Internet Association

A Look At American Digital Exports

Internet Association

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Executive Summary

Overview

Internet Association (IA) examined the economic contribution of the United States' digital service exports as well as the potential negative harm to U.S. digital exports as a result of digital trade barriers in other countries.

Findings

1. IA estimates that *Information And Communications Technology (ICT) service exports* and *potentially ICT-enabled service exports* support approximately 160,000 internet sector jobs from $65 billion in exports and an additional 1.4 million jobs in other industries from $400 billion in exports.

2. IA finds that U.S. digital service exports are significantly lower to countries with digital trade barriers. Taking all documented trade barriers together, the paper estimates U.S. digital service exports could be reduced by up to $175 billion and nearly 600,000 jobs.

3. IA finds that approximately 60% of all jobs created by digital service exports are created in 'traditional' sectors (outside of the internet sector).

Methodology

IA utilized proprietary data on digital trade barriers gathered from its member companies through a private survey conducted in the fall of 2016. The information from the survey was combined with IA's National Trade Estimate Submission and a comprehensive academic review on digital trade barriers conducted by one of IA's research fellows. Using these sources, IA documented digital trade barriers by type and country and then estimated differences in U.S. ICT service exports through regression analysis. IA calculated jobs figures utilizing digital export volumes and the Employment Requirement Tables.

Findings Summary Table

	ICT Service Exports 2015		Potentially ICT-Enabled Service Exports 2015	
	$ USD Millions	# Of Jobs	$ USD Millions	# Of Jobs
Total	65,348.0	158,821	398,669.0	1,411,384
Average Per ICT Trading Partner (Country)	859.8	2,090	5,245.6	18,571
Total Lost Economic Potential Harm In Documented Cases Only (43 countries)	(24,685.7)	(59,996)	(150,600.4)	(533,161)
Average Lost Economic Potential In Documented Cases Only (43 countries)	(574.1)	(1,395)	(3,502.3)	(12,399)

1. Introduction

International trade in digital goods and services has increased exponentially over the past 15 years, mirroring the rise of the internet sector. Through both the facilitation of 'traditional' products and an entirely new class of goods and services, digital trade has been a quintessential component for the internet sector's large and growing worldwide economic contribution and general global economic growth.

Across the world, the internet consistently contributes a significant amount to the economy. Estimates range from 3-13% of the gross domestic products (GDPs) of individual countries (Hooton, 2017) – from 6% in the United States (U.S.) to 5.7% in the European Union countries and 5.3% in G20 countries (Dean et al., 2012). In the U.S. alone, *information communications technology (ICT) service exports* (aka digital service exports) totaled approximately $65.4 billion and *potentially ICT-enabled service exports* totaled approximately $399 billion as of 2015 (BEA, 2016).[1]

These are not simply abstract numbers. The analysis and evidence presented in this report demonstrate that ICT service exports directly support approximately 160,000 jobs within the U.S. while potentially ICT-enabled service exports contribute up to another 1.4 million supported jobs. These figures suggest that approximately one-half of the 3 million U.S. internet sector jobs in the U.S. are supported directly by that sector's exports. Furthermore, 60% of the jobs created by these exports reside in 'traditional' industries and *not* in the internet sector itself. Finally, the report estimates that digital trade barriers potentially cost the U.S. up to approximately $175.3 billion in digital service exports every year, which could support up to nearly 600,000 additional jobs in the U.S.

Identified through a comprehensive review of academic literature, public filings on trade issues, and through proprietary data obtained by IA through its members, this report offers the first comprehensive attempt to quantify the number of jobs created by the internet sector's exports as well as the harms of digital trade barriers on the U.S. economy. The paper finds a clear negative impact on digital trade, specifically U.S. digital service exports, as a result of digital trade barriers erected by other countries. The paper also moves one step further by tying these impacts to specific trade barriers, such as data localization requirements and the weakening of intermediary liability protections, that have been documented in the literature.

The work here is a step towards better understanding how to protect the interests of the U.S. economy. There is certainly still more research and analysis to be done in terms of refining measures of digital trade barriers and areas where deep dives into specific barriers would prove immensely valuable for policymakers. It is the hope of this report that the broad, global analysis presented here can be used as a guide by other researchers to further investigate the trade environments of specific countries and examine the impacts of specific barrier types.

Section 2 begins the paper by providing context on digital trade and the state of research. Section 3 presents the paper's trade barrier documentation approach and estimation strategy. Section 4 offers analysis and results. Section 5 concludes the report.

2. Understanding Trade Barriers In The 21st Century

2.1 The Research Context

Digital trade is defined as commerce in products and services delivered via the internet (USITC, 2013). Thisform of trade has been growing rapidly in recent years and represents billions of dollars of economic activity.

Yet, as digital trade has grown, so has the variety of policies designed to block it. These *digital trade barriers* vary widely by type, mechanism, and scale, but generally demonstrate a desire by governments to impede the competitiveness of foreign digital or information technology-based enterprises competing in respective domestic markets (ITIF, 2016)[2]. Australia, for example, requires that local data centers be used for the country's e-health record systems. China has implemented a wide array of protectionist measures on data and internet censorship as well as mandatory Intellectual Property (IP) cross-licensing requirements. The EU member states are have and are considering data policies as part of the Digital Single Market, General Data Protection Regulation (GDPR), European Cloud,

[1] Economists at ESA describe ICT service exports as, "services that can be delivered almost instantaneously online at a relatively small cost" (Nicholson, 2016a). They are unique from ICT goods, which require 'physical delivery'.

[2] In some cases, they may also facilitate a domestic government goal, such as surveillance.

and other initiatives. There are also policies and regulations that are well-intentioned and not designed to be protectionist, but may ultimately hinder digital trade inadvertently.

Unfortunately, a variety of misperceptions motivate many of these barriers, whether intentionally protectionist or not. And peculiar to the digital trade sphere, the lack of understanding and misconceptions stem *not* from a lack of information *per se*, but rather from a limited body of analysis linking documented barriers to trade volumes and other economic metrics. Put differently, the issue of digital protectionism is clear even if the scope of impacts of the specific barriers are not yet understood.

This is illustrated by the European Centre for International Political Economy (ECIPE), which has compiled a comprehensive list of barriers across all countries. Their database documents over 1600 individual digital trade barriers present in 65 countries (ECIPE, 2017), meaning that at least one-third of all countries in the world implement some form of digital trade barrier. Given the lack of digital commerce in many countries where ICT is lagging, the scope of digital protectionism is even starker. Numerous other groups – governments, businesses, etc. – have conducted similar assessments of the barriers that they face themselves in different markets.[3]

What is lacking, however, is a translation of these barriers into their precise economic impacts – a goal of the current paper. Evaluations of impacts from particular barriers, either globally as a barrier type or as documented in a specific market, have proved troublesome. This is undoubtedly related to the complexity of quantifying the harms of specific barrier types in a generalized matter. For example, while ECIPE has an impressive database, their impact analyses have remained focused on individual barriers or individual markets. This is the case, for example, in their report, "The Costs of Data Localization: Friendly Fire on Economic Recovery" (Bauer et al., 2014).

> *...the issue of digital protectionism is clear even if the scope of impacts of the specific barriers are not yet understood.*

Academic literature does not offer much more in terms of additional analytical assessments. In general, there is not much literature directly focused on digital trade in any sense. There is less dealing with digital trade barriers, and even less literature attempting economic impact estimates of digital trade barriers and those with limited scopes.

Taking the digital trade literature that does exist, the paper categorizes it into three broad groups. The first body of literature consists of general issues around digital trade barriers. The second group focuses on a specific aspect of digital trade – international e-commerce adoption. Research in this category typically conducts a case study on a specific country or region. The third group mainly focuses on comparing online trade to offline trade and how the newly established digital trade market contributes to national economies.

A summary of key works is presented in Table 1 while the paper's bibliography documents all relevant literature found in its review. The important takeaway from the literature (of all sources) is that there is no comprehensive measurement of how digital trade barriers impact digital trade.

Table 1: Summary Of Key Academic Studies On Digital Trade

Author	Title	Years Of Analysis	Country/ Region	Barriers Documented
Digital Trade Barriers				
Hauser, 2003	*Der sardinenfall und das potenzial des tbt-abkommens*	Before 2003	The U.S. - other countries	E-commerce duty, IPR protection
Liu and Cynthia, 2011	Internet Censorship as a Trade Barrier: A Look at the WTO Consistency of the Great Firewall in the Wake of the China-Google Dispute	2010	China	Internet censorship

[3] For an extensive documentation of digital trade issues, see part 1 and 2 of "Digital Trade in the U.S. and Global Economies" (USITC, 2013).

Author	Title	Years Of Analysis	Country/ Region	Barriers Documented
Wunschincent and Hold, 2012	Towards Coherent Rules for Digital trade: Building on Efforts in Multilateral versus Preferential Trade Negotiations	2011	World (the U.S. and EU)	General digital trade barriers
Aaronson and Maxim, 2013	Trade and the Internet Policies in the US, EU, and Canada	2013	The U.S., EU, and Canada	General digital trade barriers
Ciriani, 2015	The Economic Impact of the European Reform of Data Protection	2015	The EU	Data privacy
Burri, 2015a	The International Economic Law Framework for Digital Trade	2015	WTO members	Digital trade Laws
Burri, 2015b	Designing Future-Oriented Multilateral Rules for Digital Trade	2015	World	General digital trade barriers
Fergusson et al., 2015	The Trans-Pacific Partnership (TPP): In Brief	2015	TPP members	Cross-border flows of data, data localization
Burri, 2016	The World Trade Organization as an Actor in Global Internet Governance	2016	WTO members	General digital trade barriers
E-Commerce Adoption				
Nagle, 2001	E-Commerce in Latin America: Legal and Business Challenges for Developing Enterprise	2001	Latin America	NA
Rotchanakitumnuai and Speece, 2003	Barriers to Internet banking adoption: a qualitative study among corporate customers in Thailand	2003	Thailand	NA
Humphrey et al., 2004	E-commerce for Developing Countries: Expectations and Reality	2004	Developing countries	NA
Kurnia, 2006	E-Commerce Adoption in Developing Countries: an Indonesian Study	2006	Indonesia	NA
Kshetri, 2007	Barriers to E-commerce and Competitive Business Models in Developing Countries: A case study	2007	Nepal	NA
Lawrence and Tar, 2010	Barriers to E-commerce in Developing countries	2010	Developing countries	NA
Comparisons Of Digital Trade Versus Traditional Trade				
Freund and Weinhold, 2002	The Internet and International Trade in Services	2002	The U.S.	NA
Blum and Goldfard, 2006	Does the Internet Defy the Law of Gravity?	2006	The U.S.	NA
Gomez-Herrera et al., 2014	The Drivers and Impediments for Cross-border E-Commerce in the EU	2013	The EU	NA

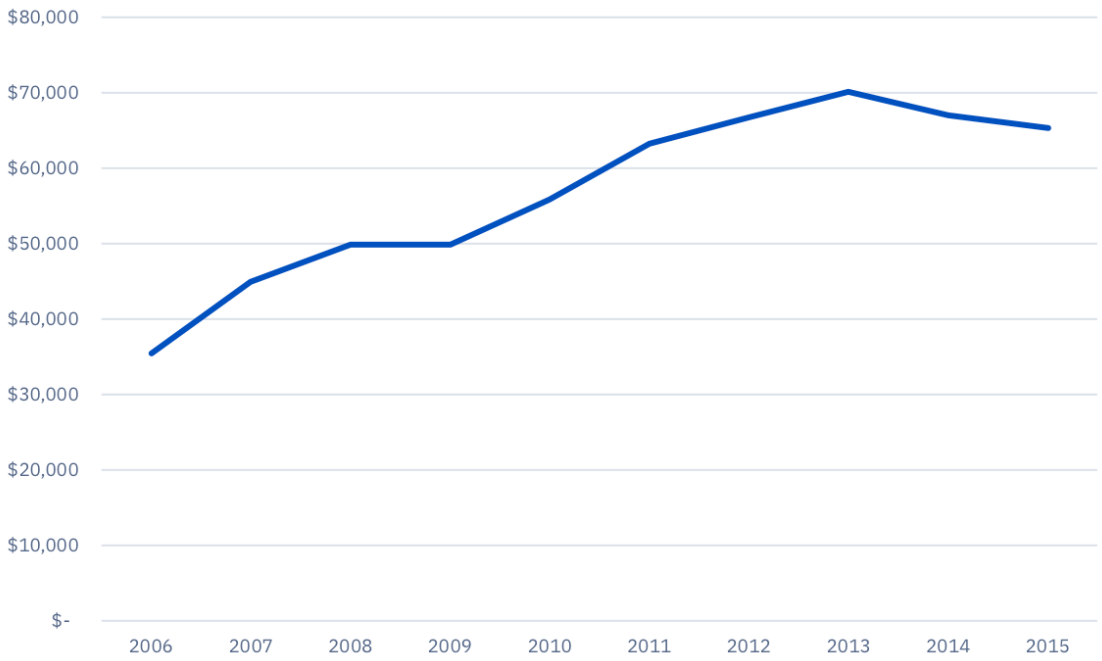
Note: Review conducted by Yuxuan Huang at George Washington University during a Research Fellowship appointment at Internet Association.

2.2 Digital Trade For The United States

In the U.S., the rapid growth of digital trade and its barriers are prompting policymakers to consider which environmental elements create a facilitative digital trade environment and which elements are a hindrance. Less of a debate on the merits of digital trade, the policy dialogue still revolves around a lack of understanding on what internet-based commerce *is* and what changes to the existing international trade rules are necessary to prevent and remove barriers (Burri, 2015a). It is in this context that the inability to link specific harms to digital trade barriers has hampered constructive steps forward.

As of 2011, the USITC (2013b) calculated digital trade from the U.S. to add between approximately $517 to $710 billion to U.S. GDP. The most recent figures from Bureau Of Economic Analysis (BEA) (2016) estimate U.S. ICT service exports totaled $61.4 billion as of 2015 as shown in Figure 1.[4] Additionally, BEA estimates another $398.7 billion of potentially ICT-enabled service exports.

Fig 1. United States ICT Service Exports To All Countries



Source: Author's elaboration; data from US Bureau of Economic Analysis

The data from BEA also demonstrate a positive picture from digital exports, both for the U.S. and other digital exporters. Utilizing paired annual estimates for 2006 through 2015, Figures 2 and 3 demonstrate this positive growth by comparing digital service exports from the U.S. to other countries globally and digital service imports to the U.S. from its trading partners (respectively) with general economic indicators.[5] Specifically, the paper compares these metrics with *net income per capita* and *GDP per capita (PPP)* as well as with *mean tariff rate* and against each other (i.e. exports compared with imports).

The simple analysis shows there are strong positive correlations between digital trade and the economic welfare of a country. The figures show a positive correlation of digital

> *The simple analysis shows there are strong positive correlations between digital trade and the economic welfare of a country.*

[4] At the time of writing, the 2015 figures were the most recent available. The BEA has since released updated estimates for 2016 (in October of 2017), which estimates ICT service exports at $66.1 billion. The paper's analysis uses 2015 figures.

[5] For example, the paper pairs U.S. ICT service exports in 2010 with Net Income Per Capita in 2010.

imports and exports, indicating the two are likely complementary. They also suggest that higher tariff rates reduce digital trade, as expected. There are, of course, limited conclusions that can be drawn from this exercise[6], but the correlations do seem to confirm the general economic benefits of digital trade as well as a negative general reaction in that trade from barriers. This simple documentation (emphasis) alone is an important step.

The exercise may also raise the question of why digital trade barriers exist when data seem to illustrate economic benefits of digital trade *prima facie*. The paper does not purport that the intricacies of international trade can be 'boiled down' to a few correlation plots and certainly believes there are other influencing factors for policymakers. However, the paper argues this is likely linked to the misperception that erecting barriers to digital trade will somehow be good for a country's economy. Further, it aims to solve the problem of a simultaneous lack of analysis and data that clearly translate the benefits of digital trade for U.S. policymakers.

Fig 2. ICT Service Exports From The United States

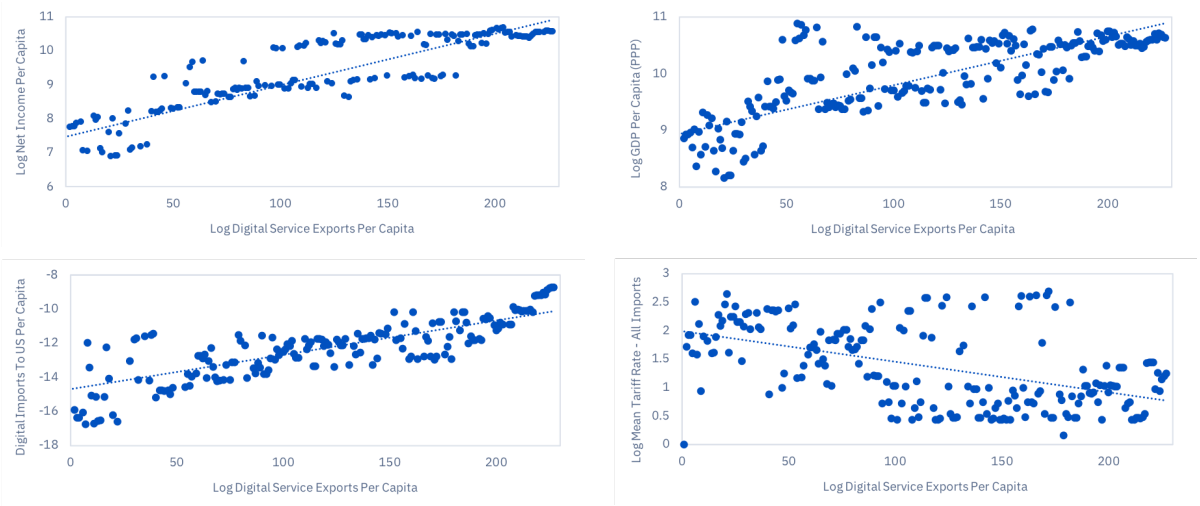
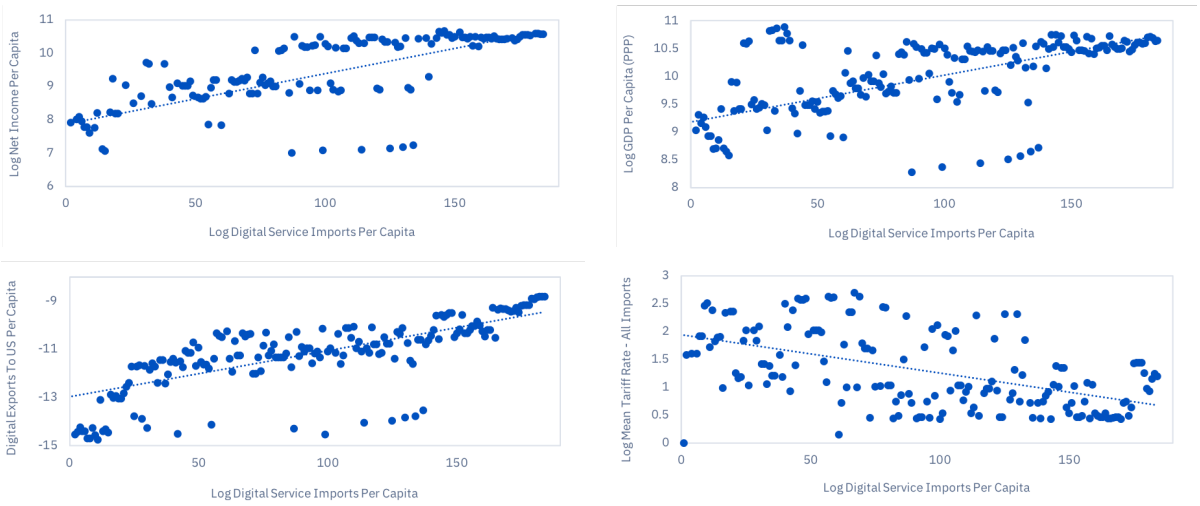


Fig 3. ICT Service Imports Into The United States



[6] The technological sophistication inherent in digital services clearly implies that they will be concentrated in developed economies. The positive correlation in income measures and digital service exports is expected and does not reveal much in terms of the relative benefits of digital trade among developed countries or how digital trade barriers may affect those benefits.

3. Assessing Global Digital Trade Barriers

3.1 Research Questions

Moving out of the background, the paper poses a few questions:

1. What type of digital trade barriers exist?
2. What countries have which digital trade barriers?
3. Do digital trade barriers impact digital trade flows and, if so, by how much?

The first two questions are repetitive in a sense – as mentioned, barriers are documented by governments and other parties. However, the paper has found no attempt to convert these barriers to into operational variables that can be used in analysis.

The third question is also not new, but remains unaddressed on a global scale. Rather than looking at specific case studies, the paper attempts to answer this question from a global perspective using global digital trade flows and a comprehensive set of digital trade barriers. It is, to the extent of the paper's knowledge, the first attempt to perform such analysis.

3.2 Data And Strategy

The report attempts to estimate the economic impacts of digital trade barriers on U.S. digital exports, both by specific barrier type and also in aggregate. The hypothesis is that digital trade barriers erected by countries reduce U.S. digital exports into that country and, thus, hurt the U.S. economy.

The paper begins by documenting digital trade barriers by type and country and then building a matrix of dummy variables by country and region indicating the presence of specific barriers. Next, the paper collects data on digital trade volumes for all available countries as well as several key control variables, merging the data with the matrix of trade barriers. Third, the paper conducts a series of regression analyses estimating the percent differences in U.S. export volume associated with each specific trade barrier as well as their statistical significance (or lack thereof). The paper uses U.S. *ICT Service Exports* from the BEA as its dependent variable; the dataset provides annual observations of U.S. exports to each trading partner country for 2006-2015. Finally, the paper utilizes the percent differences to estimate the impacts in terms of dollar amount (i.e. volume) as well as supported jobs through a methodology developed by the International Trade Administration in the U.S. Department of Commerce (see Rasmussen, 2016).

3.3 Identifying Digital Trade Barriers

The report draws on three sources for identifying digital trade barriers. First, it documents and codifies the barriers and their respective countries found in its literature review discussed in Section 2. Second, the paper documents and codifies the barriers discussed in IA's *National Trade Estimate Report Comments on Digital Trade Barriers* (NTE) report (Internet Association, 2016). This report provides a detailed list of countries that have enacted specific barriers that impede U.S. internet services. Third, the report conducted a survey of its member companies[7] on the specific trade barriers they face internationally.[8] This provided IA a unique, proprietary dataset on digital trade barriers from the perspective and experiences of the internet sector. The year of observation for the trade barriers in the NTE report and the IA member survey are 2016. The barriers documented in the academic literature have varying years of observation and are documented in the paper's summary table.

Using these three sources, the paper developed a list of different digital trade aspects describing the current status of trade barriers for all countries. It then constructed a matrix of country-specific trade barrier factor variables. In total, the paper identifies 43 countries with documented digital trade barriers out of a total of 76 digital trade partners identified by the U.S. government.

The paper assumes that all digital trade barriers identified through its survey and reviews have been active since the first year of observation for the digital trade volume variables shown in Table 2 and that they are still active. The paper also assumes that these represent a robust list of digital trade barriers, though it recognizes it is likely not comprehensive.

[7] A full list of members is available at https://internetassociation.org/our-members/

[8] The survey consisted of 31 questions presented to all IA members in the Fall of 2016. Due to anti-competition guidelines, IA cannot release the specific questions or response summaries from the survey.

Finally, due to the differing presentation/reporting styles of the sources used, the report standardized the labels of these barriers using the terminologies of the sources themselves. While the paper argues most of the barriers identified are clear to stakeholders and self-explanatory, there are a few that may be duplicative and may measure the same barrier. This paper addresses the duplicity issues through statistical approaches which identify overlapping variable influences and multicollinearity issues.

The trade barrier matrix is presented as Table 2. For the econometric analysis later, the paper converts the factor variables to regular 0 or 1 dummy variables.

Table 3: Digital Trade Barrier Matrix

	Unbalanced Copyright Frameworks	Intermediary Liability	Data Localization	Customs/ Trade Facilitation	Filtering, Censorship, & Service Blocking	Restrictive Regulation Of Online Services	Unilateral Or Discriminatory Tax Regimes	Discriminatory Or Non-Objective Application Of Competition Regulations	Burdensome Or Discriminatory Data Protection Frameworks	Financial System Issues (Including Access To Payment Platforms)	Labor Issues (Including Worker Classification)	Infrastructure Issues (Including Postal System)	Socio-Cultural Barriers (Including Lack Of Market Information)	Socio-Economic Barriers
Argentina						X								
Australia	X						X							
Brazil		X	X	X	X	X			X					
Belgium							X							
Canada				X										
Chile														
China			X		X	X		X	X				X	
Colombia		X				X								
EU	X	X	X	X		X	X	X	X		X		X	
France														
Ghana														
Germany	X													
Hungary					X									
India		X	X		X	X	X	X		X		X		
Indonesia			X			X	X					X	X	X
Italy					X									
Japan	X													
Kenya		X	X											
Korea			X					X	X					
Malaysia														
Mexico				X										
Morocco						X								
New Zealand	X													
Nepal										X		X	X	X
Nigeria			X											
Oman						X								
Pakistan						X								

	Unbalanced Copyright Frameworks	Intermediary Liability	Data Localization	Customs/ Trade Facilitation	Filtering, Censorship, & Service Blocking	Restrictive Regulation Of Online Services	Unilateral Or Discriminatory Tax Regimes	Discriminatory Or Non-Objective Application Of Competition Regulations	Burdensome Or Discriminatory Data Protection Frameworks	Financial System Issues (Including Access To Payment Platforms)	Labor Issues (Including Worker Classification)	Infrastructure Issues (Including Postal System)	Socio-Cultural Barriers (Including Lack Of Market Information)	Socio-Economic Barriers
Panama									X					
Peru														
Russia			X		X							X	X	
Saudi Arabia			X			X								
Senegal														
Sri Lanka														
South Africa														
Spain	X				X									
Taiwan								X						
Thailand										X			X	X
Turkey		X												
Ukraine		X				X								
United Arab Emirates														
United Kingdom	X										X			
Uruguay														
Vietnam		X	X											
Zimbabwe														
Africa										X		X	X	
Developing countries										X		X	X	X
East Asia										X			X	
Latin America			X				X			X		X	X	X

Source: Source: Author's elaboration; Review and documentation conducted by Yuxuan Huang, 2016-2017 IA Research Fellow

Notes: This table details all trade barriers found in the paper's review and cited through IA's member survey. X denotes barrier type documented for specific country or region through literature review or IA member survey; Blank denotes no or weak limitation. It should also be noted the barrier of customs/trade facilitation, which applies to goods trade, is not applicable to trade in digital services (the paper's dependent variable) and included later in analysis only as a control variable. Definitions of each barrier type provided in Appendix A.

4. Measuring The Impacts Of Digital Trade Barriers

4.1 Differing Levels Between Countries Based On Digital Trade Barrier

Following the work earlier in this paper paper demonstrating the strong positive correlation between digital trade metrics and indicators for economic health, the paper now turns to each individual trade barrier. Because of the potential imprecision of documenting trade barriers from unstandardized sources, the report argues care should be given to diagnostics of the data and model.

Table 4 provides the averages and their differences for the paper's dependent variable between countries with and without each particular trade barrier identified in the paper's review. Figures 4-6 plot observed levels for the primary dependent variable (ICT service exports from US) against the dummy variable for each of the 13 digital barrier types identified in the paper's review.[9] Each plot shows data for all countries and all years where observations are available.

These plots show only raw figures recorded in the data and their fitted line correlations. There are no controls and no modeling. However, the trade barriers documented by the paper largely conform to the expectations of the hypothesis – that digital trade barriers do reduce digital trade volume.

Of the 14 barriers identified by the paper, all but three barriers exhibit a negative correlation (fitted line) with U.S. digital service exports (i.e. the presence of the digital trade barrier correlates with lower digital exports from the U.S. compared to countries without the barrier). Digital trade barriers related to copyright issues and labor issues demonstrate positive correlation with digital exports from the US.[10] However, the paper strongly cautions against interpreting positive correlation as a sign that the barriers facilitate digital trade. These relationships are more likely related to sizes of the economies where they are documented – namely the EU, Brazil, and Canada – which is not controlled in simple pairwise correlations. There is a clear expectation that larger economies will receive more digital exports from the United States and, indeed, when a set of controls are put in place, these positive correlations change.

Table 4: Summary Statistics On US ICT Service Exports An Digital Barriers

		US ICT Service Exports ($ US Millions)	
		Countries Without Barrier	Countries With Barrier
Unbalanced Copyright Frameworks	Mean	1108.5	2383.4
	Difference	1274.9	
Intermediary Liability	Mean	1356.1	2064.6
	Difference	708.5	
Data Localization	Mean	1502.4	1278.8
	Difference	(223.7)	
Filtering & Censorship,	Mean	1398.0	1607.0
	Difference	209.0	
Restrictive Regulations	Mean	1538.6	1225.1
	Difference	(313.5)	
Unilateral Or Discriminatory Taxes	Mean	805.5	2995.6
	Difference	2190.15	

[9] The reader may note that the directions of some fitted lines do not correspond to signs of the difference in averages shown in Table 4. This relates to the differences between the summary exercises and how observations in the data may cluster depending on the metric. For example, intermediary liability plot in Figure 4 shows a negative influence (a negative sloping fitted line), while the differences in averages in Table 4 show those countries with the intermediary liability barrier as having higher trade volumes. It is crucial to note that the differences in averages are descriptive only and cannot be interpreted one way or another without additional analysis.

[10] While further investigation into these positive correlations is necessary, the paper argues that they are related to general income levels of countries. More specifically, that richer countries are more likely to have regulations around copyright and labor markets designed to protect domestic industries. Additionally, the analysis showed positive correlation with for countries with customs/duties, but this is, again, not relevant to the paper's analysis and reported in the Table 3 and Figure 4 only to be comprehensive.

		US ICT Service Exports ($ US Millions)	
		Countries Without Barrier	Countries With Barrier
Discriminatory Competition Regulations	Mean	1484.0	1066.1
	Difference	(417.9)	
Data Protection Frameworks	Mean	1319.8	2626.5
	Difference	1306.65	
Financial System Issues	Mean	1529.3	598.9
	Difference	(930.5)	
Infrastructure Issues	Mean	1532.3	568.5
	Difference	(963.8)	
Socio-Cultural Barriers	Mean	1595.8	474.8
	Difference	(1121.0)	
Socio-Economic Barriers	Mean	1530.4	588.1
	Difference	(942.3)	
Labor Issues	Mean	1262.3	5436.5
	Difference	4174.2	

Figure 4: Individual Barriers And U.S. Exports

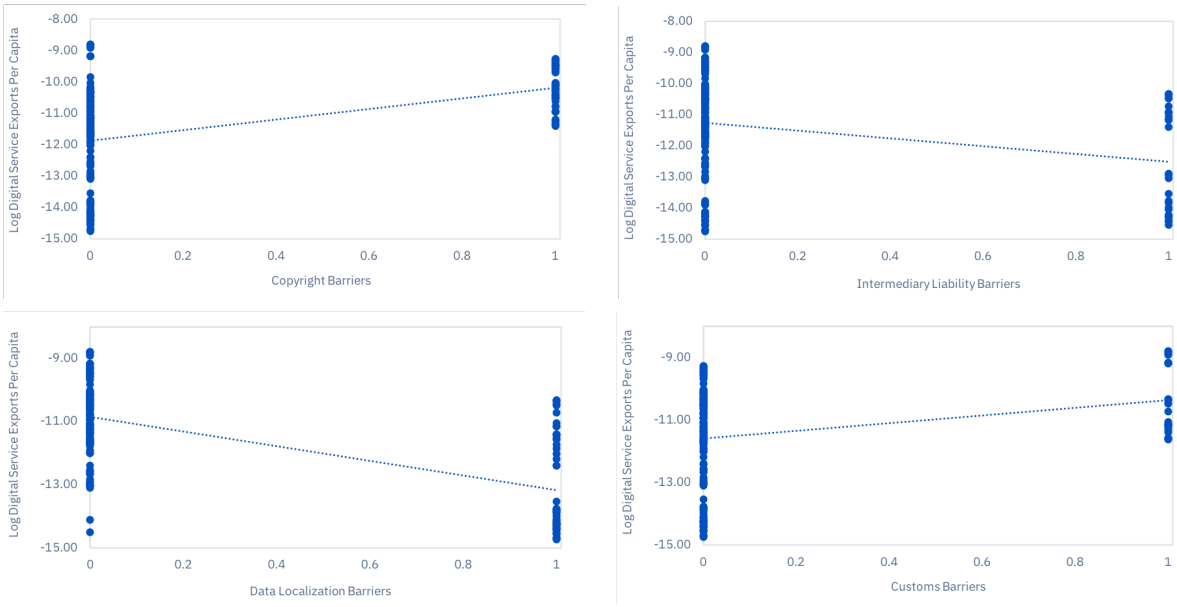


Figure 5: The Influences Of Individual Barriers On Exports From U.S. (cont.)

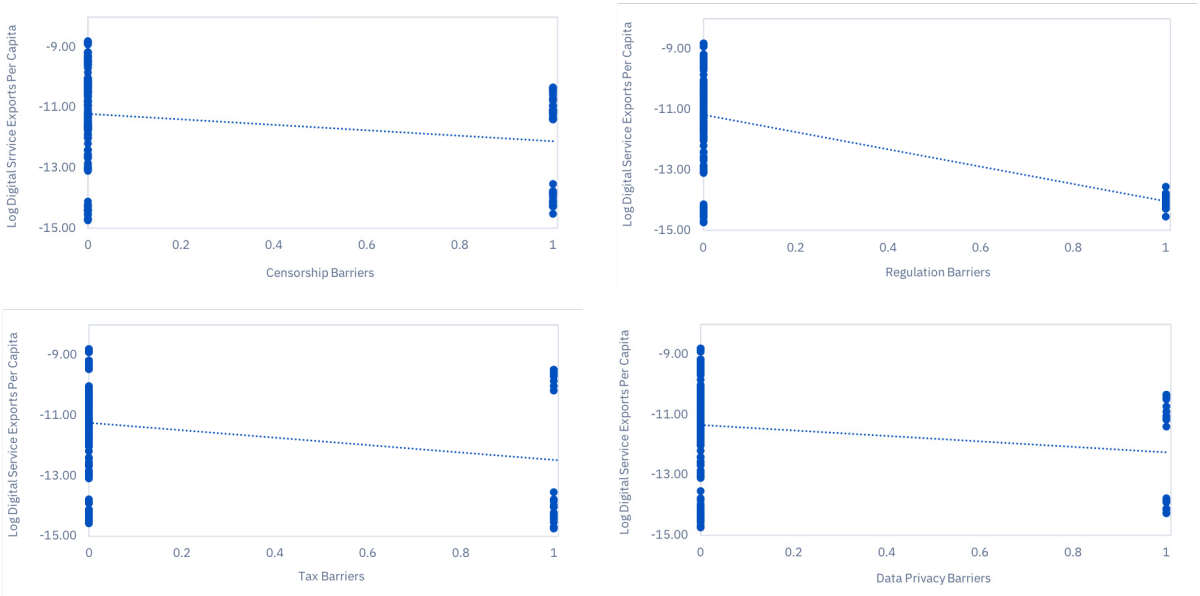
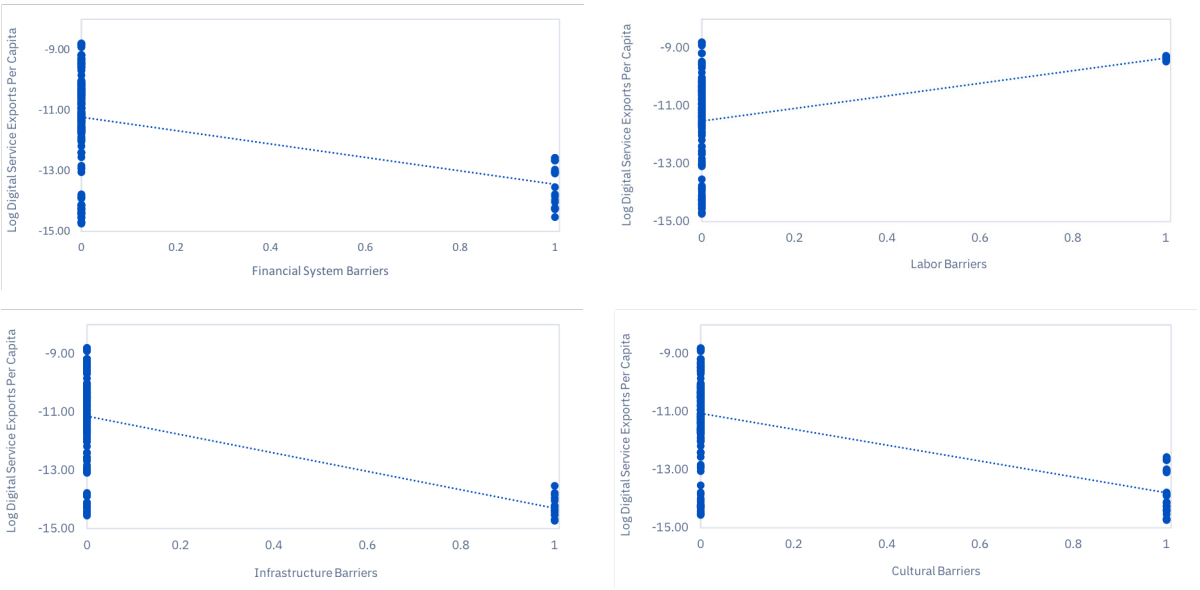


Figure 6: The Influences Of Individual Barriers On Exports From U.S. (cont.)



4.2 Model

The paper models digital trade volume as:

$$y_{it} = \beta_0 + \beta_1 DigitalTradeBarriers_{it} + \beta_1 X_{it} + u_t + v_i + \varepsilon_i$$

Where y_{it} is the dependent variable (ICT Service Exports Per Capita From U.S.) for country *i* at time *t*. The paper uses the natural log of its dependent variables given log-normal distribution of the variables. The term *DigitalTradeBarriers* is a vector of the digital trade barriers from the paper's review. The term X_{it} is a vector of country controls. The paper includes country fixed effects u_t and a full set of time fixed effects v_i (for years). Epsilon is the error term.

The model allows the paper to test the significance of differences in ICT service (export) volumes from the U.S. between countries that have each specific digital trade barrier while controlling for all other barriers and important general characteristics. The model does not provide causal impact estimates; however, the paper argues, based on the quality of model fit and its robustness, that the trade barriers are likely strong contributing factors to the differences in digital trade volumes.

The paper began with a variety of potential country-level controls, which can be found in the Appendices. Due to high Variance Inflation Factors scores and to eliminate multicollinearity, these were refined to a "clean" set of controls that included ICT services imports, a customs/tariff barrier dummy, total imports as a percent of GDP, and GDP growth. It controls for population by using per capita figures. The paper includes a correlation matrix and VIF score table are included as Appendix A to help illustrate the refinement process.[11]

4.3 Results

The results largely confirm the hypothesis and the initial descriptive evidence. Countries with digital trade barriers receive significantly lower levels of U.S. digital exports. The U.S., its digital exports, and its economy suffer from the institution of digital trade barriers in other countries. The important contribution from this paper is the addition of actual estimates for the degree of volume differences.

> *Countries with digital trade barriers receive significantly lower levels of U.S. digital exports.*

For digital service exports from the U.S., the results show negative coefficients as a result of 1) data localization requirements, 2) weak intermediary liability protections, 3) online censorship/blocking, and 4) discriminatory tax regimes, as well as from the non-policy barriers including 5) less-developed financial systems, and 6) less-developed socioeconomic conditions (e.g. higher inequality, poverty, etc.). All of these are statistically significant. Countries with digital copyright barriers and barriers around privacy rules receive higher U.S. ICT service exports on average, which are also significant. Again, these relationships do not imply a facilitating nature per se – the correlations merely point to the need for more refined controls in the analysis and, specifically, controls for overall economy size. The scope of the analysis is limited and does not include causal tests.

Taken as a whole, the model and analysis prove useful and informative. There is great analytical difficulty in developing estimates for the causal impacts of digital trade barriers across countries. This is evidenced by the stunning lack of analysis, even of intermediary steps (such as this paper offers), by government agencies who are best equipped and most directly responsible for such estimations. The current paper's model is a new and unique approach to moving the conversation forward by examining the significance of differences in digital export volumes between countries with and without barriers. The model and results provide some initial evidence confirming the overwhelming suspicion of economists and researchers working in this area. Diagnostic tests show the model fit to be robust.[12]

The regression results are given in Table 5. Readers should not over interpret these and should not concentrate on the coefficients of individual barriers. The paper recommends interpreting the results 'as a whole' – the relationships and policies that drive international trade are complex and information will be lost if a reader focuses

[11] VIF tests provide a measure of multicollinearity in multiple regression, providing an index of how much any single explanatory variable is related to and distorting the results. High VIF scores indicate the results of the model are likely distorted. Read more at: https://www.investopedia.com/terms/v/variance-inflation-factor.asp

[12] The Shapiro-Wilk normality test rejected the null hypothesis (W = 0.9952, p-value = 0.8288) indicating normality in distribution residuals as demonstrated in the QQ plot Appendix D.

Table 5: Digital Trade Barriers And U.S. Digital Service Export Volumes

	(1)	(2)
Copyright	0.9273***	1.6969***
	(0.1906)	(0.1899)
Data Localization	-1.8618***	-0.7760*
	(0.2418)	(0.4488)
Intermediary Liability	-0.1752	-1.5875***
	(0.2994)	(0.2304)
Online Censorship	-0.2476	-1.5658***
	(0.2042)	(0.1383)
Tax Regimes	-0.0567	-2.5055***
	(0.2286)	(0.4229)
Privacy Rules	1.1952***	0.7916*
	(0.3971)	(0.4237)
Financial Systems	-1.9642***	-1.2003***
	(0.4134)	(0.3777)
Socioeconomic Conditions	0.0519	-0.5635***
	(0.2958)	(0.1375)
Constant	-11.1915***	-11.0490***
	(0.2196)	(0.1883)
Year & Country FE	No	Yes
Control Vector	Yes	Yes
N	180	180
R2	0.6902	0.9815
Adjusted R2	0.6679	0.9761
Residual Std. Error	0.8752 (df = 167)	0.2347 (df = 139)
F Statistic	30.9993*** (df = 12; 167)	183.9048*** (df = 40; 139)

Note: Control variables include ICT services imports, total imports as a percent of GDP, customs/tariff rates and GDP growth.

in on only one specific policy. More work is needed to investigate the specific impacts of specific trade barriers, but the paper argues the results below demonstrate the aggregate influences of digital trade barriers on U.S. digital service exports.

Table 5 offers coefficient estimates for the differences in average U.S. ICT service export volume per country from 2006-2015 based on the presence of specific trade barriers identified. The coefficient estimates do not represent direct causal impacts from each digital trade barrier; however, they demonstrate statistically significant differences and negative correlation that suggest U.S. ICT service exports are indeed hampered by the erection of barriers. Further investigation is required to determine the exact degree of impact specifically from each trade barrier, but the current coefficients can provide reasonable estimates of how much U.S. digital exports were potentially hurt in total over that period.

Tables 6-7 converts these measures into estimated export volumes ($ USD) and jobs supported by those exports using a method from the U.S. ITA to calculate export supported jobs. This approach utilizes National Employment Requirement (NER) Tables and applies the multiplier figures within them from internet industries as defined by IA's identification methodology.

First, Table 6 documents the ICT service export volumes for 2015 provided by BEA and applies the multiplier approach used by Rasmussen (2016) to estimate the number of jobs supported by those exports. These calculations demonstrate approximately 160,000 U.S. jobs come from U.S. digital exports while approximately 1.4 million

additional jobs come from potentially ICT-enabled service exports. In calculating these figures, the paper assigns only the internet sector internal multipliers from direct internet sector industry codes to the service exports while it assigns the internet sector external multipliers (for all other industries) to the potentially enabled service exports. This process dampens the overall job estimates creating a more conservative and likely more accurate estimate.[13]

Table 6: US ICT Service And Supported Jobs In 2015

	ICT Service Exports 2015		Potentially ICT-Enabled Service Exports 2015	
	$ USD Millions	# Of Jobs	$ USD Millions	# Of Jobs
Total	65,348.0	158,821	398,669.0	1,411,384
Average Per ICT Trading Partner (Country)	859.8	2,090	5,245.6	18,571

Note: Author assumes that ICT Service Exports represent the direct internet sector (as defined by IA) component of the National Employment Requirement Tables multiplier while Potentially ICT-Enabled Service Exports represent the indirect (i.e. non-internet sector) component of the National Employment Requirement Tables multiplier. See BLS (2017), Rasmussen (2016), and BEA (2017)s for additional details.

Next, the paper applies the regression results to the overall export volume and supported job estimates (in Table 6) and presents them in Table 7. The table once again provides the regression coefficients for each barrier and their significance along with estimates for the impact of each specific barrier on U.S. digital export volumes and supported jobs. The estimates for export volume impacts applies the coefficient estimate of each barrier to the average export volume per digital trade partner (both ICT service exports and potentially ICT-enabled service exports) and then applies that figure to the number of documented cases where that trade barrier is present. In other words, the impact of each trade barrier is only counted in those countries that actually have it rather than for all 76 digital trade partners of the U.S. This produces an estimate for total potential reduction per year for each barrier and, summed together, for the total potential impact of all digital trade barriers. Only those barriers with statistically significant results are included in this process.

Together, the paper finds that digital trade barriers could lower U.S. ICT service exports by approximately $25 billion or 38 percent. On average, each individual trade barrier represents a potential loss of approximately $574 million from U.S. ICT service exports. This equates to approximately 60,000 U.S. jobs lost in total or about 1,400 jobs per trade barrier. For potentially ICT-enabled service exports, the paper finds that digital trade barriers potentially reduce their volume by approximately $151 billion in total or $3.5 billion per individual barrier. This equates to approximately 533,000 jobs lost in total or about 12,400 jobs per individual barrier.

> *Together, the paper finds that digital trade barriers could lower U.S. ICT service exports by approximately $25 billion or 38 percent.*

Table 7: Estimated Influences Of Digital Trade Barriers On Digital Trade

	Digital Service Exports From US					
	Regression Results		ICT Service Exports		Potentially ICT-Enabled Service Exports	
	Average % Impact From Barrier	Significant?	$ USD Millions	# Of Jobs	$ USD Millions	# Of Jobs
Unbalanced Copyright Frameworks	169.7%	Yes	7,295.8	17,732	44,509.3	157,574
Customs/Trade Facilitation	-4.3%	No	(147.9)	(359)	(902.3)	(3,194)

[13] To clarify, the combined multiplier for the internet sector industries is approximately 6.0. This means that for every $1 million of exports from the U.S. in these industries, approximately 6 jobs are directly supported. Using the NER matrix, approximately 40% of the multiplier applies to the internet industries themselves (the internal multiplier portion) while approximately 60% applies to non-internet industries, such as trucking (the external multiplier portion).

	Digital Service Exports From US					
	Regression Results		ICT Service Exports		Potentially ICT-Enabled Service Exports	
	Average % Impact From Barrier	Significant?	$ USD Millions	# Of Jobs	$ USD Millions	# Of Jobs
Data Localization	-77.6%	Yes	(6,672.4)	(16,216)	(40,706.2)	(144,110)
Intermediary Liability	-158.8%	Yes	(6,827.1)	(16,593)	(41,650.4)	(147,452)
Filtering, Censorship, & Service Blocking	-156.6%	Yes	(8,079.1)	(19,635)	(49,288.1)	(174,492)
Unilateral Or Discriminatory Tax Regimes	-250.6%	Yes	(10,773.8)	(26,185)	(65,727.9)	(232,693)
Burdensome Or Discriminatory Data Protection Frameworks	79.2%	Yes	3,405.0	8,275	20,772.8	73,541
Financial System Issues (Including Access To Payment Platforms)	-120.0%	Yes	(2,064.1)	(5,017)	(12,592.7)	(44,581)
Socio-Economic Barriers	-56.4%	Yes	(969.9)	(2,357)	(5,917.1)	(20,948)
Total Economic Harm In Documented Cases Only (43 Countries)			**(24,685.7)**	**(59,996)**	**(150,600.4)**	**(533,161)**
Average Economic Harm In Documented Cases Only (43 Countries)			**(574.1)**	**(1,395)**	**(3,502.3)**	**(12,399)**

Note: Aggregate figures include both positive and negative impacts for statistically significant barriers only.

5. Conclusion

Economists and trade proponents have too often ignored the very real impacts from the opening of borders and other traditional industries to global markets. However, it is crucial that we do not blindly apply historical lessons to industries of the future without consideration of evidence from the past. America's digital industries enjoy a massive competitive advantage and are a driving force of the economy. Consequently, they have a strong, positive trade balance for the United States and allow industries, such as the internet sector, to thrive.

The paper set out to estimate the economic costs of digital trade barriers on the U.S. economy and on global trade. The report examined the influences on digital exports of a series of digital trade barriers identified through a comprehensive academic review, IA's NTE report, and an internal survey of IA's member companies. Using a variety of controls, refinements, and diagnostics, the paper finds initial evidence that digital trade barriers do indeed harm U.S. exports and the U.S. economy more broadly. More than generalizations, the paper offers the first estimates for the number of jobs supported by digital exports from the United States and the first estimates on the harms caused by digital trade barriers. The evidence shows that the U.S. potentially loses about 600,000 supported jobs and $175 billion in exports per year due to digital trade barriers in other countries. These figures are significant and should give pause, particularly given the report's conservative estimation approach.

> *The evidence shows that the U.S. potentially loses about 600,000 supported jobs and $175 billion in exports per year due to digital trade barriers in other countries.*

Further research must be done. This report has laid a groundwork, but has worked with limitations in data. Further detail on specific trade barriers and further nuance on how different barriers impact exports are welcome starting points. Furthermore, research examining global digital trade flows, rather than simply U.S. exports, would be immensely valuable.

The evidence in this paper should serve as proof to policymakers that an open trade environment is crucial for American jobs, the broader U.S. economy, and digital industries everywhere. The intentional use or inadvertent existence of digital trade barriers is an unfortunate reality, and it is in the best interests of the United States, its businesses, and its workers to help remove these burdensome barriers.

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Appendix A

Table A1: Correlation Matrix Of Trade Barrier Indicators And Control Variables

Variable ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1.00																				
2	-0.27	1.00																			
3	-0.31	0.32	1.00																		
4	-0.23	0.51	0.73	1.00																	
5	-0.25	0.30	0.46	0.69	1.00																
6	0.01	-0.17	0.42	0.21	0.06	1.00															
7	-0.13	-0.08	0.42	0.58	0.40	0.48	1.00														
8	-0.19	0.64	0.53	0.74	0.50	-0.12	-0.06	1.00													
9	-0.18	-0.11	0.26	0.39	0.24	0.32	0.73	-0.08	1.00												
10	0.42	-0.11	-0.13	-0.10	-0.14	-0.11	-0.05	-0.08	-0.08	1.00											
11	-0.20	-0.12	0.64	0.34	0.19	0.73	0.66	-0.09	0.46	-0.08	1.00										
12	-0.19	-0.12	0.31	-0.10	-0.15	0.37	-0.06	-0.08	0.38	-0.08	0.53	1.00									
13	0.26	-0.14	0.15	0.28	0.14	0.21	0.58	-0.10	0.39	-0.10	0.34	-0.10	1.00								
14	0.51	0.05	-0.41	-0.29	-0.26	-0.17	-0.25	-0.18	-0.32	0.29	-0.38	-0.34	0.01	1.00							
15	0.41	0.16	-0.39	-0.27	-0.17	-0.09	-0.27	-0.12	-0.34	0.14	-0.39	-0.34	-0.15	0.63	1.00						
16	-0.26	0.01	0.37	0.22	-0.01	0.27	0.24	0.11	0.16	-0.13	0.35	0.17	0.08	-0.30	-0.31	1.00					
17	-0.17	0.43	0.28	0.44	0.36	0.14	0.27	0.28	0.14	0.09	0.23	-0.02	-0.07	0.06	0.16	-0.03	1.00				
18	0.20	0.27	-0.09	0.20	0.17	0.00	0.27	0.01	0.07	0.25	-0.02	-0.36	-0.01	0.35	0.47	-0.22	0.49	1.00			
19	-0.13	-0.15	-0.32	-0.30	-0.28	-0.13	-0.02	-0.30	0.13	0.06	-0.10	0.05	-0.03	0.07	-0.04	0.02	-0.13	-0.02	1.00		
20	-0.37	0.30	0.45	0.42	0.09	0.14	0.19	0.37	0.28	-0.28	0.23	0.23	0.07	-0.45	-0.40	0.38	-0.04	-0.22	-0.11	1.00	
21	-0.06	0.13	0.46	0.41	0.31	0.15	0.27	0.24	0.28	0.08	0.40	0.29	-0.12	-0.15	-0.09	0.00	0.40	0.26	-0.27	0.11	1.00

Pairwise correlations over 0.60 threshold are highlighted and those variables removed from analysis to address multicollinearity.

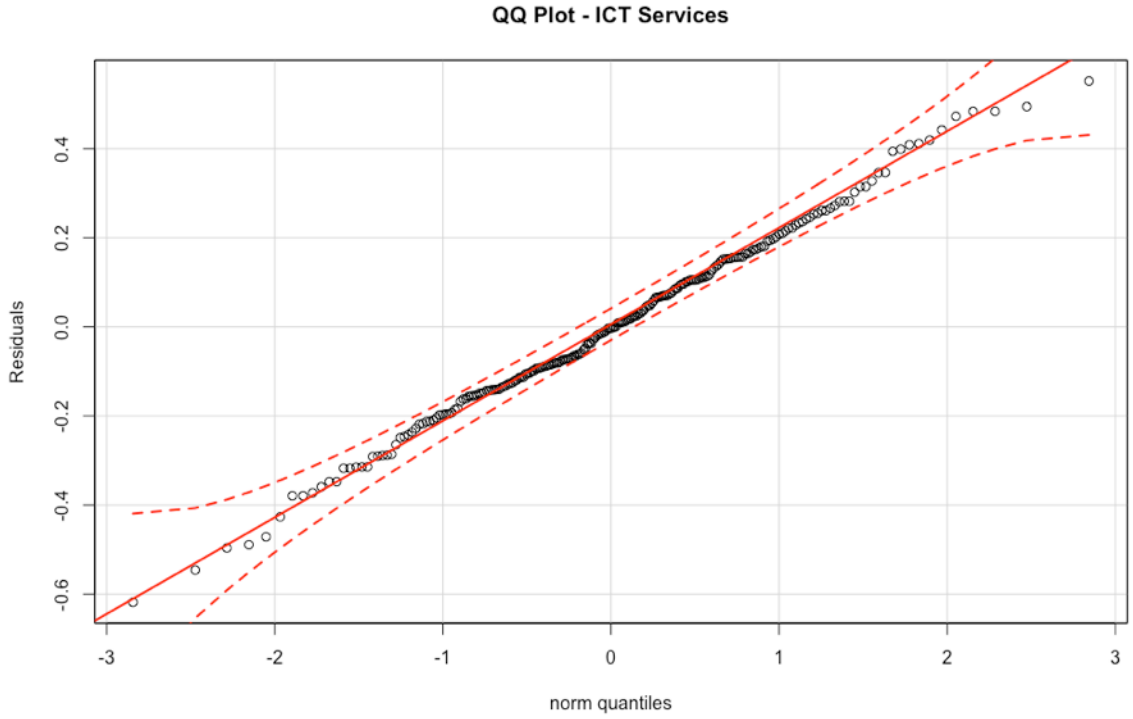
Table A2: Variable VIF Scores – Digital Service Exports

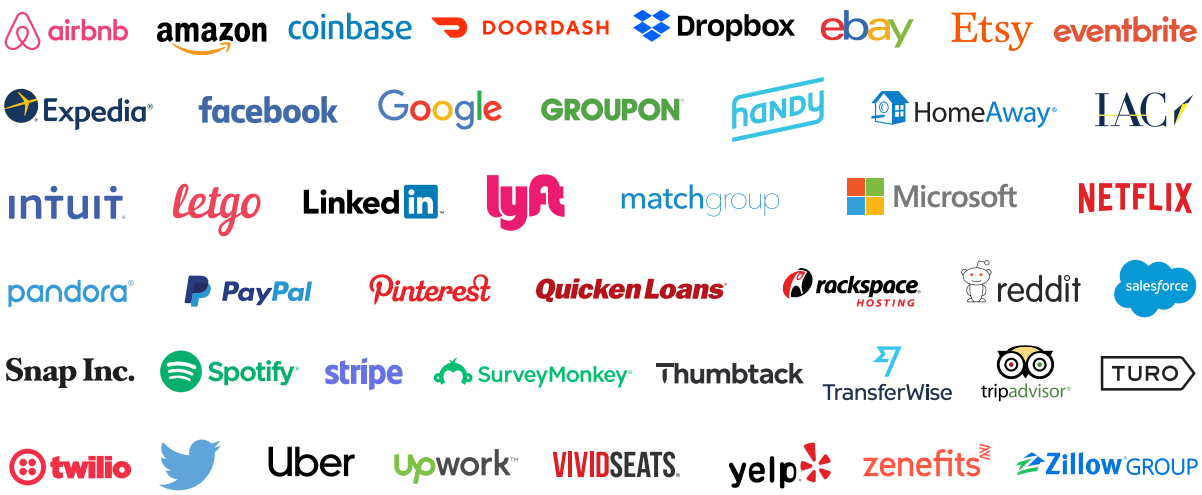
	Trade Barriers Only	Cleaned Trade Barriers	All Potential Controls	Cleaned Controls Only
copyright	1.9119	1.7763	3.4700	1.6690
customs	1.4455	1.4230	1.9020	1.7902
localization	2.9759	2.6124	5.5011	2.4576
liability	2.7550	2.6258	3.0345	2.3479
censorship	2.0465	1.9330	2.4500	1.6927
tax_regimes	2.8196	1.6098	4.1889	1.4691
discriminatory_regs	3.0579	3.0525	103.1453	
data_privacy	4.2575	3.1947	5.5887	2.6574
finance_systems	2.7210	2.6361	3.9324	2.3038
labor	1.3012	1.2397	1.3750	
infrastructure	5.5172		11.9664	
cultural	3.3146	2.7011		
socioeconomic	2.4818	2.1206	3.3921	1.6651
internet_users_100			7.9656	
netincome_capita			8.3583	
gdp_growth_pct			1.7618	1.5453
ICT_service_ex_pct			*	
US_ict_service_im			10.8693	2.2655
total_imports_pct_gdp			3.1994	1.3611
meantariff_all_pct			6.9430	
population			96.1968	

Note: bracketed numbers refer to regression specifications in Table D1; *Variable produces multicollinearity and was dropped from potential controls list

Appendix B

QQ Plot Of ICT Service Export Residuals From Specification (2)





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