. Census Bureau

Small Business Pulse Survey – Phases 2 and 3

Since March 13, 2020, has there been an increase in this business's use of online platforms to offer goods or services?

- Yes
- No
- This business does not use online platforms to offer goods or services.

Small Business Pulse Survey – Phases 2 – 8

In the next six months, do you think this business will need to do any of the following?

- Obtain financial assistance or additional capital
- Identify new supply chain options
- ***Develop online sales or websites***
- Increase marketing or sales
- Identify and hire new employees
- Make a capital expenditure
- Cancel or postpone a planned capital expenditure
- Identify potential markets for exporting goods or services
- Permanently close this business
- None of the above

Small Business Pulse Survey – Phase 8

Q18. In the next six months, do you think this business will do any of the following?

- ***Adopt or expand use of digital technologies***
- Change management practices
- Change business strategies
- Introduce new goods or services
- Improve existing goods or services
- Improve methods of producing goods or services
- Improve methods of logistics, delivery, or distribution
- None of the above

Small Business Pulse Survey – Phase 7

Q17. Comparing now to what was normal before March 13, 2020, has this business done any of the following? Select all that apply:

- ***Adopted or expanded use of digital technologies***
- Changed management practices
- Changed business strategies
- Introduced new goods or services
- Improved existing goods or services
- Improved methods of producing goods or services
- Improved methods of logistics, delivery, or distribution
- This business has not made any of these changes

Appendix C: Content of Telemedicine Question from Service Annual Survey

7 REVENUES FROM TELEMEDICINE SERVICES

Telemedicine (TM) services are billable visits that use live interactive audio-video telecommunications to deliver patient health care services by a physician or a practitioner at a remote location.

Include:

- TM revenues from delivering health care services such as evaluating, diagnosing, and/or prescribing treatment.
- TM revenues from facilitating visits at the patient's physical location such as technical support with telecommunications.

A. Did this firm receive revenues from telemedicine services in 2020?

Yes

4120

No - Go to **8**

B. Of the total 2020 revenues reported in **6, what was the dollar amount (or percentage) that was from telemedicine services in 2020? Please provide an estimate if exact figures are not available.** 4121

2020			
\$ Bil.	Mil.	Thou.	Dol.

OR

4122

2020	
Percent	
	%