Measuring the Value of Cross-Border Data Flows

Prepared by the

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Foreword

Here at the Department of Commerce, we recognize that global digital interconnectedness has allowed for significant advances in economic activity. New technologies allow for vast amounts of data and digital information to flow between countries. Our citizens' ability to understand the world is enhanced by access to information, travel, and digital interaction with people and businesses in other countries. Digital flows of data between countries represent value added to an economy and can contribute to economic growth through trade and other cross-border transactions among both consumers and businesses.

Led by this conviction, our Department has made the digital economy and data important priorities in its Strategic Plan for Fiscal Years 2014-2018. The Department's efforts have resulted in substantial improvements in how we manage, optimize, and enable public access to the vast treasures of data produced every minute of every day. From weather data to measurement of U.S. economic activity, the Department leads the world in producing government data that helps communities, businesses, citizens, and policymakers inform their decisions, foster innovation, and support job creation and economic growth. Secretary Pritzker has led the Department's digital economy agenda through her tireless promotion of a free and open Internet, trust, including privacy and security, access and skills, and innovation.

The following report, Measuring the Value of Cross-Border Data Flows, provides a helpful summary of current methods being utilized to define and measure these flows as well as the challenges associated with such measurement. The report provides an important assessment of the research on data flows measurement and how regulations and transparency can influence the estimation of the value attached to these data flows. Finally, the report provides six recommendations regarding next steps the Department and the private sector can undertake to improve the economic measurement and analysis of cross-border data flows.

Given that these public assets are valuable in fostering innovation, creating jobs, and driving better decisions—both by businesses and policymakers—we expect that there will be significant support for this in the years ahead. Indeed, one of the hallmarks of the U.S. economy will continue to be our leadership in open data to support innovation and economic growth for all. Keeping the data highways open, and measuring these flows, can only heighten this success in the future.

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Executive Summary

The Internet has transformed how Americans live, work, and play. It has connected people around the world in new ways through data that flows seamlessly across borders. Businesses rely on cross-border data flows to access markets and interact with customers across the globe; find new suppliers; and communicate with their overseas affiliates. Citizens rely on these flows to access a wealth of information from around the world; communicate with family, friends, and colleagues overseas; and gain access to foreign consumer and financial markets. Data users around the globe are exploring new ways to use big data to learn more about the world in which they live.

The economic data that is available from the Department relies on sound methodology and standard nomenclature. This data helps businesses choose strategies and informs policymakers as they set priorities. These priorities, in turn, drive policy choices, international negotiations, regulations, and legislation. A growing body of research has examined the relationship between cross-border data flows and economic growth—these studies point to the growing economic significance of these flows. But while the government has robust datasets on traditional industries, currently the U.S. Government does not regularly collect data that is specifically intended to measure how cross-border data flows impact the U.S. economy. As the use of cross-border data flows grows, we need to expand the information available to measure the economic impact of these flows and to help businesses and policymakers make informed decisions. Data on cross-border data flows and the digital economy should employ the same solid statistical foundations that our other economic data rely on. Some academics and private sector studies have examined the economic importance of cross-border data flows, but data gaps remain.

To better understand the potential data gaps and where the U.S. Department of Commerce (the Department) could best add value, the Department's Digital Economy Leadership Team (DELT) initiated a six-month effort to gather information on unmet data needs related to the measuring the economic value of the free flow of information. As the culmination of that effort, this report catalogues the challenges of measuring cross-border data flows and makes recommendations for improving the related data. Our analysis is based on numerous meetings with researchers and other stakeholders, a literature review, and a roundtable convened on May 9, 2016, to discuss measurement gaps.

This report and the recent Department effort are primarily focused on cross-border data flows. Cross-border data flows are one component of the broader digital economy. The digital economy encompasses all the goods and services that rely on or facilitate digital technologies. Many of the recommendations presented in this report relate to both cross-border data flows and the larger digital economy that encompasses them.

During the course of our research, culminating with the May 9, 2016 roundtable, stakeholders provided recommendations to help reach the goals noted above. While there are opportunities for both the private sector and U.S. Government agencies to improve the available measures of the value of cross-border data flows, this report primarily focuses on the opportunities specific to the Department. From the

recommendations, we identified six actions the Department can take to improve the availability and quality of statistics and economic analysis related to cross-border data flows and the digital economy:

1. Improve the overall coverage and quality of the government statistics on the service-sector.

2. Develop a standard nomenclature or standard definitions for concepts related to cross-border data flows, distinguishing between concepts such as digital economy, digitally-intensive, digitally-enabled economy, and information and communications technologies (ICT).

3. Develop a greater understanding of how firms use cross-border data flows and what economic value the data flows provide. These metrics should cover the entire U.S. economy as well as specific sectors.

4. Develop improved and consistent macro-economic statistics to measure the value of cross-border data flows and the digital economy, such as the contribution of data flows and the digital economy to gross domestic product (GDP). These metrics should cover the entire U.S. economy as well as specific sectors.

5. Continue the dialogue between the Department and private industry to facilitate data sharing and the linking of public and private datasets, where legally and logistically feasible and consistent with strong privacy protections for firms.

6. Continue the collaborative efforts of the Department and international organizations to ensure that metrics on cross-border data flows and the digital economy are widely available for countries around the world.

In this report, we discuss these six recommendations in more detail and explore some of the challenges in measuring the value of cross-border data flows. We also describe related efforts that are currently underway at the Department. For example, the Bureau of Economic Analysis (BEA) is already taking several steps to improve its trade in service statistics. BEA and the National Telecommunications and Information Administration (NTIA) are also embarking on a three-year study to define the digital economy, improve measurement related to ICT pricing, and provide initial estimates of the digital economy's contribution to GDP. The Department is committed to continuing collaboration with the private sector and other non-governmental groups, as well as with other government entities, both domestic and international.

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Introduction

The cross-border flow of data, an increasingly important driver of the U.S. and global economies, has transformed how people live, work, and communicate. Businesses rely on data flows to access markets, facilitate supply chains, and enable transactions around the world. Individuals rely on data flows to access a global wealth of information; communicate with family, friends, and colleagues; and access consumer and financial markets.

Cross-border data flows are important for all of these reasons and more, and a number of researchers have begun using existing statistics to provide evidence on the importance of these flows as well as on the costs of restrictions such as data localization laws or onerous data protection rules.[1] These studies are numerous and varied, focusing on both macroeconomic and microeconomic effects, domestically and internationally. The literature spans topics from measuring the value of cross-border data flows to measuring and mapping the capacity of undersea fiber optic cables.[2] Although several researchers have looked at the volume of data flows,[3] this does not necessarily provide insight on the economic value of their content.[4] Streaming a video might be of relatively little monetary value but use several gigabytes of data, while a financial transaction could be worth millions of dollars but use little data.

Policymakers, industry decision makers, and researchers need improved and consistent measurement of the size and the importance of cross-border data to make better decisions and increase our understanding of the U.S. economy.[5] The types of data and standard definitions available in the traditional statistics for goods and services help businesses choose strategies and inform policymakers as they set priorities. These priorities, in turn, drive policy choices, negotiations, regulations, and legislation. Standard definitions and strong statistics are also essential for measuring the effects of policies once implemented. The absence of data to

[1] Appendix A summarizes some of the available statistics generated by the research to date. Appendix B lists data sources relevant to measuring the economic impact of cross-border data flows.
[2] Appendix C lists references and literature related to cross-border data flows identified during this project.
[3] For example, McKinsey Global Institute (MGI) applied data on used cross-border bandwidth in an econometric model of global flows to conclude that data flows directly increased world GDP by 3 percent, or $2.2 trillion, in 2014. MGI, McKinsey & Company, Digital Globalization: The New Era of Global Flows, (2016), Retrieved from http://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-globalization-the-new-era-of-global-flows, at p. 1 (Last accessed May 5, 2016). Paul Hofheinz and Michael Mandel use a measure of digital density—used data per capita—as a proxy for cross-border data flow usage. Hofheinz, P. & Mandel, M. The Lisbon Council & Progressive Policy Institute (PPI), Uncovering the Hidden Value of Digital Trade, (2015), Retrieved from http://www.progressivepolicy.org/wp-content/uploads/2015/07/2015.07-Mandel-Hofeinz-Uncovering-the-Value-of-Digital-Trade_Towards-a-21st-Century-Agenda-of-Transatlantic-Prosperity.pdf, at p. 5. (Last accessed July 7, 2016). Cisco also provides annual global and regional five-year data traffic forecasts. See, Cisco, Visual Networking Index (VNI), Retrieved from http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html, (Last accessed Aug. 9, 2016).
[4] Meltzer, J. Brookings Institution, The Importance of the Internet and Transatlantic Data Flows for U.S. and EU Trade and Investment ("Meltzer 2014 Internet Report"), (2014), Retrieved from http://www.brookings.edu/research/papers/2014/10/internet-transatlantic-data-flows-meltzer, (Last accessed May 5, 2016).
[5] While this report focuses specifically on the importance of measuring the economic impact of cross-border data flows, much of the information presented here is relevant to understanding the impact of the digital economy as a whole.

measure these data flows and even agreed-upon standard terminology and definitions makes it difficult to assess the importance of cross-border data flows for these purposes.

This report is the culmination of a six-month effort to gather information about the existing research and unmet data needs related to measuring the economic importance of cross-border data flows. From November 2015 to April 2016, we, the authors of this report, met with representatives from more than 30 stakeholder groups, including the U.S. Government, private sector firms and industry associations, think tanks, academia, and other research institutions.[6] During this time, we also reviewed the available literature on measuring the value of cross-border data flows and the potential economic impacts of restrictions to these flows. We also participated in a series of international working group meetings on these topics hosted by the United Nations Conference on Trade and Development (UNCTAD). On May 9, 2016, we convened a roundtable of stakeholders to discuss further what data gaps exist when trying to measure the value of cross-border data flows.[7]

> *"The world is more connected than ever, but the nature of its connections has changed in a fundamental way. The amount of cross-border bandwidth that is used has grown 45 times larger since 2005. It is projected to increase by an additional nine times over the next five years as flows of information, searches, communication, video, transactions, and intracompany traffic continue to surge. In addition to transmitting valuable streams of information and ideas in their own right, data flows enable the movement of goods, services, finance, and people. Virtually every type of cross-border transaction now has a digital component."*
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> McKinsey Global Institute (MGI). McKinsey & Company. (2016). Digital Globalization: The New Era of Global Flows. p. 40.

Cross-border data flows are one component of the broader digital economy. The digital economy encompasses these flows, as well as all the goods and services that rely on or facilitate digital technologies. This report summarizes the existing data sources that provide insight to the value of cross-border data flows, the challenges in measuring the value of these flows and the larger digital economy, and the recommendations made by stakeholders to improve the existing data. These recommendations include improving data that the Department already produces as well as areas for new research.

[6] Appendix D identifies experts and stakeholders consulted during this project.
[7] Read more about the May 9, 2016 roundtable "Measuring Cross-Border Data Flows: Unmet Data Needs" on the Department of Commerce blog, Retrieved from https://www.commerce.gov/news/blog/2016/05/commerce-brings-stakeholders-together-improve-digital-economy-metrics.

Types of Data Flows

For the purposes of this report, it is useful to develop a working categorization of various types of cross-border data flows. A report by the Department's Office of the Chief Economist[8] suggests distinguishing between four types of data flows:

1. **Purely non-commercial data traffic**, including government and military communications.

2. **Transaction data flows between buyers and sellers at a market price**, including direct purchases between buyers and sellers, such as in online banking or advertising, and services transactions that involve digital platforms acting as intermediaries between buyers and sellers.

3. **Commercial data and services exchanged between or within businesses or other related parties at $0 market price**, including supply chain, personnel, or design information.

4. **Digital data and services delivered to and from end-users at $0 market price**, including free email, search engine results, maps and directions, and information via social media.

The framework above is helpful because it distinguishes between several categories of transactional data flows based on the relationship between the sender and recipient and the type of transaction that connects them.[9] As described in greater detail below, one of the central challenges of measuring the economic impact of cross-border data flows is that the transactions in the last two categories have $0 market price. However, even these transactions have value for data users and implications for the level of economic activity.

Our effort was intended to identify data needs for measuring the value of cross-border data flows for consumers and businesses. Consequently, we focused primarily on the last three of these four categories. Data flows related to government and military communications was beyond the scope of this work. Likewise, we did not attempt to identify data gaps related to the measurement of the actual bits of data flowing across borders. We acknowledge that measuring the volume of data flows is important, but focus here on measuring the *value* of the data flows.[10]

More research and data collection is needed to fully understand where and how data is flowing throughout the global economy. As noted later in this report, this is a critical first step to better measurement.

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[8] Nicholson, J. & Noonan, R. Office of the Chief Economist, Economics and Statistics Administration (ESA), U.S. Department of Commerce, Digital Economy and Cross-Border Trade: The Value of Digitally-Deliverable Services, (2014), Retrieved from http://www.esa.doc.gov/sites/default/files/digitaleconomyandtrade2014-1-27final.pdf, at p. 1, (Last accessed May 5, 2016).

[9] These categories are useful in discussing how cross-border data flows may be captured by economic statistics. There may be several other ways to categorize data flows; for instance, by type of content or purpose. Below we discuss the importance of developing a detailed nomenclature of data flows for the purpose of accurately measuring their economic importance.

[10] Appendix A and Appendix B list sample statistics and datasets related to the measurement of data traffic or the volume of data flows.

Restrictions to Cross-Border Data Flows

Governments around the world are increasingly pursuing laws and policies that seek to restrict the flow of cross-border data. Data localization requirements generally reduce economic efficiency by forcing businesses to store data in countries in which they would not otherwise. This increases storage costs and may also have a large impact on business operations, especially for small firms that might not have the resources to comply with these regulations.[11] Beyond increasing costs and requirements for companies that operate internationally, data localization is likely to be a trade barrier for firms that would otherwise enter the local market, so understanding the direct costs alone may not be sufficient to estimating the harm. In addition, in order to transmit protected data to, or from, a country with a different privacy policy than the United States, firms are required to comply with a variety of laws and regulations, which can be time-consuming and complicated.

> *"Companies and consumers must be able to move data as they see fit. Many countries have enacted rules that put a chokehold on the free flow of information, which stifles competition and disadvantages American entrepreneurs."*
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> Office of the United States Trade Representative (USTR). (2016) The Digital 2 Dozen. p. 2.

In its 2016 National Trade Estimate report and accompanying fact sheet, the Office of the United States Trade Representative (USTR) summarizes trade partners' current policies related to digital and telecom-related trade including key barriers to digital trade, such data localization or local content requirements.[12] Other organizations are also working to document barriers to digital flows.[13] The Organisation for Economic Cooperation and Development (OECD) is in the process of creating a taxonomy to classify data localization policies into groups, such as those that explicitly require some local data storage and those policies that ban cross-border data flows, effectively requiring all data to be stored locally.[14]

In 2012, the U.S. Senate Committee on Finance requested that the United States International Trade Commission (USITC) conduct two investigations into the role of digital trade in the U.S. and global

[11] For example, a study by Leviathan Security Group estimated that forced data localization laws could require local companies to pay 30 percent to 60 percent more for computing needs. Leviathan Security Group, Quantifying the Cost of Forced Localization, (2015), Retrieved from http://static1.squarespace.com/static/556340ece4b0869396f21099/t/559dad76e4b0899d97726a8b/1436396918881/Quantifying+the+Cost+of+Forced+Localization.pdf.

[12] See Office of the United States Trade Representative (USTR), National Trade Estimate, (2016), Retrieved from https://ustr.gov/sites/default/files/2016-NTE-Report-FINAL.pdf; see also USTR, Fact Sheet: Key Barriers to Digital Trade (2016), Retrieved from https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2016/march/fact-sheet-key-barriers-digital-trade, (Last accessed May 5, 2016).

[13] For example, a paper by the Global Commission on Internet Governance has documented legislative measures related to data localization in a number of countries and jurisdictions, and attempts to quantify the related economic costs of data localization. See Bauer, M., Ferracane, M., & van der Marel, E. Global Commission on Internet Governance, Tracing the Economic Impact of Regulations on the Free Flow of Data and Data Localization (2016), Retrieved from https://www.cigionline.org/sites/default/files/gcig_no30web_2.pdf (Last accessed July 5, 2016).

[14] 2016 Localising Data Presentation at p. 11.

economies: one to define and document restrictions on data flows and a second to quantify the economic impact of these restrictions.[15] As part of this effort, the USITC estimated that in 2011, digital trade increased U.S. GDP by between $517 billion and $711 billion (3.4 percent to 4.8 percent); increased average wages by 4.5 to 5.0 percent; and was the catalyst for the creation of up to 2.4 million jobs.[16] As of 2016, these are still some of the best estimates of the impacts of digital trade on the U.S. economy.[17] As discussed further below, these estimates could serve as a starting point for future government data collection and studies into the value of cross-border data flows to the U.S. economy.

The USITC also found that some restrictions on the free flow of data, such as in-country data storage requirements, privacy regulations, and online censorship, have the effect of acting as trade barriers. These digital-trade barriers, presented below in Table 1, are consistent with the restrictions identified during discussions with stakeholders and literature review. USITC estimated that removing foreign barriers to trade would likely result in an estimated $16.7 billion to $41.4 billion increase (a 0.1 percent to 0.3 percent increase) in U.S. GDP.[18] Furthermore, U.S. real wages would likely be 0.7 percent to 1.4 percent higher.[19]

[15] United States International Trade Commission (USITC), Digital Trade in the U.S. and Global Economies – Part 1 ("USITC Part 1 Report"), (2013), Publication Number 4415, Investigation number 332-531, Retrieved from https://www.usitc.gov/publications/332/pub4415.pdf at p. xxv, (Last accessed May 5, 2016);
USITC, Digital Trade in the U.S. and Global Economies – Part 2 ("USITC Part 2 Report"), (2014), Publication Number 4485, Investigation number 332-540, Retrieved from https://www.usitc.gov/publications/332/pub4485.pdf, at p. 1, (Last accessed May 5, 2016).

[16] USITC Part 2 Report at pp. 13, 17, 66, 73.

[17] These reports were one-time efforts. Below, we describe the methodology of these reports in more detail. This research points to possible ways digital trade could be measured in the future, but there are also several lessons learned from this first attempt.

[18] USITC Part 2 Report at pp. 16, 305. The USITC asked firms to estimate the impact of removing obstacles to doing business across borders over the Internet and their number of full-time employees. USITC used these data, combined with data from responses to questions about the severity and country location of barriers, in a Global Trade Analysis Project (GTAP) simulation to estimate the changes in trade costs and output that corresponded to the reported employment effects. The "shock" related to removing barriers in digitally-intense sectors, but the simulation results are economy-wide.

[19] USITC Part 2 Report at p. 18.

TABLE 1. Notable barriers and impediments to digital trade identified by industry representatives during United States International Trade Commission investigation

Impediment or barrier	Description	Effects on the economy
Localization barriers	Barriers include policies that require the in-country location of data servers; policies that require local content or technologies; and government procurement preferences and standards that favor local companies.	Industry representatives noted that localization barriers generally reduce market access, increase the costs to firms, and result in suboptimal business processes.
Data privacy and protection	Approaches to data privacy and protection diverge from country to country. Particularly noteworthy are the differences in policy between two major trading partners, the United States and the European Union (EU).	Industry representatives and experts reported that these measures impose substantial costs and uncertainty on firms, especially small- and medium-sized enterprises (SMEs). They stressed the need to find common ground and interoperability in regulatory approaches.
Intellectual property-related concerns	Digital content providers and Internet intermediaries reported substantial, although different concerns: • Representatives of the content industries—including software, music, movies, books, and video games—identified Internet piracy as the single most important barrier to digital trade for their industries. • Internet intermediaries expressed concerns about unclear legal frameworks and being held liable for the infringing or illegal conduct of users of their systems.	Representatives of content providers reported substantial negative economic effects resulting from Internet piracy. Intermediaries reported substantial negative economic effects resulting from unclear or overly broad legal liability.
Online censorship	Internet intermediaries and online content providers reported that online censorship is pervasive and growing.	Industry representatives reported that online censorship can substantially impede market access. They compared the blocking and filtering of online platforms and content to customs officials stopping all goods from a particular company at the border. They said that the negative economic effects can be considerable.
Traditional impediments	Border measures, such as complicated customs procedures and paperwork, can affect digitally-enabled trade.	Industry representatives reported that customs duties and complicated document preparation and processing can increase the costs associated with small online retail transactions, making it more difficult to conduct online business, especially for SMEs.

Source: Compiled by USITC. Published in "Digital Trade in the U.S. and Global Economies, Part 1." Investigation No. 332-531. USITC Publication 4415. July 2013. p. xxi.

Other U.S. Government agencies and firms engaged in the global economy are also very interested in measuring the economic impact of cross-border data flows on foreign economies. As discussed below, U.S. negotiators need quantifiable evidence to demonstrate to their foreign counterparts how agreements and local policies will help or hurt their local economies and businesses. From the U.S. perspective, deterring restrictive policies—like those noted above—that cut off the free flow of data, could help prevent barriers to trade and business operations.

Challenges of Measuring the Economic Value of Cross-Border Data Flows

It is apparent from our research and stakeholder meetings that there are numerous challenges to measuring the economic value of cross-border data flows (and the digital economy more broadly). We identified five key challenges:

1. **Nature of Cross-Border Data Flows**: Anecdotal information suggests that cross-border data flows have transformed how firms do business–it is hard to imagine a modern day company operating without the use of the Internet, which by its very nature relies on constant data flows, but there is very little concrete evidence on how cross-border data flows are used by firms.

2. **Lack of Standard Nomenclature**: There are no consistent definitions of the various types of cross-border data flows or of what comprises the broader digital economy.

3. **Lack of Data Specialization**: Much analysis of the economic impact of cross-border data flows and the digital economy relies on government datasets that are not intended for that purpose, and it is likely that official statistics do not capture many cross-border data flows.

4. **Limited Scope of Data**: Estimates of the value of cross-border data flows and the digital economy are often limited to "tech-related" sectors of the U.S. economy. Additionally, information is needed about how firms of different sizes use and value cross-border data flows.

5. **Absence of Regularity and Transparency**: Many of the estimates and studies of the impact and value of cross-border flows and the digital economy on which stakeholders currently rely are not produced on a regular basis and do not have transparent methodologies.

Below, we discuss each of these challenges in more detail.

Nature of Cross-Border Data Flows

Cross-border data flows have changed how many businesses operate. As one researcher states, "data are heavily used as an input within multinational companies with regards to management decisions and with the aim of administering, overseeing and operating establishments across countries."[20] Rather than requiring them to be physically present, firms may also have employees communicate with their overseas colleagues or customers via email, web chat, or video conference. Firms or individuals can share ideas, designs, and knowledge with a wider audience and at a more rapid pace than was previously possible.

[20] van der Marel, E. European Center for International Political Economy (ECIPE), Disentangling the Flows of Data: Inside or Outside the Multinational Company?, (2015), ECIPE Occasional Paper No. 07/2015, Retrieved from http://ecipe.org/app/uploads/2015/07/ECIPE-Data-Flows-final.pdf, at p. 2, (Last accessed May 5, 2016).

The U.S. international trade statistics, however, do not explicitly capture cross-border data transactions where no money is exchanged. Other official government statistics *may* be implicitly capturing the economic value generated by these $0 transactions, but it is difficult to attribute gains in productivity or GDP to these flows. Increases in multifactor productivity could be attributed to technological advances, such as the digital delivery of services. These types of digital technologies should, in theory, lower costs or increase output, or both. However, it is not possible to directly measure the contribution of digital delivery of services to productivity.

> *"Some commercially valuable cross-border data flows are not collected in national statistics. For example, when multinational companies with offices in the U.S. and Europe internally move data across borders for human resource or research and development purposes, this creates economic value but does not show up in national economic accounts."*
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> Meltzer, J. Brookings Institution. (2014). The Importance of the Internet and Transatlantic Data Flows for U.S. and EU Trade and Investment. p. 8.

The issue of how to estimate the value of $0 transactions and how, if at all, they should be captured by official statistics extends to the economics of data and data flows more generally. Commercial data and services exchanged at $0 market often do have revenues associated with them. For example, a firm might give away a "free service" to attract users to their site. Other firms pay to advertise their products or services on these sites, making it profitable for the first firm to offer free services to users.[21] Alternatively, a firm might offer a free, basic version of a service for no charge, drawing in customers, and then offer an upgraded service for a fee. In a similar vein, the implicit value that data flows generate may be large. A digital transaction that costs little or nothing may generate value for a firm or a customer by greatly reducing transaction costs. For example, a firm may be able to offer professional online training or education to customers around the world at a significantly lower cost than providing the same training in a traditional classroom setting. The proper way to value the economic benefits of these data flows is an issue that requires more attention.

As part of its digital trade investigations, in 2013 USITC surveyed firms in digitally-intensive industries to better understand the impact of digital trade and where firms are getting value from cross-border data flows. USITC defined digitally-intensive industries as: content industries; digital communications industries; finance and insurance; most manufacturing subsectors; retail trade; many services subsectors, except those that are obviously non-traded; and wholesale trade.[22] The results indicated that over 80

[21] See Forbes, How do Free Services On The Web Make Money?, (2013), Retrieved from http://www.forbes.com/sites/quora/2013/02/26/how-do-free-services-on-the-web-make-money/#7e1798094b98, (Last accessed Aug. 23, 2016). This model of offering low-cost or free services funded by advertising revenue has been used by newspapers and television networks for decades; see also Advertising Age's, Ad Age Advertising Century: Timeline, Retrieved from http://adage.com/article/special-report-the-advertising-century/ad-age-advertising-century-timeline/143661/, (Last accessed Aug. 23, 2016).

[22] USITC classified firms as digitally-intensive based on finding from their first digital trade report. Three ratios were considered: (1) e-commerce as a percentage of total revenue; (2) digital/IT inputs as a percentage of total intermediate inputs; and (3) shares

percent of businesses had used the Internet for advertising or marketing, engaging in business to business communication or internal communication, or ordering products that were physically delivered.[23] Over 60 percent had used the Internet to communicate with consumers, to conduct market research, or to order products that were delivered online. More than a third of the surveyed firms had used the Internet for supply chain management or for selling products.[24]

Beyond surveys like the one conducted by USITC, information on how data flows contribute to a firm's costs, profits, or productivity is limited. Stakeholders believe that the contribution of data flows to innovation and productivity is large, but the effects are difficult to quantify. USITC estimated that losing Internet access would reduce productivity by at least 15 percent for more than 40 percent of digitally-intensive firms.[25] However, we do not have precise information about how firms—from large enterprises to SMEs—are using data flows in their operations to access new labor markets; build and manage supply chains; deliver services or otherwise interact with customers; and perform administrative operations, such as tasks related to human resources or marketing. We cannot begin to quantify the value of these effects until we can better quantify how, and to what extent, firms are using data flows to do business.

There may also be several alternative approaches to quantifying the contribution of data flows to the economy. For example, the value of the data flows could be measured as the value of the content flowing (e.g., operational plans, the value of a single email, etc.) or as the value generated by the digital transmission (e.g., what are the productivity gains generated by businesses having the ability to send operational data digitally, as opposed to physically sending that information). However, more research is needed to determine the appropriate circumstances under which to use these or other concepts.

> *"The Internet is also giving SMEs access to business services that can increase their productivity and global competitiveness. Such access includes functions like Google search, which helps businesses develop market intelligence on competitors and learn about foreign laws and regulations. The cloud provides access to low-cost software on demand and data flows allow for regular updates and security patches."*
>
> Meltzer, J. Brookings Institution. (2014). The Importance of the Internet and Transatlantic Data Flows for U.S. and EU Trade and Investment. p. 3.

of employees in digital/IT-related job classes by employer sector. For more information, see USITC Part 2 Report, Appendix F, at p. 275.

[23] USITC Part 2 Report, at p. 173.

[24] USITC Part 2 Report, Figure 2.10., at p. 51.

[25] Ibid.

BOX 1. International Organizations are also Working to Better Measure the Economic Value of Digital Data Flows

The global community acknowledges that measuring cross-border data flows from an economic perspective is difficult. For example, the United Nations Conference on Trade and Development (UNCTAD) noted that "Measuring e-commerce is challenging. There are no comprehensive official statistics on the value of domestic and international e-commerce. Only a few countries—mainly developed ones—compile data on e-commerce revenue."[i] However, several international organizations are actively working with governments and private firms to improve the measurement of e-commerce, the economic impact of cross-border data flows, and the digital economy overall.

The OECD is actively trying to better measure the economic value of the digital economy and cross-border data flows. The OECD Working Party of the Trade Committee is developing a database of policies in effect around the world that limit the free flow of data across borders and working to quantify the impacts of regulations restricting cross-border data flows. As part of this effort, they have created a business survey to address the effect of data localization policies on firms. Additionally, the 2016 OECD Ministerial meeting in Cancun, Mexico from June 21 to June 23 was on the topic "The Digital Economy: Innovation, Growth, and Social Prosperity."[ii] At the Ministerial, Commerce Secretary Penny Pritzker stressed the importance of "protecting the Internet as a platform for innovation, free expression, commerce, and economic opportunity."[iii]

Like the OECD, UNCTAD has been working to measure the information economy and ICT-enabled services for many years.[iv] So far in 2016, UNCTAD, along with the World Trade Organization (WTO) and the Universal Postal Union (UPU), has convened two expert meetings devoted to measuring e-commerce, with an emphasis on cross-border e-commerce. The Department has been actively participating in these meetings alongside representatives from USITC, private firms, international organizations, and foreign statistical agencies with the goal of furthering the domestic and international availability of relevant data and the establishment of common definitions.

UNCTAD has also formed the Partnership on Measuring ICT for Development. The goal of the group is "to develop indicators for international trade in ICT services and ICT-enabled services and practical proposals on how to collect country-level data in the context of limited resources."[v]

[i] United Nations Conference on Trade and Development (UNCTAD), Information Economy Report 2015, (2015), Unlocking the Potential of E-Commerce for Developing Countries, Retrieved from http://unctad.org/en/PublicationsLibrary/ier2015_en.pdf, at p. 12, (Last accessed July 7, 2016).
[ii] For more about OECD's recent Ministerial on the digital economy, see http://www.oecd.org/internet/ministerial/.
[iii] See U.S. Department of Commerce website for Secretary Pritzker's full Ministerial remarks at: https://www.commerce.gov/news/secretary-speeches/2016/06/us-secretary-commerce-penny-pritzker-stresses-importance-open.
[iv] For more about UNCTAD's efforts on measuring the information economy, see http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Measurement.aspx.
[v] Fredriksson, T., United Nations Conference on Trade and Development (UNCTAD), (2016), New Methodology for Measuring Trade in ICT Services and ICT-Enabled Services. Presentation for United Nations Statistical Commission, 47th session, Retrieved from http://unstats.un.org/unsd/statcom/47th-session/side-events/documents/20160310-1M-TorbjornFredriksson.pdf at p. 4. (Last accessed May 5, 2016).

Lack of Standard Nomenclature

Some researchers have attempted to estimate how cross-border data flows contribute to the economy in a variety of studies. Their approaches include estimating: the contribution of cross-border data flows to GDP; the value of international trade in digital services; e-commerce; and consumption of data-related products. However, to date, these studies largely rely on author-defined definitions and categorizations of the "digital economy" or various types of data flows. For example, a 2012 report from the Bureau of Economic Analysis (BEA)[26] published estimates of the value of international trade in "digitally-enabled" services. In 2014, the Department's Office of the Chief Economist[27] and the Brookings Institution[28] used a common definition to estimate the value of "digitally-deliverable" international trade. The European Centre for International Political Economy (ECIPE) estimated trade in "data-intensive services sectors."[29] Most recently, in 2016, the BEA released a report with estimates of "potentially ICT-enabled services trade."[30]

In other reports, USITC categorized firms as "digitally-intensive"[31] to study how they contribute to the economy and rely on the Internet, while McKinsey Global Institute (MGI) ranked sectors on their level of "digitization."[32] Although the services that these reports consider "digital," or the services that make firms "digitally-intensive," are all similarly defined, they are not the same. For example, the MGI digitization index ranks sectors on the economy based on 27 different indicators related to digital assets, digital usage, and digital workers.[33] To measure the level of digital usage, MGI looked at how firms use digital payments, digital marketing, social technologies, and software to manage various operational tasks. Calculating the "digitization" of a sector using this method is complicated and requires a lot of information—and likely some analyst judgement. The USITC defines "digitally-intensive" industries as industries where firms are "particularly involved in digital trade."[34] To determine this, they relied on three measures: (1) e-commerce as a percentage of total revenue; (2) digital/IT inputs as a percentage of total intermediate inputs; and (3) shares of employees in digital/IT-related job classes by employer sector. As in the case of the MGI digitization classification, the USITC determination of which industries are digitally-intensive also relied on

[26] Borga, M. & Koncz-Bruner, J., Bureau of Economic Analysis (BEA), Trends in Digitally-Enabled Trade in Services, (2012), Retrieved from http://www.bea.gov/international/pdf/trends_in_digitally_enabled_services.pdf, (Last accessed May 5, 2016).
[27] Nicholson, J. & Noonan, R., Economics and Statistics Administration – U.S. Department of Commerce, Digital Economy and Cross-Border Trade: The Value of Digitally-Deliverable Services ("2014 Digital Economy Report"), (2014), Retrieved from http://www.esa.doc.gov/sites/default/files/digitaleconomyandtrade2014-1-27final.pdf, (Last accessed Aug. 22, 2016).
[28] See Meltzer 2014 Internet Report at p. 10.
[29] van der Marel, E. European Center for International Political Economy (ECIPE), Disentangling the Flows of Data: Inside or Outside the Multinational Company?, (2015), at p. 9, Retrieved from http://ecipe.org/app/uploads/2015/07/ECIPE-Data-Flows-final.pdf, (Last accessed Aug. 22, 2016).
[30] Grimm, A., Bureau of Economic Analysis, Trends in U.S. Trade in Information and Communications Technology (ICT) Services and in ICT-Enabled Services ("2016 ICT Grimm Report"), Survey of Current Business, (2016), Retrieved from http://bea.gov/scb/pdf/2016/05%20May/0516_trends_%20in_us_trade_in_ict_serivces2.pdf, (Last accessed June 14, 2016).
[31] USITC Part 2 Report at pp. 13-23.
[32] McKinsey Global Institute (MGI). McKinsey & Company, Digital America: A Tale of the Have and Have-Mores, (2015), Retrieved from http://www.mckinsey.com/industries/high-tech/our-insights/digital-america-a-tale-of-the-haves-and-have-mores, (Last accessed May 5, 2016).
[33] Ibid.
[34] USITC Part 2 Report, Appendix F, at p. 275.

analyst judgement. The lack of official definitions and categorizations for what comprises digital trade and the digital economy, or of what makes a firm or sector digitized, means data users need to resolve differences in researchers' use of these terms to compare estimates across studies.[35]

Similarly, in order to better measure and understand the economic importance of data flows, there needs to be a clear definition of the different types of data flows. Data flows can be classified based on how they are being used or what information they contain. Such a classification would be most useful if the concepts are clearly defined and consistently used. For example, researchers may use different methods to measure intra-firm data flows, business-to-business data flows, and business-to-consumer data flows based on the characteristics of those flows. Moreover, flows that contain economically valuable information such as personally-identifiable information (PII) or business operation information, or that result from a financial transaction, might need to be categorized and measured differently than other types of flows.

Lack of Data Specialization

Many of the studies that measure the economic value of cross-border data flows use government data that was not specifically designed for this purpose. Consequently, the resulting estimates of the economic value associated with those data flows are imprecise and based on numerous assumptions.

For example, the reports that estimate the value of digitally-deliverable or ICT-enabled trade, noted in the previous section, use BEA's international trade in services statistics. These estimates represent researchers' best attempts at using the available data about the services that are, to a large extent, likely delivered digitally, such as: insurance services; financial services; charges for the use of intellectual property; telecommunications, computer, and information services; and some other business services like research and development (R&D) services, consulting services, and architectural services.[36] These estimates are the best quantitative evidence of the importance of cross-border data flows using regularly updated government data. However, BEA follows international guidelines and does not identify mode of delivery in the international trade in services statistics and, therefore, does not distinguish between digital and in-person provision of the service.[37]

There are also many valuable cross-border data flows that are not captured by any official statistics. For example, the U.S. national accounts data includes information only on transactions with explicit prices. The intra- and inter-firm data flows crossing-borders that are not tied to an explicit monetary transaction are

[35] For examples of relevant statistics from these and other reports, please see Appendix A.
[36] See 2016 ICT Grimm Report for a complete list of the services included in BEA's estimate of potentially ICT-enabled services and more information on international standards related to measuring digital trade.
[37] There are generally four modes of services trade, based on the location of supplier and consumer: cross-border where the service is transmitted across a border to the consumer (mode 1); consumption abroad in which the consumer receives the service while traveling abroad (mode 2); commercial presence, where the service provider has an international affiliate (mode 3); and movement of natural persons, where foreign nationals travel abroad to provide the service (mode 4). Mode of supply can be approximated using BEA's published statistics. See Chapter 14, section 14.10 in the BEA's U.S. International Economic Accounts: Concepts and Methods documentation, Retrieved from http://www.bea.gov/international/pdf/concepts-methods/14%20Chapter%20ITA-Methods.pdf.

not captured in any official statistics.[38] Some organizations, like USITC and MGI, have conducted surveys to collect specific information on digitization and the use of cross-border data flows.[39] However, these data collections tend to be sporadic, as we will discuss further below. Statisticians and researchers need to find new data collection vehicles and data sources that more explicitly and regularly measure the economic significance of cross-border data flows.

Limited Scope of Data

As discussed in the preceding sections, measurement of the economic importance of cross-border data flows, and of the digital economy generally, is often limited to economic sectors that are traditionally data or digitally-intensive. However, businesses throughout the entire economy rely on the Internet and other digital technologies. According to MGI, 98 percent of the U.S. economy is impacted by digitization[40] and the extent to which businesses use cross-border data flows and interact in the digital economy will likely increase. The impacts of barriers to data flows reach beyond firms in the tech-sector or those that comparatively purchase or use more digital resources.

Although there are currently no official U.S. Government statistical series that measure how cross-border data flows contribute to the overall U.S. economy or various sectors within the economy,[41] the USITC published two reports as a result of their investigation into digital trade that present several estimates of the value of cross-border data flows.[42] In particular, the 2014 report provides a look at the value of digital trade at the firm level, the industry level, and economy-wide. USITC used three methods: case studies of individual firms, a survey of U.S. firms in digitally-intensive industries (as referenced earlier), and quantitative assessments involving various economic modeling techniques. Nonetheless, although the USITC model estimates the economy-wide impact of digital trade, the underlying source data is based on the USITC survey of firms in digitally-intensive

> *"Some dismiss data protectionism as a narrow issue affecting only the technology sector; however, its impact is actually far-reaching — and decidedly counterproductive — because companies in nearly every sector of the modern economy depend on data-driven innovations to do business."*
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> Castro, D. & McQuinn, A. Information Technology and Innovation Foundation (ITIF). (2015, February). Cross-Border Data Flows Enable Growth in All Industries. p. 1.

[38] For more information on the relevant metrics collected by Census and BEA, see Appendix B.
[39] See Appendix C for a list of relevant reports.
[40] See Manyika, J., Digital Economy: Trends, Opportunities and Challenges, presented at the Department of Commerce Digital Economy Board of Advisors (DEBA) meeting, (May, 2016), Retrieved from https://www.ntia.doc.gov/files/ntia/publications/james_manyika_digital_economy_deba_may_16_v4.pdf, (Last accessed May 5, 2016).
[41] See Appendix A and Appendix B for a list of relevant statistics and datasets we have identified.
[42] USITC Part 1 Report and USITC Part 2 Report.

industries only. If the model included data from firms in all sectors, the total economy wide effects would likely be higher.

Beyond government statistics, there are some private studies that attempt to measure the economy-wide effects of data flows and the digital economy. For example, in a 2011 report, researchers from MGI estimated the Internet's impact on the world economy, specifically on growth, jobs, and wealth creation.[43] They estimated that in the mid-2000s the Internet accounted for 21 percent of GDP growth among the group of developed economies included in their study. Furthermore, 75 percent of this growth was captured by "traditional industries" that do not rely entirely on and would exist in the absence of the Internet. More recently, MGI estimated that in 2014 the value of global data flows increased worldwide GDP by $2.8 trillion.[44] These estimates highlight the need to capture the value of cross-border data flows and the digital economy in all sectors of the economy, rather than just the "tech" or ICT sector.

Estimates of how cross-border data flows contribute to the overall economy are important, but it is also helpful to understand that firms of all sizes, including very small firms, rely on cross-border data flows in their operations. Reports by MGI and eBay show that SMEs leverage cross-border data flows to access global markets that allow them to better compete with larger firms.[45] While it is likely that smaller firms use the Internet and cross-border data flows in ways that are similar to larger firms, the impact of these technologies could be different.

Similarly, there is only limited information, and no government data series available, to assess how SMEs might fare when faced with restrictions to cross-border data flows. Because their resources are more limited compared to large, multi-national firms, the costs for SMEs to comply with new data policies that change how data flows across borders or restricts it altogether may be more detrimental to these firms or even prohibit them from operating at all. Analyzing the impact of such restrictions is particularly challenging for startups. While it may be possible to estimate the cost of complying with restrictions, it is difficult to know how such restrictions affect businesses that would have otherwise entered a market, but chose not to.

Absence of Regularity and Transparency

As discussed above, BEA's regularly produced statistics can be used to estimate roughly some of the impact of cross-border data flows and the digital economy over time, although they lack the specificity necessary

[43] McKinsey Global Institute (MGI) - McKinsey & Company, Internet Matters: The Net's sweeping impact on growth, jobs, and prosperity, (2011), Retrieved from http://www.mckinsey.com/industries/high-tech/our-insights/internet-matters, (Last accessed May 5, 2016).
[44] MGI - McKinsey & Company, Digital Globalization: The New Era of Global Flows ("2016 MGI Digital Globalization Report"), (2016), Retrieved from http://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Digital%20globalization%20The%20new%20era%20of%20global%20flows/MGI-Digital-globalization-Full-report.ashx, at p. 10, 25, (Last accessed May 5, 2016).
[45] See 2016 MGI Digital Globalization Report at p.7; see also eBay, Small Online Business Growth Report: Towards an Inclusive Global Economy, (2016), Retrieved from https://www.ebaymainstreet.com/sites/default/files/ebay_global-report_2016-4_0.pdf, (Last accessed July 3, 2016).

for more precise measurement. Stakeholders want more representative data collections that are intended to regularly assess the use of cross-border data flows and other digital technologies.

Oftentimes, researchers use the results of smaller, one-time data collections in economic models to estimate the impacts of the Internet and cross-border data flows on the U.S. and foreign economies. For example, USITC and MGI have both used the results of their surveys to estimate the Internet's impact on GDP growth and jobs at some point in time. However, in these cases, the detailed source data is not readily available to researchers. This, coupled with an often general lack of transparency of the modeling techniques, means that it is difficult to interpret and replicate the published estimates. So, while there can be great value in small, one-time surveys of firms and of models to calculate broad economic effects based on these surveys, researchers need more regular and transparent estimates for least some economic indicators.

Recommendations

During the course of our research, culminating with the May 9, 2016 roundtable,[46] stakeholders provided numerous recommendations to improve and add to the available metrics of the economic value of cross-border data flows. From these recommendations, we identified six actions that the Department can take to improve the availability and quality of statistics and economic analysis related to cross-border data flows and the larger digital economy:

1. Improve the overall coverage and quality of the government statistics on the service-sector.

2. Develop a standard nomenclature or standard definitions for concepts related to cross-border data flows, distinguishing between concepts such as digital economy, digitally-intensive, digitally-enabled economy, and ICT.

3. Develop a greater understanding of how firms use cross-border data flows and what economic value the data flows provides. These metrics should cover the entire U.S. economy as well as specific sectors.

4. Develop improved and consistent macro-economic statistics to measure the value of cross-border data flows and the digital economy, such as the contribution of data flows and the digital economy to GDP. These metrics should cover the entire U.S. economy as well as specific sectors.

5. Continue the Department-private industry dialogue to facilitate data sharing and the linking of public and private datasets, where possible.

6. Continue the collaborative efforts of the Department and international organizations to ensure that metrics on cross-border data flows and the digital economy are widely available for countries around the world.

Below, we discuss these six recommendations in more detail and describe efforts to improve the data to measure the economic importance of cross-border data flows and the larger digital economy that are currently underway in The Department.

Recommendation 1. Improve government statistics on the service-sector

By their very nature, services data is challenging to collect and analyze. Some stakeholders noted these challenges and voiced concern that attempting to collect data on digital services would be even more challenging and prone to measurement error without also improving the overall service-sector statistics. The Department's service-sector statistics are less detailed and more limited in scope than similar data about the manufacturing sector, for example. As the U.S. economy has transitioned from an industrial to a more service-based economy, demand for service-sector statistics has grown.[47] Statisticians have made great

[46] For more about the May 9 roundtable, see https://www.ntia.doc.gov/category/global-free-flow-information.
[47] In 2015, private service industries contributed 68 percent of all value added in the U.S. economy. See Industry Economic Accounts, Bureau of Economic Analysis, Retrieved from http://www.bea.gov/industry/index.htm. In addition, the proportion

strides to expand the scope and generally improve the specificity of service-sector statistics, but there is more work to be done.

Data on international trade in services is one example of where continuing improvements are essential. There are administrative systems in place to collect data for thousands of categories of traded goods for all countries in the world. Data on all shipments of U.S. goods exports valued above $2,500 and all shipments of U.S. goods imports valued above $2,000 are captured at ports and customs, and track the value, quantity, and method of transport of these items.[48]

Services trade is different; since services do not pass through a traditional port, there is no customs data. BEA strives to be comprehensive, but as noted, services data is difficult to collect.[49] BEA collects data for its International Transactions Accounts through 11 business surveys and publishes the results for just over 30 individual countries in about 20 services categories.[50] BEA conducts mandatory quarterly and annual surveys, as well as benchmark surveys at five-year intervals. The challenge for BEA is to make sure they are surveying the right companies and services to capture an accurate representation of services trade.[51] Generally speaking, the minimum value thresholds are relatively large, measured in hundreds of thousands or millions of dollars. Minimum value thresholds for reporting are higher in the quarterly surveys than in the benchmark surveys to reduce respondent burden.[52] Stakeholders want survey sample sizes increased, minimum services trade-reporting thresholds decreased, and a finer level of industry detail. Additionally, as new technologies, such as 3-dimensional printing, change how goods are traded, the methods for collecting data on goods trade will also need to be reconsidered.

BEA combines the survey data it collects with other source data to create its final estimates of the value of international services trade.[53] For example, the U.S. Department of Homeland Security provides BEA data on travel between the United States and countries other than Canada and Mexico, while the International

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of total private sector jobs in the service industry has grown: in 1950, 56 percent of all private sector jobs were in service-providing industries while 43 percent were in goods industries. This share of jobs in service-providing industries grew to 67 percent by 1980 and 84 percent by 2015. See Current Employment Statistics, Bureau of Labor Statistics at: http://www.bls.gov/ces/.

[48] The Census Bureau, who tabulates the data on trade in goods, also creates a low value estimation to cover those goods valued below these thresholds. Read more on the methodology of the low value estimation at: http://www.census.gov/foreign-trade/guide/sec2.html#low_value.

[49] In between benchmark surveys, BEA estimates transactions for those companies that fall below the quarterly survey reporting thresholds. In this way, BEA ensures that there is a full universe of transactions in the quarterly data.

[50] See more information on BEA's international trade in services statistics in Appendix B. For more information on the data sources for the ITAs, see Chapter 13 in the BEA's U.S. International Economic Accounts: Concepts and Methods documentation available at: http://www.bea.gov/international/pdf/concepts-methods/13%20Chapter%20ITA-Methods.pdf.

[51] BEA survey forms for U.S. international services transactions are available at: http://www.bea.gov/surveys/iussurv.htm.

[52] If a firm's total sales for a particular service type fall below the threshold, they do not have to report sales for that service, although they do still have to report total sales overall. Minimum value thresholds vary by type of service. For specific information on thresholds, see BEA, A Guide to BEA's Services Surveys available at: http://www.bea.gov/surveys/pdf/surveysu.pdf.

[53] For more information see Chapter 10 in the BEA's U.S. International Economic Accounts: Concepts and Methods documentation at: http://www.bea.gov/international/pdf/concepts-methods/10%20Chapter%20ITA-Methods.pdf.

Trade Administration provides data on the average amount spent by foreigners visiting the United States. BEA also uses financial data from the U.S. Department of Treasury to supplement its own surveys.

BEA is already working to improve the international trade is services data. In October 2016, BEA will release annual trade in services statistics for at least 35 additional countries, with a focus on countries that are part of negotiated U.S. trade agreements or agreements currently under negotiation. Over the next several years, BEA will begin publishing the detailed geographic data on a quarterly, rather than annual basis. And by June 2019, BEA expects to expand the level of industry detail within the categories of R&D, intellectual property, medical services, financial services, and ICT services.

Aside from international trade statistics, the Department has two efforts underway to improve the general breadth and depth of the service-sector statistics. First, BEA is in the process of publishing more detailed industry-level GDP estimates, increasing the number of published industries from 71 to 120, including several new additions in information services; professional, scientific, and technical services; financial services; and insurance services. Although this improvement does not provide new information about which services are digital, this will still be useful for better measurement of the digital economy, as parts of these services groups are ICT-enabled services according to the UNCTAD definition. Having more specific services categories will help refine the estimates of ICT-enabled services by allowing BEA to remove services that are not ICT-enabled from the current estimate.

Second, the Census Bureau is working to accelerate the release of its Quarterly Services Survey (QSS) data, which feeds directly into the calculation of GDP. If Census shortens the processing time of the QSS data, BEA can incorporate this important data earlier each year, reducing revisions to the quarterly GDP estimates. As an additional benefit, BEA may be able to accelerate the release of industry GDP statistics from 110 days after the end of the quarter to 80 days after the quarter.

The Department is continuously working to improve the data it collects and publishes. These efforts should continue, with an eye toward how existing data series could be expanded or modified to allow for better measurement of cross-border data flows and the digital economy.

Recommendation 2. Develop a standard nomenclature or standard definitions

To measure accurately, the first prerequisite is to have a clear definition of what is being measured. However, terms such as "digital economy," "digitally-intensive," and "digitally-" or "ICT-enabled economy" are used widely and interchangeably. Many different organizations are creating estimates to value digital trade or the contribution of the digital economy to GDP.[54] Even the definition of *data* and *data flows* in the context of economics and statistical measurement requires clarification. Without common definitions, these estimates are only useful in isolation from each other. Comparing two one-time studies from different organizations at different points in time is difficult without standard definition of what is being measured.

[54] See Appendix A for examples of the types of estimates already developed in this area.

UNCTAD, which has been working on improving measurement of digital economy concepts for over a decade, is working to promote an official definition of ICT-enabled services. The definition includes "services that can be delivered remotely," such as: ICT-services (telecommunications services, computer services, and licenses to reproduce and/or distribute computer software); sales and marketing, management, administration, and back office services; insurance and financial services; engineering; R&D; education; and "any other service that can be delivered remotely."[55]

A new BEA report on "potentially ICT-enabled services" uses the UNCTAD definition to look at U.S. international trade in these services from 1999 to 2014.[56] BEA plans to update these estimates each October, institutionalizing this definition into its services statistics. BEA's adoption of this official terminology and commitment to regularly update estimates using this definition are steps in the right direction.[57] However, identifying *potentially* ICT-enabled services is not enough; to properly value digital trade and cross-border data flows, we need to be able to identify with certainty the services that are *actually* traded digitally.

The Department is also in the process of developing a series of definitions and estimates to measure economic output related to the digital economy. More specifically, BEA and NTIA are embarking on a three-year study to establish a definition for the digital economy by identifying the commodities that comprise the digital economy. To do so, BEA will engage with stakeholders to develop a range of definitions, from narrow to broad, and then assess those definitions. Ultimately, the goal is to develop estimates of the domestic output, value added, and employment associated with the digital economy. As part of this effort, BEA will also be conducting research to improve the measurement of ICT-enabled goods and services. This project is a significant step in setting up the framework to estimate the size of GDP related to the digital economy.

Recommendation 3. Develop a greater understanding of how firms use cross-border data flows and the economic value the data flows provide

Where and how is data flowing throughout the economy? How are firms using cross-border data flows? How do restrictions to data flows impact firms? As noted above, we need to understand more about the presence, quantity, and purpose of inter-firm and intra-firm data flows, including $0 transactional flows, before we can estimate the value of these flows to firms throughout the economy and the effects of

[55] See United Nations Conference on Trade and Development (UNCTAD) International Trade in ICT Services and ICT-Enabled Services: Proposed Indicators from the Partnership on Measuring ICT for Development, (2015), Retrieved from http://unctad.org/en/PublicationsLibrary/tdr2015_en.pdf, at p.12, (Last accessed May 5, 2016); see also Fredriksson, T. UNCTAD, New Methodology for Measuring Trade in ICT Services and ICT-Enabled Services - Presentation for United Nations Statistical Commission, 47th session, (2016), Retrieved from http://unstats.un.org/unsd/statcom/47th-session/side-events/documents/20160310-1M-TorbjornFredriksson.pdf, (Last accessed May 5, 2016).

[56] 2016 ICT Grimm Report at pp. 1-3.

[57] See Economics and Statistics Administration blog about these new estimates and how they compare to previous estimates at: http://esa.doc.gov/economic-briefings/new-bea-estimates-international-trade-digitally-enabled-services, (Last accessed May 5, 2016).

restrictions to these flows. In particular, we need to understand more about how firms use cross-border data flows in their internal operations and in their external interactions with customers and suppliers.

There are some surveys that have attempted to gather information on the use of cross-border data by subsets of firms. For example, MGI partnered with 1776 to survey 271 start-ups worldwide.[58] USITC sent out survey forms to a sample of 10,000 firms in sectors that represented close to 20 percent of the U.S. economy.[59] However, to date, these surveys are not recurring and there is still a large set of firms for which data about usage of cross-border data flows does not exist.

Some of the firms that participated in these various surveys about cross-border data usage shared with us that the survey questions were difficult to answer. Firms do not necessarily think about their usage of cross-border data in the same way as economists and other researchers. For example, whereas researchers attempting to determine the impact of trade restrictions want to know whether a firm chose not to participate in a market due to such policies, firms may not keep conscious track of such decisions. Additionally, firms do not necessarily keep records of their usage of cross-border data flows.

Numerous stakeholders suggested that surveys asking firms about their use of cross-border data flows should start off with very simple questions around clearly defined concepts such as: "Does your firm use the Internet to interact with other firms overseas?" As noted above, it may be useful to develop a nomenclature that allows differentiation between types of data flows. Which characteristics are most important for a nomenclature is likely to depend on the objectives of tracking this information.

Firm case studies could also provide more details on the use of cross-border data. While these may be useful for generalizing how firms in a particular sector are using cross-border data flows, case-studies are usually conducted once, provide little quantitative data, and may be too specific to the studied firm to be useful. On balance, the Department should explore the extent to which case studies can be used to develop more generalized information.

Perhaps one step in better measuring the value of cross-border data flows and how they create economic value is to first develop a better understanding of which services are provided digitally and which services are delivered in-person. Beyond that, for the services that are provided digitally, we need more detail about how they are supplied or delivered in order to understand how to capture the value of these transactions and associated flows. For example, firms might be bundling goods and services in a single transaction, making it more challenging to identify or disentangle the value of the service; services may be based on a recurring subscription or a one-time payment, so linking ongoing data flows with a particular service transaction would be challenging; some providers may deliver services through digital and non-digital modes, but charge for all the services in a lump sum, making it difficult to identify the digital portion of the provided services. Firms cannot provide the Department with data that they do not have, so it is important to ask relevant questions that firms will be able to answer.

[58] See 2016 MGI Digital Globalization Report at p. 46.
[59] USITC Part 2 Report at p. 19.

Also, as discussed above, nearly all of the U.S. and global economies are now impacted by digitization. Therefore, as we work to improve our measurement of all aspects of the digital economy, it is critical to ensure that measures extend beyond sectors that are traditionally considered data or digitally-intensive. It may be useful to have, for example, estimates of the value of cross-border data flows for specific industries, firms of different sizes, or public and private firms. These focus industries should extend beyond the traditional digitally-intensive to include, for example, agriculture, manufacturing, information, finance, and real estate.

BEA's data on direct investment and multinational enterprises already provides some information on cross-border intra-firm activities.[60] Information such as the types of services that multinationals provide to their overseas affiliates and the number of employees working abroad is available from this dataset. Like the international trade in services data, however, it does not include information on whether transactions occurred online. For example, the data tell us that in 2013, U.S. parent companies purchased $53.8 billion of services from their majority-owned foreign affiliates of U.S. enterprises in Europe.[61]

While we can assume that many of these services could have been—and probably were—transmitted digitally, we cannot say with certainty what portion of these services were digital. The data also tell us that majority-owned European affiliates of U.S. companies employed 4.2 million workers in 2013.[62] It is likely that foreign affiliates of U.S. enterprises need to transmit sensitive data containing PII back to the United States for general management and human resources operations. Understanding these uses of cross-border data flows and the extent to which firms are using them is important for understanding the implications of digital privacy policies that differ between countries.

We recommend that the Department collect these data through business surveys, through private surveys, or, alternatively, by partnering with firms for case studies, if private firms are willing to share this information. Indeed, one of the central data needs identified regularly by stakeholders is to develop new and better information to evaluate the impact of restrictions on the global flow of data, bearing in mind challenges above. Restrictions to data flows disrupt the operations of firms and they likely incur costs to adapt to new policies that block or limit cross-border data flows. Better information is needed about what these costs are, what form they take (e.g., labor, equipment, services, lost revenue), and how disruptive they are to operations for firms across all industries and of all sizes.

[60] See Appendix B for more information on this dataset.
[61] See BEA tables on U.S. Multinational Enterprises (MNE) Activities: Preliminary 2013 Statistics - Majority-Owned Affiliates, Table II.E.1., (2013), Retrieved from http://www.bea.gov/international/usdia2013p.htm.
[62] Ibid. at Table II.G.1.

Recommendation 4. Develop improved and consistent macro-economic statistics to measure the value of cross-border data flows and the digital economy

Policymakers, private firms, and researchers all want improved data and new measures of how cross-border data flows and the digital economy, more generally, contribute to GDP, job growth, and productivity. Both BEA and the Census Bureau are currently working on projects with this in mind. As part of the BEA/NTIA collaboration to define the digital economy, BEA is working to improve how it measures prices of ICT goods and services, which has implications for estimates of GDP and productivity.[63] Stakeholders also want improved e-commerce statistics, including a break out of sales to domestic and foreign consumers.[64] The Census Bureau recently established the E-commerce Innovation Working Group to examine both short and long-term improvements to e-commerce presentation and measurement. Moreover, the Census Bureau continues to participate an international working group focusing on measuring e-commerce (See Box 1).

While the projects noted above are significant steps forward, researchers still need new and better data to perform their own analysis to measure the impact of data flows and the digital economy. Currently, researchers are using the Department's datasets such as the international trade in services, the input-output tables, and the e-commerce statistics to estimate how cross-border, as well as domestic, data flows may be influencing the U.S. economy. As noted above, however, with the exception of the e-commerce statistics, none of the Department's datasets distinguish between digital and non-digital activity. And, while the international trade data provide information on cross-border transactions, the e-commerce data do not distinguish between domestic and cross-border transactions. Estimating the macro-economic value of cross-border data flows and restrictions to

> *[D]ata is neither a good or service. Data is intangible, like a service, but can easily be stored and delivered far from its original production point, like a good. What's more, the statistical techniques that have been traditionally used to track goods and services don't work well for data-driven economic activities. The implication is that the key statistics watched by policymakers—economic growth, consumption, investment, and trade— dramatically understate the importance of data for the economy.*
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> Mandel, M. Progressive Policy Institute (PPI). (2012). Beyond Goods and Services: The (Unmeasured) Rise of the Data-Driven Economy. Policy Memo. p. 2.

[63] For more information on how the measurement of ICT prices impact GDP and productivity measurement, see Byrne, D. & Corrado. C., The Conference Board., ICT Prices and ICT Services: What do they tell us about Productivity and Technology?, Economics Program Working Paper Series, (July 2016), Retrieved from https://www.conference-board.org/pdf_free/workingpapers/EPWP1605.pdf, (Last accessed August 10, 2016).

[64] See Appendix B for a description of the available e-commerce data.

these flows might best be achieved through economic models, but researchers and statisticians need accurate, regularly-updated data as inputs.[65]

Consequently, we may need to collect new data and develop new statistics to improve the economic analysis and measurement of cross-border data flows.[66] One suggestion on possible new measures to estimate how cross-border data flows affect various macro-economic indicators, put forth by Michael Mandel of the Progressive Policy Institute (PPI), is to treat data as a third commodity, separate from goods or services.[67] The logic is that when data is copied, it does not generally lose value to the original data holder. With standard flows of goods and services, the asset or service is thought to transfer value from one entity to another, captured as an output from one entity and an input to another. Data, however, is non-rivalrous, so when someone consumes it, their consumption does not prevent someone else from also consuming it. For example, R&D conducted and paid for by a U.S. firm could be copied and transmitted to a European company at no cost. Provided the U.S. company willingly shared this information, this transfer could increase the knowledge base of the European company without depleting the stock of knowledge of the U.S. firm that also continues to use the information. In this way, knowledge that is repeatedly copied and transmitted with permission from the creator may contribute to productivity improvements of firms around the world without ever being captured as a flow that transfers value from one entity to another. Additionally, how to quantify the value of this data is ambiguous if there is no monetary transfer, because the data could be valued differently by the sender and the receiver. Including data as a third commodity, however, would be a significant change from how BEA currently measures GDP.

Mandel also suggests that some consumer services might not be picked up in output measures because they are now powered by data, often at no or little cost. An example of this is tax preparation, which is traditionally provided by accountants but is increasingly powered by data in the form of free tax preparation websites. How the shift from people-provided services to Internet- or software-provided services has impacted GDP or other macro-economic measures is unknown, especially when the services are provided for free.

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[65] For select examples of economic models that attempt to evaluate the impact of cross-border data flows, see USITC Part 2 Report or 2016 MGI Digital Globalization Report. Several studies have attempted to estimate the impact of costs associated with restrictions to data flows. For example, see Leviathan and Bauer, M., Lee-Makiyama, H., van der Marel, E., & Verschelde, B., ECIPE, The Costs of Data Localisation: Friendly Fire on Economic Recovery, (2014), Retrieved from http://www.ecipe.org/app/uploads/2014/12/OCC32014__1.pdf.

[66] Some research efforts in the Department related to better measurement of the digital economy are already underway. BEA is beginning to develop a roadmap to improve estimates of prices for ICT goods and services, which will ultimately lead to better measurement of productivity. BEA is also researching how to update the depreciation profiles on ICT for improved estimates of capital stock and capital services. While some of this work will be done in-house, BEA is also exploring the possibility of contracting with other government agencies and private sector researchers. Additionally, BEA and NTIA are collaborating to establish a standard definition or series of definitions of what comprises the digital economy. If this effort is successful, the next step would be to apply the definition(s) to BEA data to produce estimates of the size of the digital economy.

[67] Mandel, M., Progressive Policy Institute (PPI), Beyond Goods and Services: The (Unmeasured) Rise of the Data-Driven Economy, (2012), Retrieved from http://www.progressivepolicy.org/wp-content/uploads/2012/10/10.2012-Mandel_Beyond-Goods-and-Services_The-Unmeasured-Rise-of-the-Data-Driven-Economy.pdf, at p. 3, (Last accessed May 5, 2016).

Beyond Mandel's suggestions, other stakeholders suggested several ways to provide a more complete statistical view of the economic importance of data flows and the digital economy. For example, some stakeholders noted that it may be useful to track the economic activity of digital platforms to measure the impact on firms—particularly startups—and the macro-economy generally given the increasing role of these platforms in facilitating economic transactions. For example, some digital platforms act as intermediaries between buyers and sellers, such as digital matching firms, [68] like Uber and Airbnb, and online marketplaces, like Amazon and Etsy. Others primarily provide social connections between users that help businesses communicate with customers and potential customers, such as Facebook, Twitter, and Instagram.

There may be other additional measures or new methods for tracking official U.S. statistics that may better account for the economic contributions of data flows and the digital economy. With respect to additional measures, stakeholders suggested that tracking the number of users of a particular type of service, or similar measures of usage and adoption, may be an indicator of sector growth. Additionally, researchers from BEA and the Federal Reserve Bank recently released a working paper that explores how to measure free media in GDP.[69] A similar approach may be applicable to data flows.

Finally, exploring the use of economic measures of well-being, such as consumer welfare and time cost savings, that people derive from the digital economy and cross-border data flows may provide insight on their implicit value. However, estimating consumer surplus or consumer welfare, either as part of or separate from GDP, represents a significant departure from how BEA has historically estimated the national accounts or any other U.S. statistics, and would include numerous new measurement and conceptual challenges.[70]

It may be most useful for the Department to review possible new data sources and new methodologies that could better inform our understanding of the digital economy. The Department has not historically produced measures of consumer welfare for other areas of the economy, and another organization may be better suited to take the lead on this recommendation. The Department will need to consider these various suggestions and determine which are most feasible and suitable for implementation by Department agencies.

[68] For one estimate of the economic importance to a subset of digital platforms, called digital matching firms, see Rudy Telles Jr. Office of the Chief Economist, Economics and Statistics Administration (ESA), U.S. Department of Commerce, Digital Matching Firms: A New Definition in the "Sharing Economy" Space, (2016), Retrieved from http://www.esa.gov/sites/default/files/digital-matching-firms-new-definition-sharing-economy-space.pdf, at 1, (Last accessed June 15, 2016).

[69] Nakamura, L., Samuels, J., and Soloveichik, R., Valuing 'Free' Media in GDP: An Experimental Approach, (2016), Retrieved from http://www.bea.gov/papers/pdf/Valuing-Free-Media-in-GDP-An-Experimental-Approach.pdf.

[70] For more discussion of some of these challenges, see Nordhaus, W., Principles of National Accounting for Non-Market Accounts, (2004), Retrieved from http://www.nber.org/CRIW/CRIWs04/nordhaus.pdf.

Recommendation 5. Continue the Department-private industry dialogue and explore the use of private datasets

Stakeholders from both the public and private sectors agree that collaboration is the key to enhancing the data available to measure the digital economy and the economic impact of cross-border data flows. From a Department perspective, understanding how digitization is impacting specific firms is necessary to develop statistics that measure the broader macro-economic impacts of the digital economy. Moreover, determining what types of data firms can provide about how they use digital technologies will likely require additional collaboration. There may also be ways that the Department can leverage private data to enhance U.S. statistics. The May 9, 2016 roundtable on data needs for measuring cross-border data flows was just the beginning.

The Department relies on various advisory councils to gain direct feedback on numerous topics affecting U.S. businesses, and we are following the same model with the digital economy. In May 2016, the first Departmental Digital Economy Board of Advisors (DEBA), a group of 17 distinguished industry and academic leaders, held its inaugural meeting.[71] The DEBA will provide recommendations on ways to advance economic growth and opportunity in the digital age, with one working group devoted specifically to measurement of the digital economy.

Additionally, there may be ways in which detailed firm data, where available, may supplement existing government data collections to inform our understanding of the digital economy. For instance, overlaying detailed industry datasets with macro-economic statistics may also prove fruitful. BEA is already exploring how it can better employ big data and private sector data to improve its economic statistics. It has engaged in a public-private partnership with data vendors to explore how this data might be used to improve the national statistics. BEA has also convened a workshop to explore the potential for using private sector data. The Department should continue to explore opportunities such as these to enhance its own data collection with private sector data.

Finally, we recommend that the Department convene additional roundtables of experts as the movement toward improved statistics to measure the value of cross-border data flows and the digital economy continues. The Department relies on private sector input and feedback for improving statistical processes and methodology around new technologies and is committed to ongoing collaboration with the private sector.[72]

[71] Read more about the Digital Economy Board of Advisors on the Department of Commerce blog at: https://www.commerce.gov/news/press-releases/2016/03/us-secretary-commerce-penny-pritzker-announces-appointees-inaugural.

[72] For example, on April 5, 2016, the Department of Commerce issued a Request for Comment on questions posed by the growth of the Internet of Thing (IoT), the broad category of devices, appliances, and objects that can be connected via the Internet. The Federal Register notice and comments are at: https://www.commerce.gov/news/press-releases/2016/04/us-department-commerce-seeks-comment-potential-policy-issues-related?utm_source=newsletter&utm_medium=email&utm_campaign=CWG_040816.

Recommendation 6. Continue the collaborative efforts of the Department and international organizations

The Department needs to continue to collaborate with international stakeholders as well. Engaging with the international community will allow us to better understand the global value of cross-border data flows and how barriers impact those flows in other economies around the world. Stakeholders are also interested in analysis that demonstrates the importance of cross-border data flows to our foreign counterparts to help emphasize the importance of a free and open Internet. This requires consistent, detailed statistics on other countries, particularly U.S. trade partners.

By participating in international working groups that are committed to measuring the digital economy, the Department can stay abreast of and continue to influence the development of standard definitions and methodologies of digital economy concepts. This will help the United States continue to be a leader in the development and production of economic statistics. Having standard definitions is mutually beneficial to the United States and to our foreign counterparts. Cross-border data flows are inherently international, so the Department and our foreign counterparts need a common language to discuss policy and measurement.

Standard definitions and methodologies will facilitate the international production of economic statistics related to the digital economy and cross-border data flows. This will allow U.S. firms and policy negotiators to make more informed decisions where the impacts of business decisions or policies can be evaluated for all economies involved. To further all these efforts, stakeholders suggested holding a roundtable with the international community.

Conclusion

As new technologies change the way people interact and firms operate, the economy will evolve to adapt to the changing conditions. The Department of Commerce is committed to growing the U.S. economy by facilitating businesses large and small. To inform the development and growth of U.S. businesses and the overall economy, the Department recognizes the need for quantifiable information on which to base decisions. The initiatives described in this report are one way that the Department is working to achieve these goals.

The Department's Digital Economy Leadership Team, the Digital Economy Board of Advisors, and other Department-led groups have already started reviewing and evaluating the challenges and recommendations presented in this report to see where we may contribute to closing the gaps in the data available to measure the economic impacts of cross-border data flows and the broader digital economy. This includes prioritizing the outcomes and assessing which are most suitable and most feasible for the Department to address.

Appendix A: Examples of Relevant Statistics

These statistics represent a sample of the types of information that is currently available to inform the discussion on the economic effect of cross-border data flows. This list is not intended to be comprehensive, nor is it necessarily an endorsement of the methodologies used. We have identified four categories of statistics: U.S. macro-economy, U.S. micro-economy, foreign economies, and measuring data traffic.

U.S. Macro-Economy

- In 2014, the United States exported $385.1 billion and imported $230.9 billion in *potentially ICT-enabled services*, resulting in a trade surplus for these services of $154.2 billion. These exports accounted for 54 percent of total U.S. services exports and 48 percent of total U.S. services imports. Potentially ICT-enabled services are "services that can predominantly be delivered remotely over ICT networks" and "include activities that can be specified, performed, delivered, evaluated and consumed electronically." (Grimm, 2016, p. 2, 5)

- In 2011, the supply of *digitally-deliverable services*[73] through U.S. affiliates in Europe was worth $312 billion and Europe supplied $215 billion worth of digitally-deliverable services through U.S. affiliates. (Meltzer, 2014, p. 17)

- Removing foreign barriers to trade in *digitally-intensive industries*[74] would likely result in an estimated $16.7 billion to $41.4 billion increase (a 0.1 percent to 0.3 percent increase) in U.S. GDP. U.S. real wages would likely be 0.7 percent to 1.4 percent higher, and the effect on U.S. total employment would range from no change to an increase of 400,000 full-time equivalents. (USITC, 2014, p. 14)

- Revoking the Safe Harbor Framework[75] that had previously enabled data flows between the EU and United States could have reduced U.S. services exports to the EU by 0.2 percent to 0.5 percent. SMEs would be most affected by the policy change, as they would be least able to establish subsidiaries in the EU or to negotiate model contracts with business partners. (Bauer et. al, 2013, p. 13)

- In the fourth quarter of 2015, retail *e-commerce sales* in the United States totaled $89.1 billion, up 2.1 percent from the third quarter, and accounted for 7.5 percent of all retail sales. Retail e-commerce sales have been an important contributor to growth in the retail sales sector; e-commerce sales increased 14.7 percent from the fourth quarter of 2014 to the fourth quarter of

[73] 2014 Digital Economy Report at p. 5.
[74] See definition of digitally-intensive industries in USITC Part 2 Report, Table ES.1 on p. 15.
[75] The new EU-U.S. Privacy Shield Framework, which replaces the Safe Harbor, was approved on July 12, 2016. See: https://www.commerce.gov/news/secretary-speeches/2016/07/remarks-us-secretary-commerce-penny-pritzker-eu-us-privacy-shield.

2015 while total retail sales increased only 1.3 percent in the same period. (U.S. Census Bureau Quarterly Retail E-Commerce Sales report, February 17, 2016)

- In 2012, firms in *digitally-intensive industries* purchased an estimated $471.4 billion of products and services online. Just $49.3 billion (10.5 percent) of the estimated purchases were delivered online while $422.2 billion (89.5 percent) of these purchases were of products and services delivered physically or in person. In that same year:
    - Finance and insurance firms, with purchases of $11.6 billion, and selected other service firms, with purchases of $12.2 billion, were the firms that purchased the most products and services delivered over the Internet.
    - Firms in the manufacturing sector used the Internet to purchase $157.4 billion of physically-delivered products and services—more than any other sector. (USITC, 2014, p. 20)

- *Data-related goods and services* accounted for 37 percent of the gain in real personal consumption and 64 percent of the gains in non-health real personal consumption between 2007 and 2013. These gains increased per capita consumption, generating improvements to consumer welfare. (Hofheinz and Mandel, 2014, p. 8)

U.S. Micro-Economy

- Most firms in *digitally-intensive industries* use the Internet to communicate internally, to order physical products and services, and to conduct business-to-business communication. Firms also use the Internet for supply chain management and market research, but this is much more common in large companies than in SMEs. (USITC, 2014, p. 40)

- In 2013, majority-owned foreign affiliates of U.S. companies supplied $1.3 trillion of services to foreign persons. In that same year, all foreign affiliates of U.S. companies employed 14.3 million persons overseas; 12.4 million of whom were employed by majority-owned foreign affiliates. Cross-border data flows are a means that multinational firms use to provide services to their affiliates and to transfer information, including human resources information. (BEA Multinational Enterprise data)

- Of 271 tech-enabled startups surveyed by 1776 and McKinsey Global Institute (MGI), 86 percent had at least one cross-border activity; 62 percent had customers, clients, or users in other countries; 47 percent hired talent from other countries; 39 percent had mentors or advisors in other countries; 36 percent sourced inputs from other countries; and 36 percent received funding from other countries. (MGI, March 2016, p. 47)

- Boeing airplanes capture data inflight to reduce delays, midflight turn backs, and future cancellations. This amounts to 20 terabytes of information for a single Boeing 737 for every hour

inflight. If a problem is identified, that data is transmitted to airline maintenance personnel at the destination, who can then be ready to make repairs as soon as the plane touches down. The ability to transmit data globally makes efficiencies like this possible. (Castro & McQuinn, 2015, p. 6)

- Sweden-based Hermes Medical Solutions manufactures software applications that monitor various organ functions of patients. The applications are cloud-based and all data is stored in Sweden, sent across borders, and analyzed by medical centers in 30 different countries, including the United States. In fact, 95 percent of the services provided by Hermes are outside of Sweden. The company also facilitates research with over 200 hospitals worldwide, storing disease specific data on its servers that can then be used for clinical research. (Castro & McQuinn, 2015, p. 7)

- Between 2000, when the EU first limited the transfer of personal data out of the region, and June 2015, over 5,000 companies self-certified under the *U.S. Safe Harbor program*, pledging that they will maintain privacy of the data they are transmitting. These firms come from industries throughout the economy, including computer software, computer services, and information services, but also from industries unrelated to IT such as education, health, financial, legal services, and manufacturing industries, to name a few. (Data from ITA as reported in OECD, 2016, p. 38)

- In the U.S., 59 percent of eBay enabled SMEs (sellers with at least $10,000 in annual sales in the eBay marketplace) reached 10 or more foreign markets; the average number of markets reached was 18; 64 percent of U.S. SMEs exported to four or more continents. (eBay, 2016, pp. 11-12)

Foreign Economies

- The 28 member states of the European Union collectively exported $1.2 trillion in *ICT-enabled services* in 2014. The EU member states with the largest estimated value of ICT-enabled services exports were the United Kingdom (UK) ($159.0 billion), Germany ($149.2 billion), France ($128.0 billion), and the Netherlands ($115.3 billion). (Nicholson, 2016, p. 1-2)

- The estimated value of *global business-to-business (B2B) e-commerce* in 2013 exceeded $15 trillion with three-quarters of the total accounted for by, in order of magnitude, the United States, the United Kingdom, and China. (UNCTAD, 2015, p. 13)[76]

- Two-fifths of the EU firms selling goods and services over the Internet have sales to EU countries. One-quarter of these firms have sales outside of the EU. (UNCTAD, April 2016 E-Commerce technical note, p. 2)

[76] The U.S. Census Bureau does not break out B2B e-commerce from business-to-consumer (B2C) e-commerce. The report assumes similar average shares for B2B revenue, 82 percent, to general the global B2B sales for 2012-2013.

- The global flows of goods, services, finance, and people increased GDP by at least 10 percent or an estimated $7.8 trillion in 2014. Of this amount, data flows accounted for an estimated $2.8 trillion. (MGI, March 2016, p. 1)

- Approximately 12 percent of global goods trade is conducted via international e-commerce. Additionally, 361 million individuals around the world participate in cross-border e-commerce. (MGI, March 2016, pp. 8, 23)

- Local companies in countries that either have considered or are considering data localization policies would be required to pay an estimated 30 percent to 60 percent more for their computing needs if they were forced to maintain computing activities inside the country. Many of these countries do not have public cloud computing providers. Local businesses would have to rely on the purchase and maintenance of their own infrastructure, or rely on non-public cloud services. (Leviathan Security Group, 2015, p. 3)

- "Small businesses worldwide are becoming 'micro-multinationals' by using digital platforms such as eBay, Amazon, Facebook, and Alibaba to connect with customers and suppliers in other countries. Even the smallest enterprises can be born global: 86 percent of tech-based startups we surveyed report some type of cross-border activity. The ability of small businesses to reach new markets supports economic growth everywhere." (MGI, March 2016)

- In nine of the 18 countries and economies studied by eBay, 100 percent of eBay-enabled SMEs with $10,000 or more in sales were exporters in 2014. These countries are Mexico, Brazil, Chile, Colombia, China, South Korea, Indonesia, Thailand, and South Africa. The country in the study with the lowest rate of eBay-enabled SMEs exporters was Australia (88 percent). The traditional "offline" SMEs in the 18 countries were much less likely to export than their online counterparts. (eBay, 2016, p. 9)

- In Korea, China, and the EU, data localization measures are estimated to decrease total factor productivity (TFP) by approximately 2 percent in the communications sector. In China, for the ICT businesses services sector and the finance and insurance sector, data localization policies have resulted in a 0.34 percent loss in TFP. (Bauer et al, 2016, p. 9)

- ECIPE estimated the impact on GDP from proposed or enacted data localization requirements in seven countries, including Brazil, China, EU, India, Indonesia, South Korea, and Vietnam ranged from a decrease of 0.1 percent in India to a decrease or 1.7 percent in Vietnam in 2014. The impact on investment ranged from a decrease of 0.5 percent in Korea to 4.2 percent in Brazil. (Bauer et al, 2014, p. 2)

Measuring Data Traffic

- Use of the Internet and networked devices is exploding. By 2020 there will be:
  - 194 exabytes[77] per month of global IP traffic and 59 exabytes per month of traffic in North America.
  - Nearly 4.1 billion global Internet users (more than 52 percent of the world's population), up from 3.0 billion in 2015.
  - 3.4 networked devices per capita globally, up from 2.2 per capita in 2015.
  - Video will represent 82 percent of global Internet traffic, up from 70 percent in 2015. (Cisco Visual Networking Index Tool, pp. 1, 2, 5)

- Since 2005, cross-border bandwidth usage has increased 45-fold, and it is projected to grow another nine-fold by 2020. (MGI, March 2016, p. 45)

- Between 2008 and 2012, data-carrying capacity of transatlantic cables increased at an average rate of 19 percent per year, demand for broadband increased at a compound rate of 49 percent globally, while global goods and services trade rose at an average 2.4 percent per year. (Hofheinz and Mandel, June 2015, p. 2).

- As of April 2016, there were 63 active or planned undersea cables that connected the United States to foreign countries. Globally, Telegeography identifies 293 active and 28 planned cable systems. (Telegeography Submarine Cable Map)

- In 2014, the total potential U.S.-EU capacity was 167 terabytes per second (Tbps), but only 27.1 Tbps were "lit" and a little over half that (15.2 Tbps) was used. Likewise, total capacity between the U.S. and Asia was 90.2 Tbps, with 19.5 Tbps lit and 10 Tbps used. Between the U.S. and South America, total potential capacity was 105.5 Tbps, with 15.1 Tbps lit, and 7.9 Tbps used. (Meltzer, 2014, p. 6)

[77] For reference, an exabyte is equal to one billion gigabytes. Cisco attempted to put these data volumes in perspective in this small chart: http://www.cisco.com/c/dam/assets/sol/sp/vni/qa_c67-482177-1.jpg.

Appendix B: Relevant Datasets

We have identified the following datasets that contribute to measuring the economic value of cross-border data flows to the U.S. economy and foreign economies. These datasets are categorized into the four groups identified in Appendix A. The last section "Measuring Data Traffic" lists datasets that provide information on the amount and type of data flowing between countries.

U.S. Macro-Economy

- Bureau of Economic Analysis (BEA). Direct investment and multinational enterprise (MNE) data. Available at: http://www.bea.gov/international/di1usdop.htm.

  Dataset includes:
  - Balance of payments and direct investment position data, which covers transactions and positions between parent companies and their affiliates;
  - Activities of multinational enterprises including a wide variety of indicators of the financial structure and operations of the firms involved;
  - U.S. direct investment abroad (outward direct investment);
  - Foreign direct investment in the United States (inward direct investment); and
  - Data on services supplied by affiliates and majority-owned affiliates of MNEs.

  "The statistics cover transactions between majority-owned foreign affiliates (MOFAs) of U.S. enterprises and foreign residents, both in the local economy and in other foreign markets, and transactions between majority-owned U.S. affiliates (MOUSAs) of foreign enterprises and U.S. residents. Because of the importance of proximity to customers in the delivery of services, many MNEs serve foreign markets partly or wholly through their affiliates located in, or close to, the markets they serve." (BEA Definition of International Services)

- U.S. Bureau of Economic Analysis (BEA). Input-output (I-O) accounts, annual and benchmark. Available at: http://www.bea.gov/industry/index.htm#annual and http://www.bea.gov/industry/index.htm#benchmark_io.

  The I-O tables provide statistics on gross output (total sales or receipts), value added (contribution of an industry to GDP), the production relationship between industries, and how commodities are used for production. "They offer a wealth of information about the size of the U.S. economy, the relative size of specific industries, what and how much is produced by specific industries, the

technology used by specific industries, the incomes generated by production, and the size and scope of an industry's market."[78] (BEA Measuring the Nation's Economy)

- Bureau of Economic Analysis (BEA). International trade in services data. Available at: http://www.bea.gov/international/index.htm#services. Methodology available at: http://www.bea.gov/international/concepts_methods.htm.

  "U.S. trade in services covers services, traded between U.S. residents and nonresidents, delivered through one of the three of the four modes of supply: cross-border supply, consumption abroad, and the presence of natural persons.[79] Trade in services includes nine categories*: maintenance and repair services not included elsewhere (n.i.e.); transport; travel (for all purposes including education); insurance services; financial services; charges for the use of intellectual property n.i.e.; telecommunications, computer, and information services; other business services; and government goods and services n.i.e.* The trade statistics cover both affiliated and unaffiliated transactions between U.S. residents and foreign residents. Affiliated transactions consist of intra-firm trade within multinational enterprises—trade between U.S. parent companies and their foreign affiliates and trade between U.S. affiliates and their foreign parent groups. Unaffiliated transactions are with foreigners that neither own, nor are owned by, the U.S. party to the transaction." (BEA Definition of International Services)

- U.S. Census Bureau. Retail e-commerce report, quarterly. Available at: https://www.census.gov/retail/index.html#ecommerce. And electronic shopping and mail order houses sales available from the Monthly Retail Trade survey. Available at: http://www.census.gov/retail/index.html#mrts.

  This dataset provides estimates of retail e-commerce activity (i.e. between businesses and consumers). No data is available on whether the purchasers are domestic customers or foreign customers.

- U.S. Census Bureau. E-stats data, annual. Available at: https://www.census.gov/econ/estats/.

  This dataset provides estimates of e-commerce activity in key sectors of the U.S. economy including: manufacturing, wholesale, service, and retail businesses. Estimates of total economic activity and e-commerce activity are presented for comparison. No data is available on whether the

[78] While the I-O tables do not specifically measure cross-border data flows, they do allow data users to trace the use of goods or services throughout the supply chain. One example of how the I-O tables can inform the discussion of cross-border data flows is a 2014 report that traced the use of digitally-deliverable services through the supply chain as inputs to the production of other goods and services. See 2014 Digital Economy Report at pp. 5-11.

[79] The fourth mode of supply is commercial presence. BEA data on services supplied through affiliates includes the commercial presence mode of supply. See BEA MNE data for more information.

transactions are domestic or foreign, or if the transactions are between businesses (B2B) or between businesses and consumers (B2C).

U.S. Micro-Economy

- Bureau of Economic Analysis (BEA). Direct investment and multinational enterprise (MNE) data. Available at: http://www.bea.gov/international/index.htm#omc. See details above in the U.S. macro-economy section.

- International Trade Administration (ITA). Administrative data on Safe Harbor self-certified firms and voluntary survey of self-certified firms. For internal use only. The information that is publically available can be found at: https://safeharbor.export.gov/list.aspx (for U.S.-EU Safe Harbor) and https://safeharbor.export.gov/swisslist.aspx (for U.S.-Swiss Safe Harbor).

Foreign Economies

- Eurostat. Information Society statistics. Available at: http://ec.europa.eu/eurostat/web/information-society/data/database.

  Includes data on telecommunications services, computer and internet use in household and businesses, and e-commerce by individuals and businesses. Data is available at country level and by various aggregates.

- Organisation for Economic Cooperation and Development (OECD). Key ICT Indicators. Available at: http://www.oecd.org/internet/ieconomy/oecdkeyictindicators.htm.

  Includes data on telecommunications revenue and investment, broadband access, employment, labor productivity, and value added in the ICT-sector.

- Organisation for Economic Cooperation and Development (OECD) and World Trade Organisation (WTO). Trade in Value Added Statistics (TiVA). Available at: http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm.

  The TiVA database is a joint OECD-WTO initiative. Its aim is to allow better tracking of global production networks and supply chains than is possible with conventional trade statistics. The TiVA database contains a range of indicators measuring the value added content of international trade flows and final demand.[80] The 2015 edition of the TiVA database includes 61 economies and 34 unique industrial sectors covering years 1995, 2000, 2005, and 2008 to 2011. The indicators are

[80] A complete list of over 30 indicators and their definitions is at: http://www.oecd.org/sti/ind/tiva/TIVA_2015_Indicators_Definitions.pdf.

derived from the 2015 version of OECD's Inter-Country Input-Output Database which, in turn, has been constructed from various national and international data sources. Notable underlying sources include: national supply and use tables (SUTs); national and harmonized input-output tables; bilateral trade in goods by industry and end-use category; and bilateral trade in services.[81]

- United Nations Conference on Trade and Development (UNCTAD). UNCTADStat. Information Economy indicators. Available at: http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx.

  Database includes statistics on ICT from countries and regions around the world. Indicators include: core indicators of the ICT producing sector, ICT goods as a percentage of total trade, bilateral trade flows by ICT goods categories, and ICT use by businesses.

- World Bank. Trade in Services. Available at: http://data.worldbank.org/data-catalog/trade-in-services.

  Database includes statistics on bilateral services trade flows through cross-border trade and consumption abroad for 199 countries between 1985 and 2011. Notable underlying sources include data from the OECD, Eurostat, UN and IMF. To increase the quality of statistics reported, particularly from developing countries, World Bank employs a mirror-technique to retrieve export trade flows of a reporting country by using information on imports of the partner country. Care must be used with these statistics, however, as the quality of services trade data varies dramatically between countries.

- World Bank Enterprise Survey. Available at: http://www.enterprisesurveys.org/data/survey-datasets.

  The World Bank Enterprise Survey is a firm-level survey that asks questions related to enterprise technology use, including whether the establishment:[82]
  - Uses technology licensed from a foreign-owned company, excluding office software;
  - Maintains its own website; or
  - Uses e-mail to communicate with clients or suppliers.

  The sample typically includes 1,200 to 1,800 firms in larger economies, 360 firms in medium-sized economies, and 150 firms in smaller economies.

[81] The concept of "digitally-deliverable" or "ICT-enabled" services could be applied to look at how these services originating in one country are used in the production of goods and services in other countries, particularly those that are potentially enacting policies restricting the flow of data.
[82] A complete description of the indicators is at: http://www.enterprisesurveys.org/~/media/GIAWB/EnterpriseSurveys/Documents/Misc/Indicator-Descriptions.pdf.

Measuring Data Traffic

- Cisco. Visual Networking Index (VNI). Available at: http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html.

  Cisco publishes annual five-year forecasts on global and regional Internet traffic. The traffic projections are available by: type, including fixed Internet, mobile, and managed IP; segment, including consumer and business; and geographic region.

- International Telecommunications Union (ITU). ICT data. Available at: http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

  Includes country data on mobile-cellular subscriptions, percentage of individuals using the Internet, fixed-broadband, and core indicators on access to and use of ICT by households and individuals.

- Telegeography. Global Bandwidth Research Service. Available at: https://www.telegeography.com/research-services/global-bandwidth-research-service/index.html.

  Telegeography is the largest source of data and analysis on long-haul networks and the undersea cable market. Telegeography maintains an interactive map of active and planned submarine cable systems and their landing stations available at: https://www.telegeography.com/telecom-resources/submarine-cable-map/index.html. Underlying data on capacity, ownership, wholesale (non-discounted) prices, and other metrics are available for subscription.

Appendix C: References and Other Literature

The literature below includes examples of the types of studies available on the economic importance of cross-border data flows and potential impacts to related restrictions. This is not necessarily a comprehensive list, nor is inclusion below an endorsement of methodologies.

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Appendix D: Contributors

The following researchers and stakeholders have each contributed to our effort to better understand the data needs around measuring the economic impact of cross-border data flows and restrictions to these flows. From November 2015 through May 2016, we met or spoke with each contributor during individual meetings or through their participation in our May 9 roundtable "Measuring Cross-Border Data Flows: Unmet Data Needs." We would like to express our sincere appreciation to everyone on this list.[83]

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[83] Asterisks (*) denote those contributors that participated in the May 9, 2016 roundtable "Measuring Cross-Border Data Flows: Unmet Data Needs." Contributors are listed alphabetically by last name.

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