

Measuring The U.S. Digital Economy: Theory and Practice

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1. Introduction

The growth, integration, and sophistication of information technology and communications are changing society and the economy. Consumers now routinely use computer networks to identify sellers, evaluate products and services, compare prices, and exert market leverage. Businesses use networks even more extensively to conduct and re-engineer production processes, streamline procurement processes, reach new customers, and manage internal operations. While the burgeoning use of electronic devices is widely acknowledged and discussed, it remained largely undefined and unrecognized in official U.S. economic statistics. The U.S. Census Bureau initiated an aggressive program in 1999 to begin filling this data gap. We first developed a measurement framework defining what we wanted to measure, and why. We found that we could fill some of the gaps by adding questions to existing surveys, making the scope of existing surveys consistent, or developing new surveys. However, we found that filling some key gaps requires addressing significant, and sometimes long-standing, challenges to economic measurement. Our multi-faceted measurement strategy produced the Census Bureau's first official U.S. measures of retail e-commerce in March 2000, baseline e-commerce measures for key economic sectors in March 2001, and baseline reports on some e-business processes in June 2001.

2. Measurement Framework

Our first challenges in early 1999 were defining the digital economy and developing a framework to guide our measurement program. It quickly became clear that policymakers, industry, and the media used a variety of terms interchangeably to describe digital economic activity, and had no common understanding of their scope or relationships. Establishing specific terms that clearly and consistently describe our growing and dynamic networked economy was a critical first step in developing useful statistics about it. The Census Bureau developed definitions and concepts (USCB 1999), starting with a thorough review of related work undertaken by other National statistical agencies, borrowing heavily from work done by Statistics Canada and others. We also chaired an OECD task force charged with developing electronic commerce definitions.

We defined three primary components of the digital economy – supporting infrastructure, electronic business processes (how business is conducted), and electronic commerce transactions (selling goods and services online). Both electronic business processes and electronic commerce transactions rely computer-mediated networks. This reliance on computer networks, and the benefits they can provide, is the “bottom line” difference between electronic and other kinds of business.

We developed a measurement framework to identify key information needs (USCB 2000). New information specific to the electronic economy – on electronic transactions, electronic business processes, and the electronic business infrastructure – was needed for all industries and sectors. Initial information on electronic commerce transactions could often be obtained through relatively small changes to existing data collection programs. However, we found that new initiatives were needed to provide basic information on electronic business processes. Some longer-term improvements, such as measuring the supporting infrastructure, required an initial round of research to identify proposals for specific improvements. We also found that providing the information data users need to make inferences about the electronic economy’s impact on such key performance measures as productivity required continuing to improve our baseline measures of the entire economy.

3. Measurement Strategy

Our measurement strategy is multi-faceted, yet purposeful. It was tempered by reductions in our FY 2000 budget (October 1999-September 2000) (USCB 2001b). Our goal was to develop an e-business measurement program, partnering with government, business, and academia. We thought it imperative to begin measuring and understanding the electronic economy sooner, rather than later.

Leverage our core competencies. Faced with resource constraints, we wanted to leverage our experience and expertise in measuring transactions and take advantage of existing survey instruments. E-commerce was our initial measurement priority. We exploited existing surveys first. Adding e-commerce inquiries to existing surveys allowed us to begin collecting new data and providing new measures in FY 2000 and FY 2001, at relatively low marginal cost.

Complement and improve our existing economic statistics. Our measurement framework showed that measures of the digital economy should not stand alone, but rather complement our existing measures. Exploiting existing surveys made our baseline measures of e-commerce comparable to such broader measures of economic activity as sector or industry totals. Applying consistent definitions to brick-and-mortar, click-and-mortar, or pure Internet plays further this comparability. Our e-business measures also will be linked to existing survey frames, allowing better understanding of how these processes are changing firms, industries, and economic sectors.

Contract for e-business process expertise. Understanding and measuring e-business processes was our second priority. E-business processes significantly change the ways business operates by altering the traditional view of the firm, supply chains, and the structure of many industries. These changes challenge statistical programs. While understanding e-business processes is likely to be far more important than quantifying e-commerce transactions, e-business processes are less well-defined, and less easily measured in our existing programs. We contracted with outside experts to help us better understand e-business processes and their effects. We then leveraged our competency in cognitive research to craft survey questions that were meaningful to our respondents.

4. First Official U.S. Measures of E-Commerce

Retail E-Commerce. In the fall of 1999, the Census Bureau initiated our first e-commerce data collection effort, adding two questions to our monthly retail trade survey. We asked some 8,000 retail firms if they were selling online. Those responding affirmatively were asked to report the dollar volume of their e-commerce sales. We collected the data monthly, but published quarterly estimates. The first official retail e-commerce estimates for the fourth quarter of 1999, were released on March 2, 2000. While retail e-commerce sales receive much attention, they remain a relatively minuscule part of overall retail trade sales, accounting for 1 percent of total retail sales only in the fourth quarter of 2000. On the other hand, our most recent estimates do not reflect much of the recent media hype over failing dot.coms. E-commerce retail sales grew 36 percent between the third and fourth quarters of 2000, a significantly stronger growth rate than the 5.4 percent increase in overall retail sales.

Baseline E-Commerce Measures for Key Economic Sectors. We provided e-commerce measures for 1999, a time when e-commerce was beginning to become economically significant, by adding questions to four existing surveys. We added e-commerce sales questions to 1999 annual surveys covering retail trade (19,000 firms), wholesale trade (6,900 firms), and selected NAICS services industries (51,000 firms). For the manufacturing sector, we also collected information about manufacturing plant's existing and planned use of selected e-business processes. A special supplement to the 1999 Annual Survey of Manufactures (ASM) collected data from some 50,000 manufacturing plants. Inquiries included e-commerce sales and purchases; the types of information manufacturers are sharing online with suppliers and customers; and present and planned use of over 25 specific e-business processes. We also provided plant managers with the opportunity to report electronically.

E-Stats E-commerce 1999 integrated the e-commerce results from these four surveys into a single report released on March 7, 2001 (USCB 2001a). Manufacturing led all industry sectors with 1999 e-commerce shipments of \$485 billion, or 12.0 percent of the total value of manufacturing shipments. Merchant Wholesalers were second with e-commerce sales that represented 5.3 percent, or \$134 billion, of total sales. Selected Service Industries, a special grouping of service industries created for this report, had e-commerce revenues of \$25 billion, or 0.6 percent of total revenues for these industries. Retail Trade had e-commerce sales of \$15 billion, or 0.5 percent of total retail sales.

Manufacturing and Merchant Wholesale Trade, sectors where goods are primarily sold to other businesses, had substantially higher e-commerce percentages than Retail Trade and Selected Service Industries, sectors where goods and services are sold to individual consumers as well as to businesses. Although the surveys did not collect separate data on business-to-business (B-to-B) and business-to-consumer (B-to-C) e-commerce, one can approximate relative shares by using some simplifying assumptions. Assuming all manufacturing and wholesale e-commerce was entirely B-to-B and all retail and service e-commerce activity was entirely B-to-C, and ignoring the definitional differences among shipments, sales, and revenue, more than 90 percent of total U.S. e-commerce was B-to-B.

One possible explanation for the large percentage differences in e-commerce shares among the four sectors may be the long-standing use of electronic data interchange (EDI) systems for online selling by many manufacturing and wholesale trade industries. By comparison, many retail and service industries adopted Internet systems much more recently. In manufacturing, while many plants used the Internet for accepting online orders from their customers, in terms of dollar volume, EDI systems continued to dominate. Of those manufacturing plants that reported offering online ordering to their customers, 52 percent used the Internet most frequently, while 36 percent used EDI most often. However, plants using Internet ordering systems most frequently accounted for only 5 percent of total manufacturing e-commerce shipments, while plants offering EDI ordering accounted for 59 percent.

E-Stats Manufacturing 1999 and mid-2000 highlights a comparison of 1999 online purchases and e-commerce shipments at manufacturing plants in the U.S. and presents the first available data on the mid-2000 use of e-business processes in those plants (USCB 2001c). On-line purchases accounted for 11 percent of all cost of materials at manufacturing plants in 1999. E-purchases were concentrated. Transportation Equipment accounted for almost half of total manufacturing e-purchases, and Computer and Electronic Products accounted for another 10 percent. Almost 90 percent of the responding plants reported a computer network in place. While over 80 percent of responding plants had Internet access, there were opportunities for further integration. Almost half of the plants that accepted orders online did not place orders online.

Next Steps. We will develop measures of household e-commerce to complement our business measures from questions that will be included in a special Internet supplement to the monthly Current Population Survey. Additional key measurements, such as continuing to collect data on e-business process use in manufacturing, developing and conducting a supply chain survey, and developing e-business infrastructure measures, would require additional funding.

5. Conclusions

During the past two years, the U.S. Census Bureau embarked on an ambitious e-business measurement program and learned valuable lessons. The six months spent developing definitions and a measurement framework was time well spent. Using precise and defined terms enhanced our ability to communicate our measurement program to our staff and customers. At the same time, we needed to put our actual survey questions in language that our respondents, who are accountants rather than technology specialists, would understand. This aspect of the structure of our existing programs placed unexpected and significant constraints on what we could collect. A final, and unexpected, benefit of using our existing surveys was being forced to address a long list of existing measurement issues. The challenges of collecting data on the digital economy gave us a fresh perspective. We invite feedback on our initial efforts and future plans. We also are very interested in other countries' experiences measuring e-business activity and invite them to share those experiences with us. Please forward your comments, experiences, and suggestions to the authors.

REFERENCES

- USCB 1999: Mesenbourg, T., "Measuring Electronic Business", www.census.gov/estats.
USCB 2000: Atrostic, B., Gates, J., and Jarmin, R., "Measuring the Electronic Economy", www.census.gov/estats.
USCB 2001a: *E-Stats E-commerce 1999*, www.census.gov/estats.
USCB 2001b: Mesenbourg, T., "Measuring the Digital Economy" www.census.gov/estats.
USCB 2001c: *E-Stats Manufacturing 1999 and mid-2000*, www.census.gov/estats.

RESUME

This paper describes the conceptual framework the U.S. Census Bureau used to develop its strategy for measuring the U.S. digital economy, and how it implemented that strategy. The first official U.S. e-commerce statistics are presented, together with lessons learned and plans for future data collections.

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