New Technologies and Trade: New Determinants, Modalities, and Varieties

Integration and Trade Sector

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Abstract

Digital technologies are changing the way people, businesses, and governments interact, but what is their impact on international trade? Although some of the effects of digital technologies on trade parallel those of past technological advancements, we argue that a variety of effects are completely novel. We present evidence that new technologies can change *why* countries trade, *how* they trade, and *what* they trade. We identify new dilemmas faced by policy makers in the digital era and provide policy recommendations.

Keywords: Digital Technologies, International Trade, Internet, E-Commerce
JEL-Code: F10, F13, F14,

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1 Introduction

Technology and international trade have been closely intertwined throughout history. Improvements in transportation and information and communication technologies (ICTs)—by reducing transport and communication costs—have enhanced trade between countries and changed the basket of goods that countries specialize in producing. The emergence of the steamship in the second half of the XIX century (Pascali, 2017), the advent of container shipping in the 1960s (Bernhofen et al., 2016, and Cosar and Demir, 2018), and the introduction of the telegraph (Steinwender, 2018) were all technological advances that had a profound impact on trade.[1]

The world is currently in the midst of a new wave of technological changes that are substantially affecting the way people and businesses interact. These changes are commonly referred to as the digital transformation.[2] Concern in policy circles and the general public is growing over the impact of this transformation on the economy. The discussion generally revolves around the effects on employment, wages, and inequality, but the implications for international trade remain relatively less explored. These implications are multifaceted since new technologies can affect the type of goods that countries trade, the volumes and values traded, the way in which goods are traded, and the set of goods that countries specialize in producing.

Some of the effects of the digital era on trade parallel those of past technological revolutions. However, other impacts are completely novel, such as the emergence of new forms of trade like e-commerce, or the appearance of new trade barriers, like the regulation of cross-border data flows. These new aspects bring with them an array of dilemmas and challenges for policy design.

These relevant economic phenomena, their trade effects, and their policy implications are the subject of this paper, which is structured as follows. Section 2 presents the drivers of the digital transformation and discusses its implications for international trade. Section 3 establishes the importance of fast internet connectivity in the digital transformation and its impacts on international trade. Section 4 defines e-commerce, addresses its measurement and strategies to improve it, elaborates on why e-commerce can make a difference by showing how online platforms can affect trade, and presents evidence on the barriers it faces. Section 5 illustrates how countries are using new technologies to facilitate and promote trade through a series of specific cases. Finally, Section 6 concludes and discusses policy implications.

[1] Other examples are the telephone and the mobile phone services (Fink et al., 2005; and Jensen, 2007, respectively).
[2] The set of economic relationships the technological changes give rise to is referred to as the *digital economy*.

2 The Digital Transformation: Drivers and Implications

2.1 Drivers and New Technologies

Despite the lack of a widely accepted definition of the digital transformation, some of its drivers, the technologies associated with them, and the changes they bring about are well recognized. The digital transformation's main drivers are the improvements in computing power and the plummeting costs of collecting, processing, storing, and transferring data. A series of technologies identified with the digital transformation (UNCTAD, 2017a) include high-speed broadband, advanced robotics, artificial intelligence (AI), the Internet of Things (IoT), cloud-computing, Big Data analytics, and additive manufacturing (which includes 3D-printing).[3] These technologies have the potential to increase efficiency in production processes and change the nature of work (see Table 1).[4] More generally, they alter the relations among people, businesses, and governments.

Table 1
The Digital Transformation: Associated Technologies

Technology	Description
High-speed broadband	It is high-speed Internet access that is always on and faster than the traditional dial-up access. It includes several high-speed transmission technologies such as: Digital Subscriber Line (DSL), Cable Modem, Fiber, Wireless, Satellite, and Broadband over Powerlines (BPL)
Advanced robotics	Industrial robots have existed for decades, but they are becoming more complex, agile, and smarter. They are also increasingly capable of collaborating with humans in the workplace. Combined with the use of AI algorithms, robots can make predictions and decisions in an automated way.
Artificial Intelligence (AI)	It is often defined as the ability of machines to respond to simulation in way consistent with how the human mind would respond. These software systems can mimic human cognitive functions such as language processing, learning or problem solving.
Internet of Things (IoT)	It is a system of interconnected objects and devices that can transfer data over the Internet. These devices can be anything from simple sensors to smartphones and wearables to self-driving cars. The data collected by these devices can be integrated in a platform that analyzes it allowing for real-time monitoring and decision-making.
Cloud-computing	It is the on-demand access to computing services such as storage and computing power over the Internet. The cloud services provider owns and maintains the hardware while the users save on costs since that they do not need to invest in hardware and can pay only for the resources they use.
Big Data analytics	Big data analytics technologies and techniques are used to examine large amounts of data and get answers almost immediately, allowing companies to make informed decisions faster and at lower costs than with traditional solutions.
Additive manufacturing	In traditional (subtractive) manufacturing, materials are removed from objects. In contrast, additive manufacturing includes processes such as 3D printing where objects are made from 3D model data by joining materials layer upon layer.

Source: Authors' elaboration.

[3] See also UNCTAD (2017a) and WTO (2018).
[4] In addition to those in table, another incipient technology is blockchain. This can be defined as a decentralized, distributed digital record of transactions that is secured using several cryptographic techniques.

2.2. *New Technologies and Trade: New (and Old) Determinants, Modalities, and Varieties*

The digital transformation can influence international trade through different channels (Table 2). The most evident is a reduction in trade costs, which can take the form of a reduction in transport and logistic costs or in information and communication costs. This channel resembles the ones brought about by previous technological changes, such as the steamship or the telegraph (Estevadeordal et al., 2003). New technologies such as autonomous vehicles, robots, AI, Blockchain, and IoT can reduce transport and logistic costs as well as those related to regulation compliance and administrative procedure compliance. In addition, online platforms and digital marketplaces, together with developments such as real time translation or teleconferencing, can lower information and communication costs. These platforms can specifically reduce frictions related to the search and matching with new clients, thereby making it easier for firms to enter into foreign markets, in particular, for those selling differentiated goods whose exchange is more information-intensive (Rauch, 1999).

Table 2
The Digital Transformation: Channels through which New Technologies Affect International Trade

Channel		Technology and Applications
Trade Costs	*Transport and Logistics*	Autonomous vehicles, unmanned aerial vehicles, and AI calculations of best route are used for optimizing planification and goods' transportation. ICT networks combined with AI inventory designing and smart robots permit the optimization of storage and inventory. AI is also applied in cargo and shipment tracking. Similarly, cloud-based IoT is used for tariff and trade flow management (e.g., Port of Hamburg).
	Trade Regulation Compliance and Procedure Completion	When combined with proper process design, broadband internet can contribute to streamline and expedite the administrative processing of trade flows by multiple border agencies both within and across countries. New technologies are especially valuable for verification and certification procedures and can raise security. AI and big data analytics can be used to increase the effectiveness of border agencies' risk management.
	Communication and Information	New technologies applied in e-commerce platforms can lower transaction costs. Online platforms, real-time translation, and online communications (e-mails, teleconferencing, chats, etc.) can reduce lack of information risk, communication costs, and augment trust. They can specifically help firms connect with potential clients in a new market.
Task Costs		Robots and AI increase the level of automatization in production, reducing tasks costs (see Box 1). Combined with 3D printing they also permit the local production of intermediate goods. IoT is applied to allow real-time monitoring of tasks and processes regardless of where the user is.
Comparative Advantage		Robots, AI, and 3D printing could reduce the role of low-skilled labor as source of comparative advantage. However, high-skilled labor could start being a new source of comparative advantage as an increasing number of professional services are exported (Baldwin, 2018).
New Trade Modalities	*Digitally-Enabled*	Online platforms allow for different forms of e-commerce: B2B, B2C, C2C and reduce the cost of communication between individuals (see Section 3).
	Digitally-Transmitted	Services such as video streaming, music, e-books, mobile apps, computer software, online advertising and games are purchased and transmitted via internet.
New Products and Services		Trade of new products such as ICT goods, 3D printers, robots, etc. and trade of digital services.

Source: Authors' elaboration.

New technologies such as robots, AI, or 3D printing can also affect trade by reducing the cost of performing certain tasks in the production process, which in turn can affect the opportunity cost of offshoring tasks to other countries. In the past two decades global production became increasingly fragmented, with some countries specializing in intermediate stages of production and others specializing in final stages, in design, or in research and development (Hummels et al., 2001; Johnson and Noguera, 2012; and Fort, 2017). High-wage countries typically would offshore to low-wage countries the most labor-intensive stages of production. With new technologies such as robotics or 3D printing, the cost advantage of offshoring those tasks could vanish, leading to a decrease in trade in intermediates globally (see Box 1).

More generally, digital technologies can also influence trade patterns by shaping comparative advantage, either intensifying previous advantages or creating new advantages, in particular in interaction with endowments and pre-existing countries' characteristics.[5] Several factors will determine future patterns of comparative advantage: (i) the initial pattern of comparative advantage, which can generate hysteresis (e.g., initial comparative advantage in industries that use robots more intensively determines robot adoption and therefore future increases in productivity in those industries); (ii) initial endowments, which can become a source of comparative advantage as a result of the digital transformation (e.g., in a context in which data is an asset for the development of AI, countries that had accumulated more data, are more likely to develop a comparative advantage in data-intensive sectors); (iii) the opportunity cost of adopting new technologies, which depends on the price of new technologies relative to the price of other factors such as labor (e.g., the adoption of new technologies may not even be profitable in low-wage countries, which will then be less likely to develop comparative advantages in technology-intensive sectors); and (iv) the existing regulatory environment (e.g., the regulatory framework on data privacy and localization can be a source of comparative advantage or disadvantage in data-intensive sectors).

Finally, digital technologies are also behind the emergence of new trade modalities and new trade varieties. Goods and services can now be digitally-ordered, a practice known as e-commerce (see Section 3). Moreover, some goods that used to be traded in physical form such as movies, music, and books can nowadays be digitally transmitted and have mutated, correspondingly, into the following services: video streaming, music downloading, and e-books.

In closing it is worth stressing that these different channels do not operate independently but tend to interact with other in determining economic and trade outcomes. Thus, for instance, existing empirical evidence suggests that availability and adoption of broadband internet in firms can improve (worsen) labor market outcomes and productivity of skilled (unskilled) workers because it complements them (substitutes for them) in executing non-routine abstract (routine) tasks (Akerman et al., 2015). On the other hand, the emerging combination of AI and robotics could potentially have important negative effects on skilled workers, especially in the service sector (Baldwin, 2019).

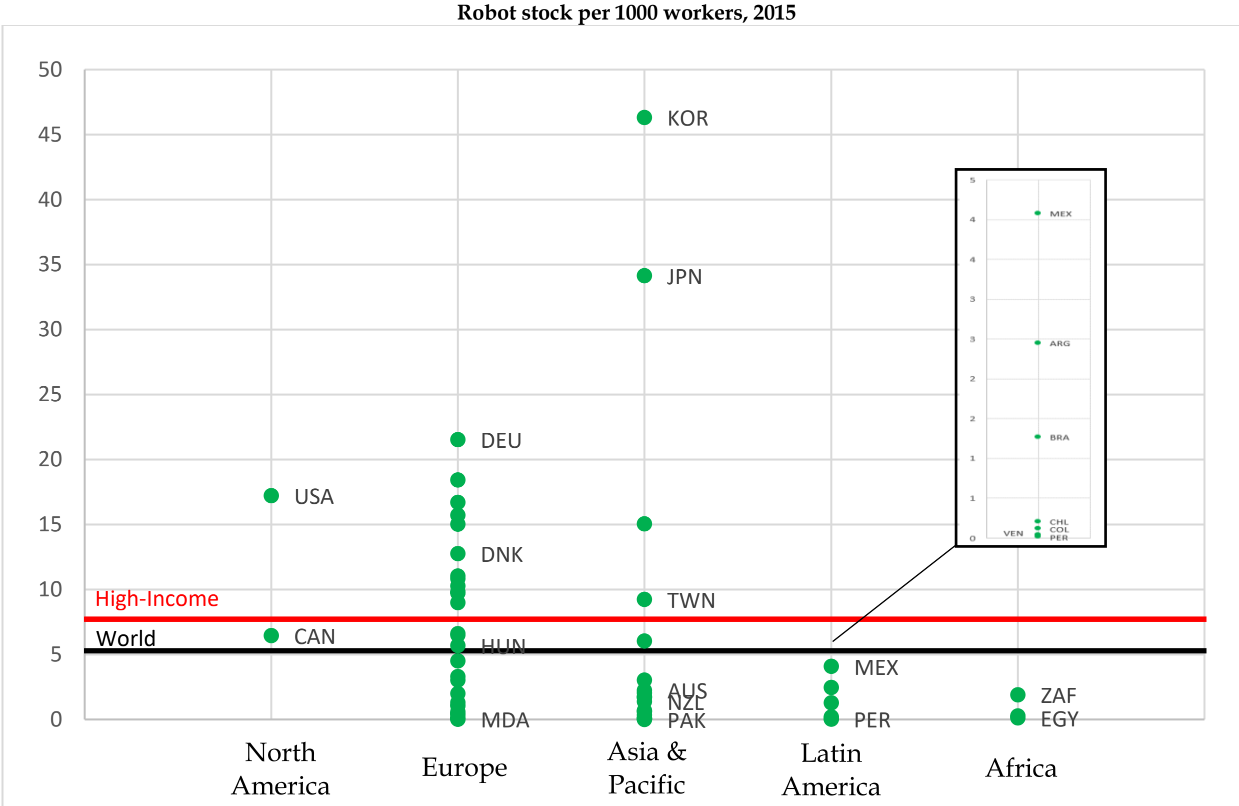
[5] For instance, the increase in world trade due to the reduction of communication costs at the end of 20th century did not occur while maintaining previous cross-country specialization patterns. In fact, the international division of labor changed dramatically since such a reduction interplayed with cross-country wage differentials (Baldwin and Martin, 1999; Baldwin and Venables, 2013; Fort, 2017).

Box 1

Robots and International Trade

The increasing use of robots for tasks previously performed by humans is transforming the manufacturing industry around the world. Robots had already been widely employed in the OECD countries' auto industry since the 1980s, but in recent years they have spread to other industries and to developing countries. Robot density (the number of robots per 1,000 workers) is highest in Korea, Japan, Germany, and the United States. Latin America and the Caribbean lags behind most regions in the world (Figure 1).

Figure 1
Robot stock per 1000 workers, 2015



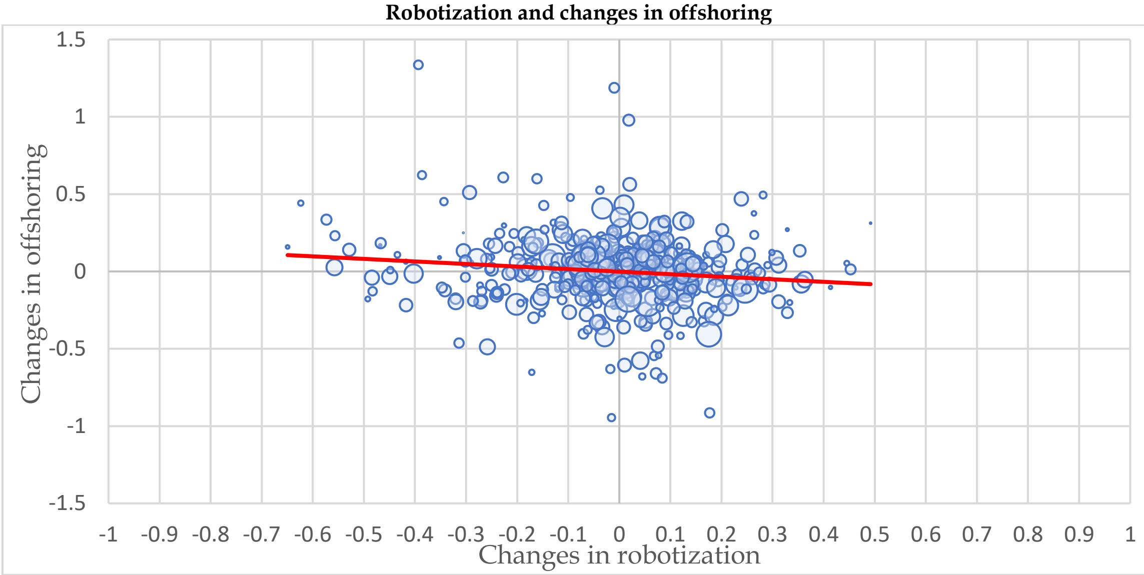
Source: IDB based on data from IFR and UNIDO.
Note: Robot stock per 1000 workers is the total stock of industrial robots in manufacturing divided by the total number of workers in manufacturing (in thousands). High-Income and World are simple averages of countries in each group. High-Income definition is based on the World Bank country groups classification.

Robotization in manufacturing can impact productivity and employment (Acemoglu and Restrepo, 2018a and 2018b and Graetz and Michaels, 2018), but can it affect trade flows? On the supply side, an increase in robot density in an industry leads to greater productivity and lower output prices, thereby stimulating exports. On the demand side, increased automation reduces the cost of producing parts at home and can erode the cost advantage of offshoring production to other countries and, therefore, slow down international demand for intermediate goods. For example, by using more robots, a U.S. manufacturing industry can reduce the cost of producing parts domestically, decreasing the incentive to produce them abroad and import them from a lower wage country (such as Mexico). Thus, robot adoption in a country can reduce its offshoring activity. This channel is particularly relevant for developing countries, including those in Latin America and the Caribbean, that export intermediate goods. Moreover, this might be the main channel through which robotization can have an impact on the region in the near future, given that manufacturing industries in the region—with the exception of the automotive industry in a few countries—have low levels of robot density.

An IDB study estimates the impact of changes in robot density on the degree of offshoring of an industry, defined as the industry's share of imported intermediate inputs in total intermediate input demand (Rodríguez Chatruc and

Nievas Offidani, 2019).[6] Figure 2 shows that, as expected, increases in robot density are associated with declines in offshoring. The study estimates a reduction in offshoring over the 1993-2015 period of 16 percent when an industry moves from the bottom to the top of the ranking of changes in robotization[7] These results highlight the importance of considering the impact of automation on the economy not only through the automation of domestic industries but through the automation of trade partners.

Figure 2.
Robotization and changes in offshoring



Source: IDB based on data from Eora, IFR, and UNIDO.
Notes: Bubbles correspond to country-industry combinations and their size is proportional to the industry employment share in each country's employment in 1993. Changes in offshoring and robot adoption correspond to the period 1993-2015. The variables in each axis are residuals net of country and sector trends. Offshoring is measured at the country and industry level as the share of (non-energy) imported intermediate inputs in total (domestic + imported) intermediate inputs and its changes are measured in log differences. Changes in robotization correspond to the percentile of change in #robots/thousands of workers. The estimated slope of the fitted regression line (in red) is -0.175 with a standard error (clustered by industry and country) of 0.0594.

[6] While this research was being conducted, two related studies became available. First, De Backer et al. (2018) estimate the impact of the growth of the robot stock on several outcomes such as offshoring, forward linkages, and backward linkages. The IDB study complements De Backer et al. because it examines a longer period (1993-2015 vs. 2000-2015) and uses a more demanding specification along with an instrumental variable approach to address the potential endogeneity of the robot stock. Second, Artuc et al. (2018) estimate the impact of an increase in robotization in the north on trade with the south. The IDB study is different in that it incorporates robotization in the south as well as north-north and south-south trade in the analysis and uses data on imports by the industry that is automating and not aggregate country-level imports as in Artuc et al. (2018).

[7] The estimated effects come from regressions of the (logarithmic) change in offshoring during the period 1993-2015 at the country-sector level on the percentile change in robot density at the country-sector level during the same period and include country trends. The change in robot density is instrumented with the sector-level replaceability of tasks by robots (taken from Graetz and Michaels, 2018). OLS regressions that also control for sector trends yield similar results.

3 (Fast) Internet Connectivity is a Prerequisite to Benefit from the Digital Transformation

3.1 Internet Infrastructure and Use: LAC in the Internet Worldwide Map

Internet infrastructure is like a long chain of links, the first of which is international connectivity, composed in its majority of fiber-optic submarine cables, through which most of the world's telecommunications and internet traffic travels. These cables are laid under the sea at 8000 m and can offer very high capacity, along with high security of transmission.[8]

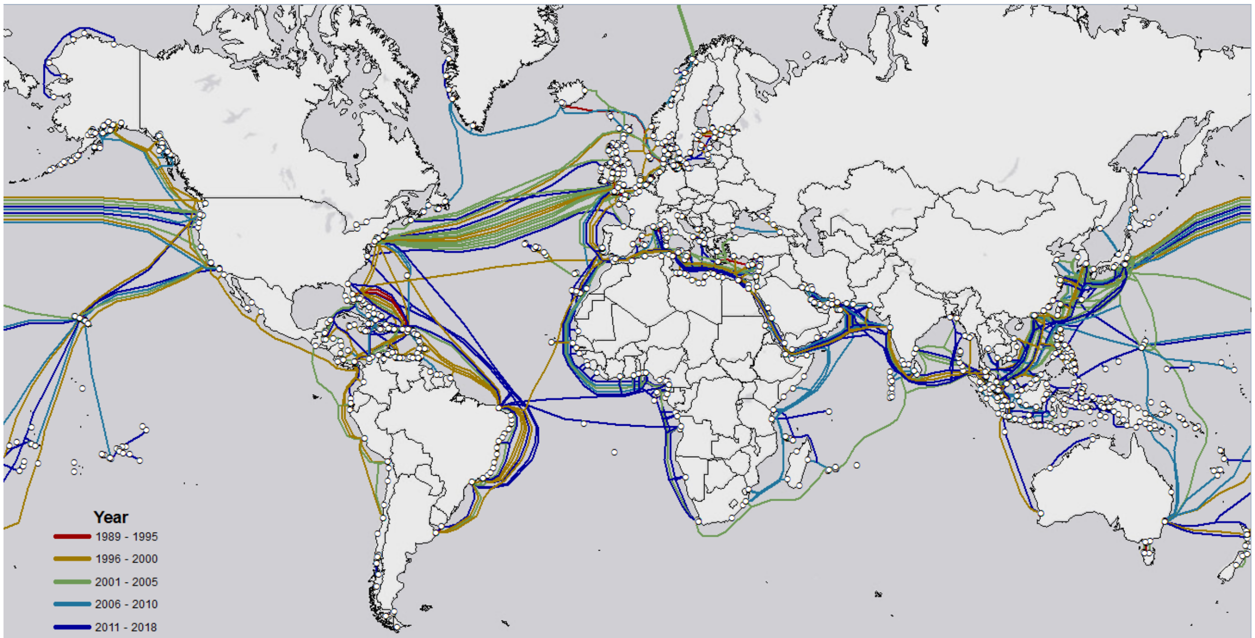
The first submarine cables were deployed connecting European countries among themselves and the U.S. with itself (Puerto Rico, Virgin Islands, Hawaii). Asia had its first cables in the early 1990s: between Iran and the United Arab Emirates in 1992. The Caribbean was connected in 1995 and South America in the late 1990s. Lastly, the majority of African countries only were connected around 2010 (Figure 3). Most cables in the world have landings in North America, Europe, and Asia. Latin America is disproportionately connected to countries within the region, vis-à-vis other regions (Figure 4). As of 2018, 30 countries in the region were connected to 45 cables and to nine countries outside the region.

Existing studies show that the deployment of cables has been associated with both increased internet penetration and faster internet connections (e.g., Cariolle, 2018; and Hjort and Paulsen, 2019, for evidence on Africa).[9] Such a positive relationship between the installation of cables and the number of internet users also holds for LAC countries, in particular, as expected over the 1990s (Figure 5).

[8] The other links are national backbone (composed of national IXPs, submarine cables landing stations, and high-capacity intercity links), followed by the middle mile (composed of telephone exchanges, mobile base stations, and lower capacity links) and finally, the last mile (composed of cell sites and the wireline). Although every link in the chain is important in providing fast and reliable internet to end users, submarine cables are the first link in the chain and once they are deployed, they can attract other investments in the backbone and middle and last miles (Schumann and Kende, 2013). Countries that do not have a submarine cable landing station connect to the network either through a neighboring country that has a cable, using an Internet Exchange Point (IXP), or they use satellite internet. Satellite internet, however, is uncommon and carries a negligible amount of the world's internet traffic.

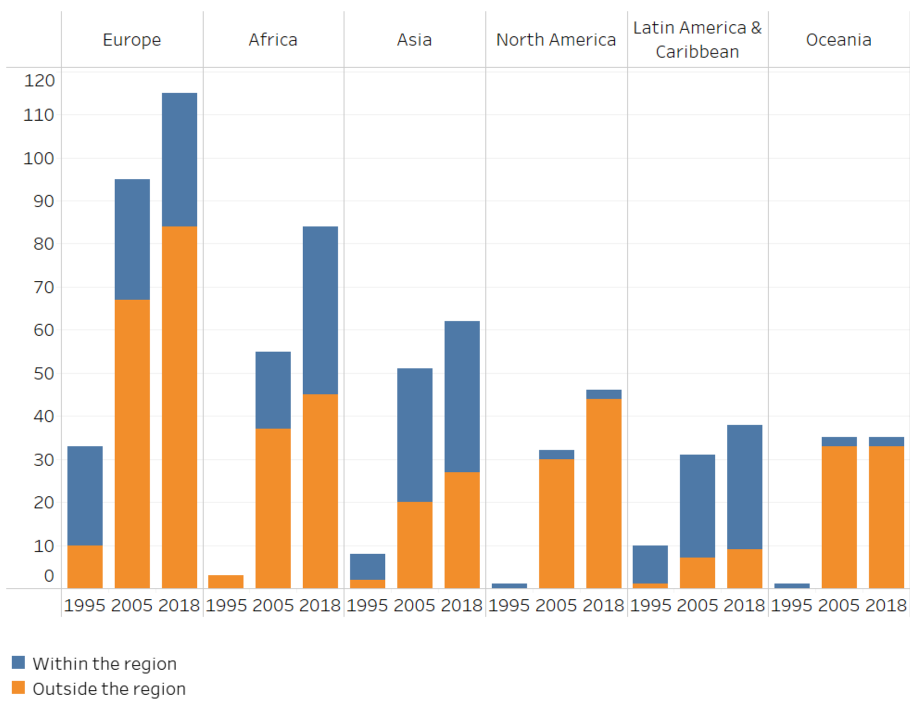
[9] Cariolle (2018) finds a significant increase in internet penetration rates in Sub-Saharan Africa after the deployment of submarine cables that started in 2009. In a related study Cariolle et al. (2018) use variation in digital vulnerability as provided by cable outages to identify the effect of increased internet usage in developing countries on their labor productivity. Hjort and Paulsen (2019) exploit the gradual cable deployment and regional variation in the terrestrial backbone network development to estimate the impact of fast internet availability on several outcomes. They find that fast internet in Africa increased the probability that an individual is employed, the probability that they are employed in a skilled occupation, and firms' exports.

Figure 3
Fiber Optic Submarine Cables, by Deployment Year, 1989-2018



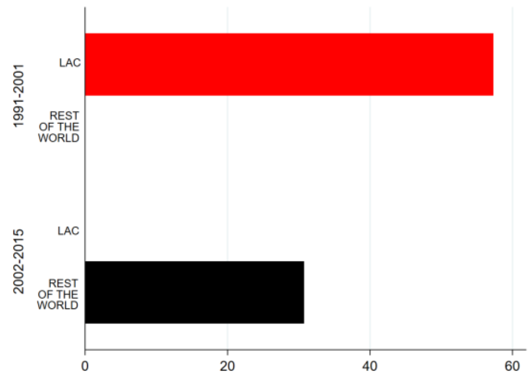
Source: Authors' calculations based on Telegeography data.

Figure 4
Number of Connections to other Countries through Fiber Optic Submarine Cables, by Region and Year



Source: Authors' calculations based on Telegeography data.

Figure 5
Submarine Cables and Internet Penetration, LAC and Rest of the World, 1991-2015

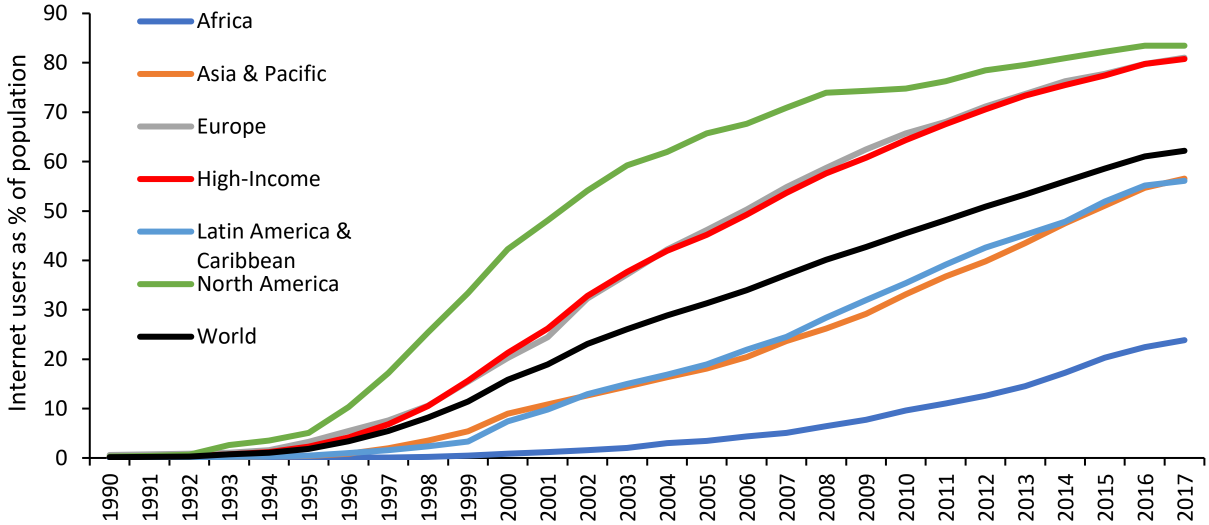


Source: Authors' calculations based on Telegeography data.
The figure shows the estimated effects of being connected to a fiber optic submarine cable on the number of internet users for both LAC countries and the rest of the world in two periods 1991-2011 and 2002-2015. In particular, the estimating equation has as dependent variable the natural logarithm of the number of internet users in a given country and a given year and as the main explanatory variable a binary indicator that takes the value of one if the country was connected through a submarine cable in the year in question and zero otherwise along with country and year fixed effects. Thus, reported estimates are computed as $(e^{\beta}-1)$*100, where β is the estimated coefficient on the binary indicator and only take a value different from zero when they are statistically significant at the 10% level. Control variables include the country's GDP and GDP per capita.

Although improvements in internet infrastructure allowed the region to significantly increase its connectivity in recent decades (Figure 6), most countries still have penetration rates lower than those of high-income countries and a group of countries has penetration rates even lower than the world's average (Figure 7). In addition, the speed at which those who have access can connect to the internet is, on average, lower. In particular, all LAC countries have a slower average connection than the world average. Among these countries, Uruguay has highest average speed (9.50 mps) and Paraguay has the lowest (1.40 mps)

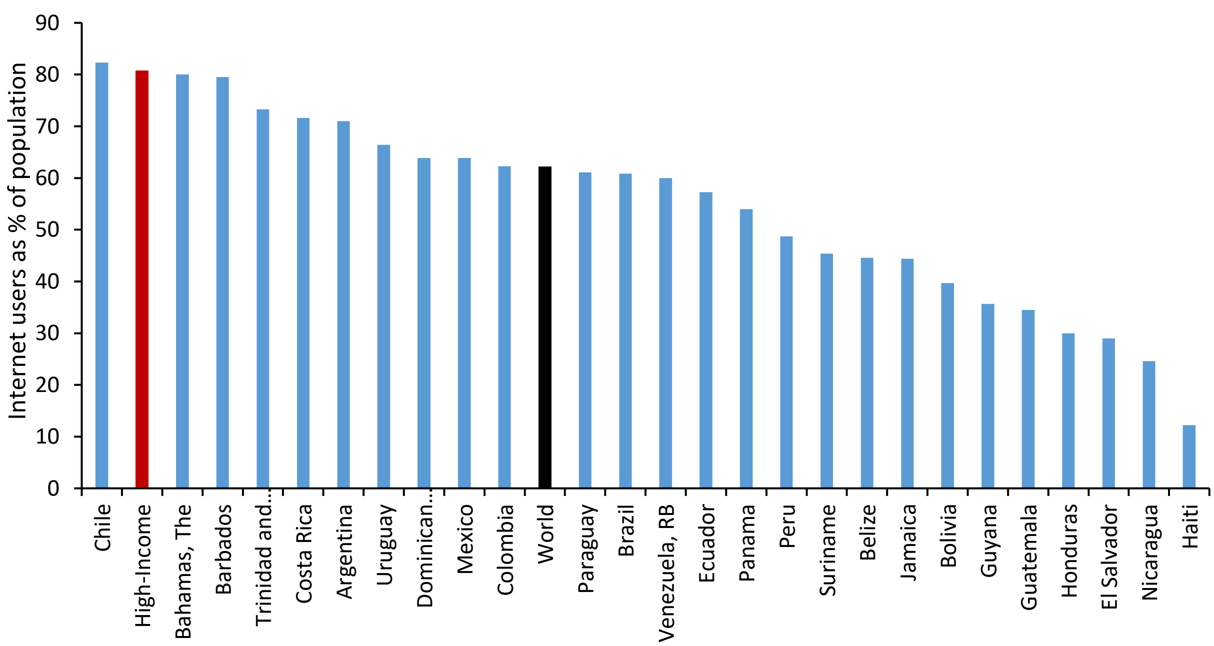
(Figure 8). These lags both in terms of the level and the quality of connectivity can severely limit the ability of the region to reap the benefits of the digital transformation and to develop digital trade.

Figure 6
Internet Users as a Percentage of Total Population, 1990-2017



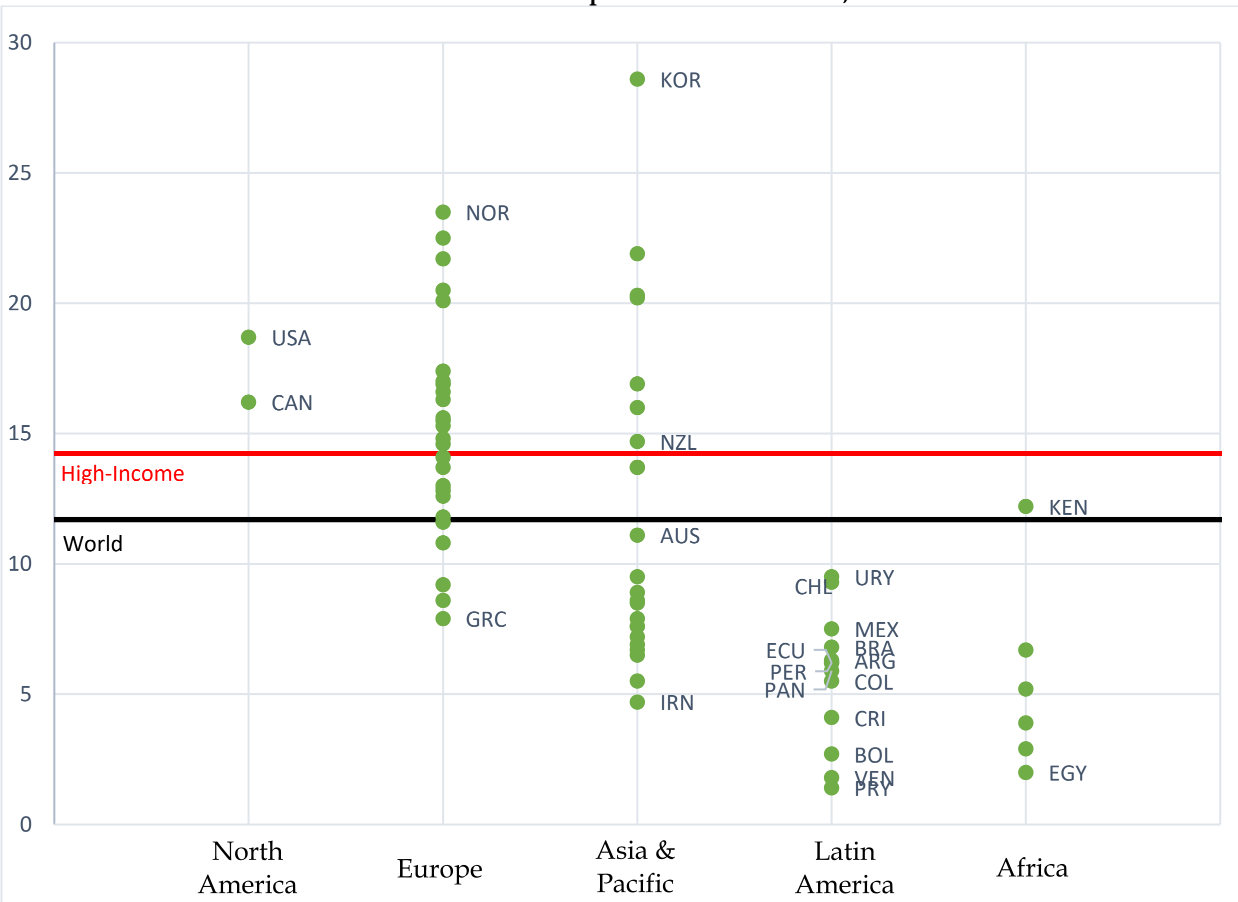
Source: IDB staff calculations based on International Telecommunication Union and World Development Indicators.
Note: High-Income and World are simple averages of countries in each group. High-Income definition is based on the World Bank country groups classification

Figure 7
Internet Users as a Percentage of Total Population in Latin America and the Caribbean, 2017



Source: IDB staff calculations based on International Telecommunication Union and World Development indicators.
Note: High-Income and World are simple averages of countries in each group. High-Income definition is based on the World Bank country groups classification.

Figure 8
Internet Connection Speed in Mb Per Second, 2017



Source: Authors' calculations based on data from Akamai.
Note: High-Income and World are simple averages of countries in each group. High-Income definition is based on the World Bank country groups classification.

3.2 *Internet and International Trade: A Positive Relationship*

Available evidence based on aggregate, country-pair level data reveals that both quantity and quality of internet connections matters for trade, albeit to different extent depending on the countries' level of development.[10] More specifically, it has been found that higher growth in a country's web hosts and in the number and broadband data speed of internet subscriptions is correlated with higher export growth (Freund and Weinhold, 2004, and Abeliansky and Hilbert, 2012, respectively).[11] Interestingly, quality - as

[10] The growth in broadband internet users is also associated with an increase in a country's overall openness to trade (Riker, 2014).
[11] While these general findings have been corroborated by similar studies considering alternative samples and using regional level data (e.g., Lin, 2015, and Barbero and Rodriguez-Crespo, 2018, respectively), different empirical examinations present a more nuanced picture. For instance, internet penetration has been reported to stimulate exports from developing countries to developed countries but neither to other developing countries nor from developed countries (Clark and Wallsten, 2006). Furthermore, bilateral exports seem to be more affected when internet adoption increases in the exporter than in the importer country (Osnago and Tan, 2016). Finally, country pairs with relatively higher adoption rates trade more with one another than country pairs with lower adoption rates but an increase in adoption within country pairs has little effect on trade (Timmis, 2012).

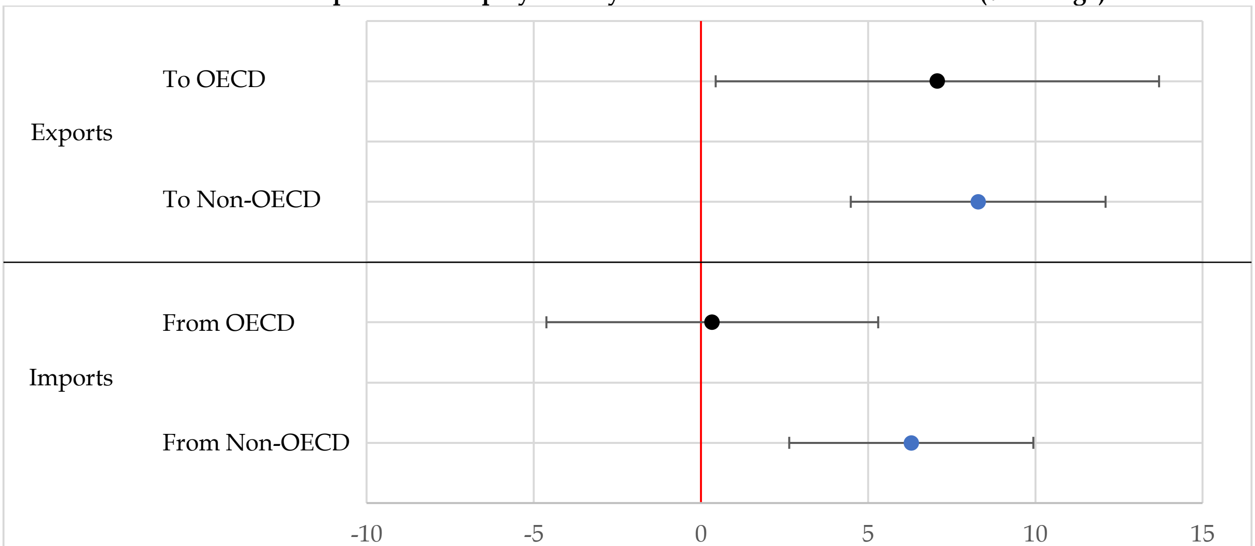
proxied by speed – seems to be more relevant for developing countries, whereas quantity – as proxied by coverage - appears to make the difference for developed countries. These findings are confirmed by several studies using country-specific firm-level data on economic outcomes. Thus, it has been shown that: (i) the number of internet users and websites (domains) in firms' own regions is positively related to their overall and export performance (Fernandes et al., 2019 - China); (ii) the number of internet users in the destinations has a positive correlation with the probability that a firms starts exporting to those markets (Lincoln and McCallum, 2018 – US -); and (iii) the use of broadband internet results in increased firms' size and propensity to export (De Stefano et al., 2018, and Kneller and Timmis, 2016 – UK -).[12]

Given the findings that the internet has boosted international trade, what is the role of internet infrastructure? Using data for more than 200 countries on bilateral trade flows and data on the year that countries were connected to a submarine cable, Figure 9 shows the results of IDB estimations that find that when a developing (i.e., non-OECD) country deploys a cable for the first time, its exports to other developing countries and to developed (i.e., OECD) countries increase by similar magnitudes of 7.1 and 8.3 percent, respectively. Interestingly, imports from developed countries do not significantly change while imports from other developing countries increase by 6.3 percent (Figure 9).[13] Hence, improvements in internet infrastructure seem to stimulate trade between developing countries and their exports to developed countries.

[12] Admittedly, some studies also using micro data find a more mixed picture. For example, broadband expansion has been found to be conducive to employment growth in services establishments but not in their manufacturing counterparts (Stockinger, 2017 – Germany -).

[13] The same study finds that the average effect for the whole sample of more than 200 countries is an increase of 5.4 percent in exports and 4.6 percent in imports.

Figure 9
Internet Infrastructure and International Trade:
Effect of Fiber-Optic Cable Deployment by Non-OECD Countries on Trade (% Change)



Source: IDB estimations based on data from COMTRADE, Telegeography, CEPII, and World Development Indicators.
Note: Bilateral trade flows between more than 200 countries in the period 1990-2017 are regressed on an indicator variable equal to one if either the exporter or the importer is connected to at least one submarine cable and on the logarithm of the number of internet users. All regressions include controls for: country pair fixed effects (to control for time-invariant factors such as distance, contiguity, common language, etc.) and free trade agreements. Regressions that evaluate the effect on exports (imports) include importer (exporter)-year fixed effects and control for the exporter's (importer's) GDP. The sample is split to consider the different OECD and non-OECD origin and destination combinations. For each variable, the dots correspond to the point estimates and the horizontal line corresponds to the confidence intervals at 95%. Standard errors are clustered by country pair.

4 The Digital Transformation's New Trade Modalities: Digital Trade and E-Commerce

4.1 What is E-Commerce (and What Not)

Although there is no universally accepted definition of digital trade, it can be considered to encompass all digitally-enabled transactions of goods and services which can be delivered digitally or physically (López González and Jouanjean, 2017). E-commerce specifically refers to the sale or purchase of goods and services conducted over computer networks by methods designed for the purpose of receiving or placing of orders (e.g., web, extranet or electronic data interchange -EDI-), which, as such, do not include orders made by telephone calls, facsimile, or manually typed e-mail (OECD, 2011).[14] Transactions can take place between individual consumers (C2C), between businesses and consumers (B2C), between businesses (B2B), and between businesses and governments (B2G) are considered cross-border only when involve the delivery of goods and services in a country different from that of the origin. In particular, e-commerce primarily takes place through major online platforms such as Alibaba (B2B), Tmall (B2C), Taobao (C2C),

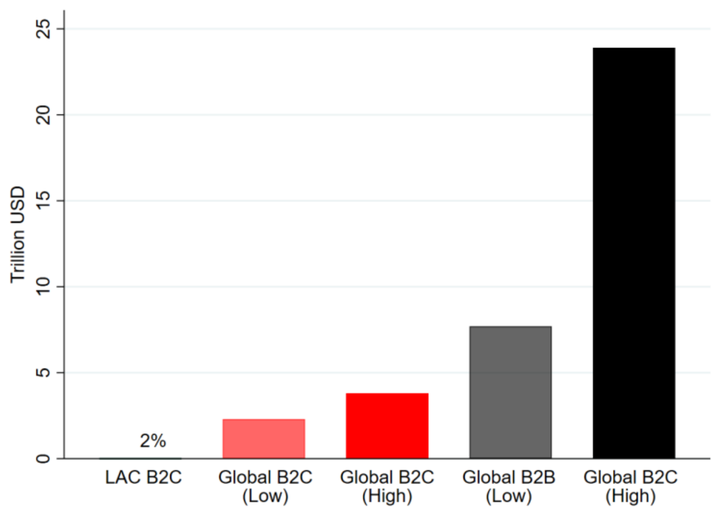
[14] The WTO instead defines e-commerce as "the production, distribution, marketing, sale or delivery of goods and services by electronic means".

all three from the Alibaba Group; Amazon (B2C and C2C), eBay (C2C and B2C), and Mercado Libre (C2C and B2C).

4.2 *How Important is E-Commerce? A Question Still Impossible to Answer Properly*

Despite its increasing importance and enormous potential, measuring e-commerce worldwide remains elusive because there are no comprehensive official statistics on its value (UNCTAD, 2016). Existing global estimates are primarily made using projections of data from the few countries that report it (UNCTAD 2017a) and their accuracy is uncertain given the strong assumptions made when computing them. This mirrors in the large dispersion of the respective figures (Figure 10). With few exceptions circumscribed to developed countries, no consistent data are available at the national level, either.[15] The challenges for measuring cross-border e-commerce are even larger, given that few countries measure it, and even fewer do so at the country of origin/destination level.[16]

Figure 10
E-Commerce by Segment, World, 2016 - 2017



Source: Authors' calculations based on data USITC (2017 – IDC) (high estimate, 2016), UNCTAD, and Statista (2017, low estimate). Global B2C figures are shown in red, whereas global B2B figures are presented in dark gray/black. The lighter tones correspond to the low estimates, while the darker tones correspond to the high estimates.

Keeping these important caveats in mind, available estimates indicate that digital forms of trade have been growing at spectacular rates. According to the upper estimates, global e-commerce sales amounted

[15] Both the US and the EU produce detailed statistics on e-commerce but without distinguishing between within and cross-border sales, at least in the reports which are publicly available – except for the share of firms doing so in the latter case (US Census Bureau, 2018; EU, 2018).
[16] Japan is a notable exception in this regard. Its Ministry of Economy, Trade and Industry (METI) tracks the value of bilateral B2C trade for selected destinations (UNCTAD, 2016).

US$ 27.7 trillion in 2016, which represented a 44 percent increase relative to 2012 (Figure 10). [17] The bulk of this value corresponds to B2B exchanges. Based on these estimates, B2B accounted for almost 90 percent of worldwide e-commerce in recent years.[18] Although most of e-commerce worldwide is conducted within domestic borders, cross-border e-commerce is increasingly important, representing in 2015 6.5 percent of global B2C sales.[19] This expansion is also reflected in the significant increase experienced by the total number of international parcels dispatched, which tripled over the last 10 years thus outpacing the growth in their domestic counterparts.[20]

E-commerce estimates for LAC are even more scarce and variable. According to these estimates, the region accounted for almost 2 percent of global B2C trade in the recent years, a percentage share which is smaller than those of the region in world GDP (7.1 percent) and in world trade (5.6 percent) (Figure 10).[21] Furthermore, it has been estimated that LAC's share in global cross-border e-commerce was around 3.2 percent in 2015.[22]

An accurate measure of cross-border e-commerce is a crucial input for both business and policy decisions in this area. Several international initiatives have been accordingly launched in this regard. Thus, the OECD and WTO chair a Task Force on International Trade Statistics, which has been coordinating efforts to develop standards to measure and report e-commerce (López González and Jouanjean, 2017). Similarly, the WCO has established a working group on e-commerce and, based on the outcomes of its activities, has recently produced and issued a set of global standards associated with guidelines and recommendations to facilitate e-commerce in which urges customs administrations "to capture, measure, analyze, and publish cross-border e-commerce statistics in accordance with international statistics standards and national policy" (WCO, 2018).

Data on international credit card transactions provide a customs-based source of information on the patterns and evolution of e-commerce. The experience of Uruguay is illustrative in this regard. In 2012 the country established a franchise regime for international postal delivery of purchases made abroad using credit and debit cards. According to this regime, individuals can receive up to five deliveries of non-commercial merchandise each of them not exceeding U$S 200 of value and 20 kilograms of weight without paying customs duties or VAT.[23] To ensure that the regime's conditions are met, all these transactions have

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[17] The figures correspond were taken from USITC (2017) based on data from International Data Corporation (IDC). UNCTAD provides similar estimates of US$ 25 trillion in 2015, up 56 percent from US$ 16 trillion in 2013 (UNCTAD 2017a). It is estimated that 1.66 billion people bought online and it is projected that 2.14 billion will do so in 2021 (Statista, 2018).

[18] UNCTAD (2017a) estimated B2B sales of U$S 22.4 trillion and B2C sales of U$S 2.9 trillion in 2015.

[19] Estimates come from UNCTAD (2017a). According to these estimates, these sales involved 380 million consumers.

[20] It should be acknowledged, tough, that international parcel deliveries still account for only a minor fraction of total parcel deliveries. These data come from the Universal Postal Union (UPU).

[21] Estimates come from Statista. Brazil, Mexico, and Argentina were the top 3 nations in this regard, concentrating more than half of the regional e-commerce. In 2016, 127 million Latin Americans bought online, and this number is expected to grow to 156 million in 2019.

[22] This estimate comes from AliResearch and Accenture.

[23] Deliveries cannot contain products subject to the Internal Specific Tax IMESI. These primarily consist of cigarettes, alcoholic beverages, parfums and cosmetics, and oils and lubricants.

been consistently recorded (and overseen) by the Uruguay's National Customs Agency DNA, which generated a unique database on B2C transactions including data on the buyers, the products, the origin countries, the values, and the weights, among others. Table 3 presents the evolution of aggregate and median indicators between 2014 and 2017. The total value and the number of buyers almost doubled between these years, reaching U$S 50 million and 180,000 (i.e., almost 7 percent of the country's adult population), respectively. The median buyer spends more than U$S 100 in three purchases of a single product from one origin country, but there are differences in median values across products and particularly across countries – with the US registering the highest value (Figure 11).[24] Wearing apparel accounts for the largest share of these purchases and the US is the largest source country (see Box 2 on the country-level determinants).

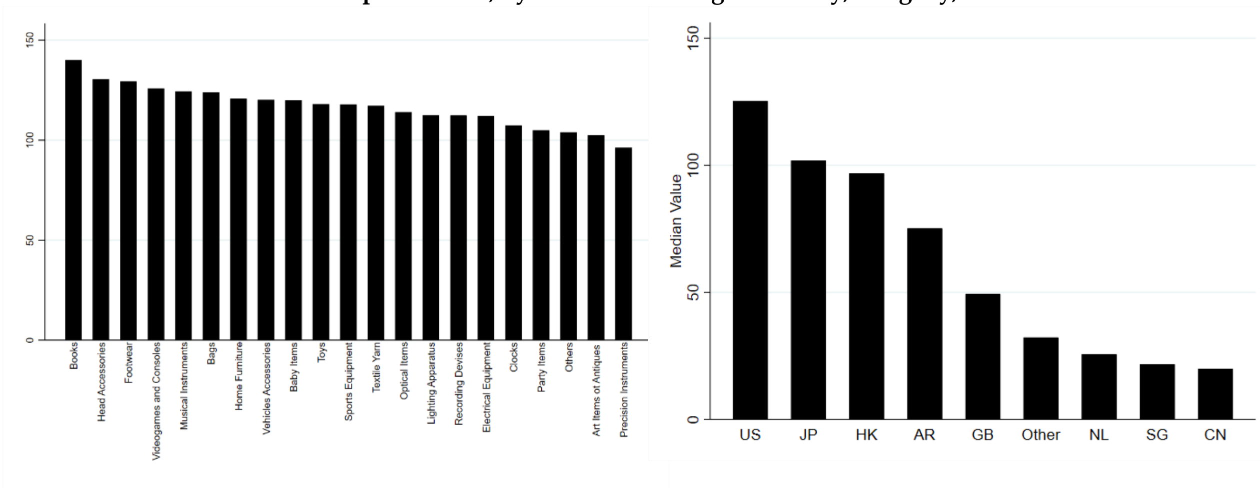
Table 3
Consumers' International Credit Card Purchases:
Aggregate and Median Import Indicators, Uruguay, 2014-2017

Aggregate Indicators						
Year	**Buyers**	**Value**	**Weight**	**Shipments**	**Products**	**Countries**
2014	94.4	26594.6	459.7	255.3	21.0	76.0
2015	98.8	23396.7	438.6	246.4	21.0	70.0
2016	126.3	30301.6	630.2	290.2	21.0	67.0
2017	176.7	49682.5	1028.0	424.2	21.0	63.0
Median Indicators						
Year		**Value**	**Weight**	**Shipments**	**Products**	**Countries**
2014		209.8	3.5	2.0	2.0	1.0
2015		147.0	2.5	2.0	2.0	1.0
2016		107.7	1.8	2.0	1.0	1.0
2017		138.3	2.2	2.0	1.0	1.0

Source: Authors' calculations based on data from DNA.
In the upper panel, the number of buyers, value, weight, and the number of shipments are expressed in thousands.

[24] Product are classified in 21 broad categories, which can be mapped into both SITC and ISIC.

Figure 11
Consumers' International Credit Card Purchases:
Median Import Values, by Product and Origin Country, Uruguay, 2017



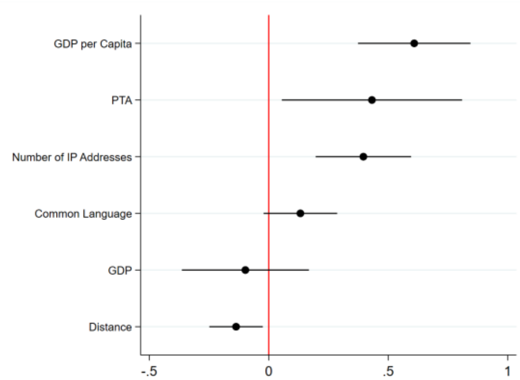
Source: Authors' calculations based on data from DNA.

Box 2

Consumers' International Online Credit Card Purchases:
What Are Their Determinants?

An IDB study explores the country-level determinants of individuals' purchases abroad estimating a gravity equation on data at the individual-origin country level for 2017 (Volpe Martincus and Salas Santa, 2019a). The estimates suggest that individuals buy more from countries which are more developed, closer, connected with Uruguay through a preferential trade agreement, and importantly, have a larger number of web sites (IP addresses) (Figure 12).

Figure 12
Country-Level Determinants of Individual Online Purchases Abroad



Source: Authors' calculations based on data Volpe Martincus and Salas Santa (2019a).
The figure reports OLS estimates of a gravity-type equation estimated on data at the individual-origin country level for 2017 whose dependent variable is the natural logarithm of the import value and whose explanatory variables include the natural logarithm of the origin country's GDP, the natural logarithm of the origin country's GDP per capita, the natural logarithm of the distance between Uruguay and the origin country, a binary indicator that takes the value of one if Uruguay and the origin country share a common language and zero otherwise, a binary indicator that takes the value of one if Uruguay and the origin country have a trade agreement and zero otherwise, and the natural logarithm of the number of websites (IP addresses) in the origin country. Individual fixed effects are included but not reported. Standard errors are clustered by origin country for inference purposes. For each variable, the dot corresponds to the point estimate and the horizontal line corresponds to the confidence interval at 95%. The results are the same when the equation is estimated on data at the individual-product-origin country level and including individual and product fixed effects.

Finally, at the national level, a simple and relatively low-cost way of improving the measurement of e-commerce is to include e-commerce modules in existing enterprise and household surveys (UNCTAD 2016).[25] Several countries in the region already collect data in this way. Table 4 shows examples of e-commerce questions included in surveys in the region and in other countries as way of a benchmark.[26] Existing businesses and households surveys include yes-no questions on access to the internet and buying or selling online but there are no questions on the value of transactions, if they are domestic or cross-border, and in the case of firms on the nature of e-commerce (i.e., whether it is B2C or B2B).[27]

Adding a few more questions to existing questionnaires could significantly enhance the measurement and understanding of e-commerce in the region. For example, in the case of businesses the following questions could be included: (i) what is the value of online sales and purchases? (ii) what is the share of those transactions that is cross-border? (iii) what is the value by destination and origin market? (iv) what is the proportion of online sales that is B2B, B2C, and B2G? (v) Does the company sell through a marketplace, through its own website or both? (vi) what are the main perceived obstacles to e-commerce participation?

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[25] OECD has been collecting statistics on e-commerce both within and across borders through households and individuals and enterprise surveys (López González and Jouanjean, 2017).

[26] Comparisons across countries should be taken with caution given the lack of a harmonized methodology, different survey years, and firms of different size being sampled.

[27] An exception is Mexico. The 2017 Household Survey on Availability and Use of ICTs (in Spanish, *Encuesta Nacional sobre disponibilidad y uso de las TIC en los Hogares*, ENDUTIH) asks households if they buy or sell online, the frequency with which they do it, what they buy, if they buy from national or foreign websites, if they had any problems while buying and which ones were they, and the reasons for not engaging in e-commerce.

Table 4
E-Commerce Indicators from Selected Business and Households Surveys
Latin America Countries, European Union, and Canada

Country	Year	Access to Internet (%)	Sell online (%)	Purchase online (%)	Institution	Survey
Businesses Surveys						
Brazil	2017	98	22	65	CETIC	*Pesquisa sobre o uso das tecnologias de informação e comunicação nas empresas brasileiras - TIC Empresas*
Chile	2015	86	13	31	INE	*Encuesta Longitudinal de Empresas*
Colombia	2017	68	15	14	MINTIC	*Primera Gran Encuesta TIC*
Ecuador	2015	97	17	17	INEC	*Encuestas de Manufactura y Minería, Comercio Interno y Servicios*
Mexico	2013	85	7	14	INEGI	*Encuesta sobre Tecnologías de la información y comunicaciones*
Paraguay	2017	76	8	36	SENATIC	*Grandes Empresas - Empresas Consumidoras de Tecnologías de la Información y Comunicación (TICs)*
		48	16	48	SENATIC	*Pymes - Empresas Consumidoras de Tecnologías de la Información y Comunicación (TICs)*
Peru	2015	62	7	17	INEI	*Encuesta Nacional de Empresas*
Uruguay	2013	49	21	19	INE	*Encuesta de Usos de Tecnología de la Información y la Comunicación en Micro y Pequeñas Empresas*
EU	2016	93	20	NA	EUROSTAT	Digital Economy and Society Statistics - Enterprises
Canada	2013	89	13	76	Statistics Canada	Survey of Digital Technology and Internet Use
Households Surveys						
Dominican Republic	2015	26	NA	16	ONE	*Encuesta Nacional de Hogares de Propósitos Múltiples*
Brazil	2017	74	NA	26	CETIC	*Pesquisa sobre o uso das tecnologias de informação e comunicação nas empresas brasileiras*
Colombia	2017	64	NA	21	MINTIC	*Primera Gran Encuesta TIC*
Mexico	2017	60	5	11	INEGI	*Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares 2017. ENDUTIH*
Paraguay	2017	87	7	14	SENATIC	*Encuesta uso y acceso internet*
Uruguay	2017	70	NA	10	INE	*Encuesta Continua de Hogares*
EU	2017	85	NA	57	EUROSTAT	E-commerce statistics for individuals
Canada	2018	91	NA	84	Statistics Canada	Internet Use Survey

Source: IDB based on official sources.

4.3 *Why E-Commerce and Underpinning Platforms Can Make a Difference*

Online platforms through which e-commerce is conducted can help reduce search costs over space for both consumers and firms.[28] Thus, these platforms can decrease the costs that consumer incur when searching for goods that match their preferences and for lower prices and generally widen the range of goods and varieties to which they have access.[29] Similarly, they can lower firms' costs arising when looking

[28] E-commerce can also have indirect reinforcing effects on international trade. More precisely, it can enable firms to increase their internal efficiency by lowering costs in general and inventory costs in particular, speeding up business processes, and increasing labor productivity (e.g., Falk and Hagsten, 2015).
[29] Dolfen et al. (2018) estimate, using U.S. data, that e-commerce gains for consumers are equivalent to a 1 percent permanent increase in consumption, which amounts to around one thousand dollars per household. Those gains originate from savings in travel costs and from being able to buy from sellers online that do not have a brick-and-mortar store and thereby accessing to greater variety of goods.

for intermediate goods that best correspond to their production needs and for better prices and the costs to reach and match with more customers and to penetrate new markets in general and foreign markets in particular.[30]

Given that search costs tend to grow larger as distance between trading partners increases and accordingly familiarity decreases (e.g. Grossman, 1998; Huang, 2007), it can be then expected that transactions carried out online through these platforms are less sensitive to the deterring effect of distance than their regular offline counterparts.[31] This is precisely what has been found for online C2C and B2C platforms using data from eBay and *Mercado Libre* (i.e., Hortaçsu et al., 2009; Lendle et al., 2016; Lendle and Vézina, 2015).[32]

More specifically, in conventional offline trade, exporters intending to enter a new market or expand foreign sales within an already served market are preceded by their reputation, which, in absence of an identifiable brand name, largely depends on the perception of country of origin (Chisik, 2003). This is especially relevant for firms from developing countries, whose products are more likely to be perceived as technologically less advanced and of poorer quality than those of peers from developed countries (e.g., Chiang and Masson, 1988; and Hudson and Jones, 2003). By allowing buyers to share information on exporters' quality and accordingly observe their reputation, online platforms can help address this particular information problem. Existing evidence based on data from Alibaba.com consistently suggests that better reputation based on ratings and substances of comments translates into larger export revenues, larger export volumes, and a larger number of destinations and buyers (Chen and Wu, 2017).[33]

In assessing these impacts and their mechanisms, it is important to take into account that standard online platforms generally have built-in payment and logistics solutions (and some even have own dedicated means such as *Alipay*). These solutions can have their own trade-creating effects. If not properly isolated, these effects can be compounded with those associated with the reduction of information frictions.[34] IDB's *ConnectAmericas.com* is a purely informational B2B online platform which neither allows for direct transactions among firms nor incorporates the respective logistic solution and, as such, provides an ideal setting to identify the trade effects of these platforms strictly derived from lowering information barriers. As highlighted in Box 3, these effects are positive and significant and can even translate into improved overall firms' performance.

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[30] For new businesses, e-commerce reduces the entry cost to the market, since it renders irrelevant the setting up of a brick-and-mortar store.

[31] Blum and Goldfarb (2006) provide evidence that distance matters in the case of digital taste-dependent products (e.g., music and games) consumed over the Internet that have no trading costs but not for non-taste-dependent products (e.g., software).

[32] Couture et al. (2018) explore the economic effects of a Chinese government program to expand e-commerce to the country's rural areas. Findings from the examination of this program indicate that e-commerce led to sizable but heterogeneous gains in households' and villages' real incomes and that these gains primarily come from overcoming the logistic barriers.

[33] Cabral and Hortacsu (2010) study the implications of seller reputation using data from eBay.

[34] Hui (2016) shows that the trade-increasing effect of eBay online platform is strengthened when intermediation services -customs clearance and international shipping handling- are integrated.

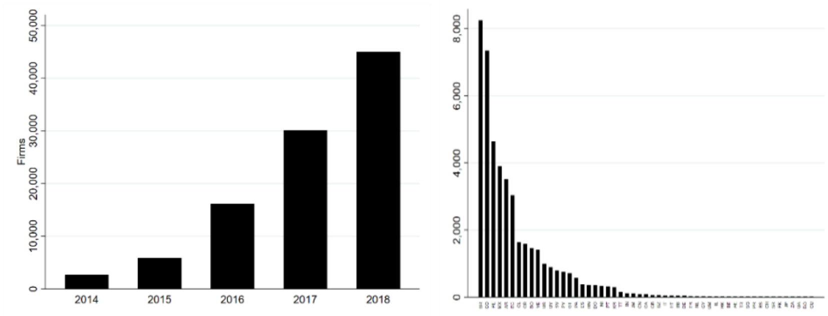
Box 3

ConnectAmericas.com

Digital Reduction of Information Barriers to Boost Firms' Internationalization

The IDB has developed an online B2B platform in partnership with Google, DHL, SeaLand (Maersk), MasterCard, and Facebook. The platform, called *ConnectAmericas.com*, was launched in 2014 and as of 2018 had more than 45,000 registered firms from more than 100 countries (Figure 13).

Figure 13: Number of Firms in *ConnectAmericas.com*, over Time and Across Countries



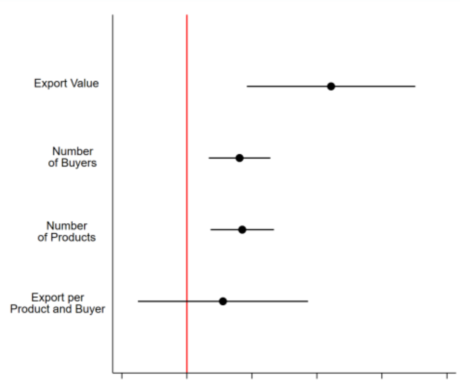
Source: Authors' calculations based on data from *ConnectAmericas.com.*

ConnectAmericas.com has two main functions:

- *The learn function, which provides firms with general trade information through a number of capacity building services.* These services include online courses and webinars; access to trade datasets, business self-evaluation tools, video testimonials, and articles; and information about support available to firms in their countries.
- *The connect function, which provides firms with specific commercial information through a variety of means.* It primarily allows firms to participate in business communities - post about goods or services they want to buy or sell -; be notified about business opportunities and apply to them; and search for a company's profile.

An IDB study evaluates the impact of the platform on Peruvian firms' exports using detailed records on firms' activities in *ConnectAmericas.com* along with transaction level export data from the Peruvian customs (Carballo et el., 2019). The results suggest that the use of *ConnectAmericas.com* has actually resulted in increased firms' exports (Figure 14). This export increase (i) can be traced back to expansions along both the product and buyer extensive margins, which are exporting activities facing more severe information problems than their respective intensive margin counterparts; and (ii) is more pronounced for firms with less market-specific export experience, in less familiar countries, and in destinations with larger numbers of firms registered with the platform.

Figure 14: The Effect of Using ConnectAmericas.com on Firms' Exports, Peru, 2013-2016



Source: Authors' calculations based on Carballo et al. (2019).

Note: The figure shows the estimated effect of the number of days using ConnectAmericas.com on the export value, number of buyers, number of products, and average export per product and buyer at the firm-destination level. Control variables include firms' age and export promotion assistance status, along with firm-destination fixed effects and destination-year fixed effects (not reported). Standard errors clustered by firm are used for inference purposes. For each variable, the dot corresponds to the point estimate and the horizontal line corresponds to the confidence interval at 95%.

Empirical evidence from a follow-up study using additionally firm-level data on imports and employment for the same country further suggests that use of *ConnectAmericas.com* has also helped Peruvian firms increase their foreign purchases – particularly of intermediate goods – and grow in terms of their number of employees (Volpe Martincus and Salas Santa, 2019b).

4.4 *Harnessing the Benefits of E-Commerce: Old and New Policy Challenges*

As seen above, available evidence indicates that LAC accounts for a relatively small share of world's digital trade. This can be considered the outcome of several concurring factors whose specific combination and relative importance vary across countries. In addition to - on average - limited and poor connectivity and more broadly inadequate ICT infrastructure and literacy, these include unreliable and costly power supply, underdeveloped financial systems in general and limited use of credit and debit cards in particular, underperforming postal services, weak legal and regulatory frameworks that restrict the extent to which people trust and do online transactions, and, importantly, explicit barriers to digital trade (UNCTAD, 2018) (see Box 4). Some examples of the latter are: (i) *restrictive data policies* such as restrictions on cross-border data flows (or data localization policies), data privacy, and data retention, and *restrictions on access to online content* such as filtering, blocking, censoring, and departures from net neutrality;[36] (ii*) restrictions on trading* such as restrictions on online sales and payment methods, and burdensome practices on electronic signatures; (iii) *establishment and technological barriers* such as requirements to surrender source codes; (iv) *traditional fiscal and market access barriers* such as tariffs and non-tariff measures and discriminatory tax regimes on ICT products and digital goods (but also on traditional goods traded online), and custom duties on electronic transmissions (Ciuriak and Ptashkina, 2017, and ECIPE, 2018).

Box 4

The Digital Trade Restrictiveness Index

A full a taxonomy of countries' barriers to digital trade does not exist. The most comprehensive analysis available to date is given by the Digital Trade Restrictiveness Index (DTRI). The DTRI is constructed by the European Centre for International Political Economy (ECIPE) and was released in 2018. The index, which takes values from 0 to 1 and is based on more than 100 categories of policy measures intends to capture by how much 64 countries in the world restrict digital trade. The index is composed of four policy clusters:

(A) *Fiscal Restrictions and Market Access:* tariffs and trade defense, taxation and subsidies, and public procurement.

(B) *Establishment Restrictions:* Foreign investment restrictions, intellectual property rights measures, competition policy and business mobility.

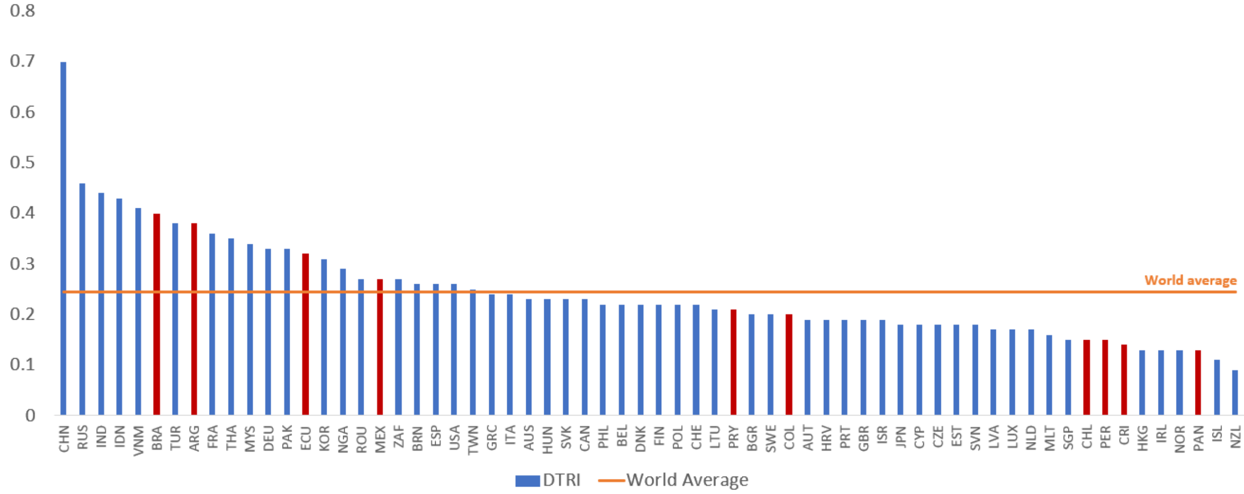
(C) *Restrictions on Data*: Data policies, intermediate liability and content access.

(D) *Trading Restrictions*: Quantitative trade restrictions, standards and online sales and transactions.

The DTRI covers 10 Latin American countries: Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, Paraguay, and Peru.

[36] A central policy issue in the digital economy is how to regulate the collection, storage, and transfer of data. Data has been transmitted electronically for decades as a part of the normal conduct of business, and the cross-border flow of data is already considered in international agreements such as the GATS (1995). However, in the digital economy data acquires value as an asset, in particular when it is used in developing AI algorithms, which are used for multiple purposes including targeted marketing. Data has given rise to a sort of "barter exchange" (Ciuriak and Ptashkina, 2017) where firms allow the "free" use of their platforms in exchange for consumers' data. This type of exchange is hard to track and quantify since it leaves no trace and has no clear market value even though data is part of the intangible capital of digital giants like Amazon, Facebook, and Google (Ciuriak 2017).

Figure 15
Digital Trade Restrictiveness Index, 2018



Clusters of the Digital Trade Restrictiveness Index, 2018

Source: Authors' calculations based on ECIPE (2018).

Emerging economies with large populations generally have more restrictive policies regarding digital trade. The region offers a heterogeneous picture. Four countries (Brazil, Argentina, Ecuador, and Mexico) are above the world average in terms of restrictions to digital trade, two countries are below but close to the world average (Paraguay and Colombia) and the other four countries the dataset (Chile, Peru, Costa Rica, and Panama) are markedly below the world average (Figure 15, upper panel). In particular, it seems

that the most pressing restrictions in the region are related to and market access policies and for some countries refer to trading policies. Brazil and Argentina have high fiscal and market access restrictions, Ecuador has high establishment restrictions, and these three countries have high trading restrictions (Figure 15, lower panel) (see Box 5 on the regulations at the multilateral and regional levels).

Box 5

E-Commerce Regulation: The Multilateral and Regional Levels

While at the multilateral level the rules established by the WTO are technologically neutral – i.e., they apply to all trade regardless of how it is conducted - as early as 1998, WTO members recognized that e-commerce brought new issues to the table and established the Work Program on Electronic Commerce, in which they agreed on maintaining a moratorium on duties to electronic transmissions that has been renewed periodically ever since, the last one at the Ministerial Conference in Buenos Aires in December 2017. Despite the early advancements brought by the 1998 Program, the ensuing progress at the multilateral level has been slow.

With multilateral negotiations on digital trade stalled, most of the action has been taking place in RTAs. Since 2001, 69 agreements, involving at least half of the 164 WTO members, have been signed that include a standalone e-commerce chapter and 21 include provisions related to digital trade (Wu, 2017). These agreements have a wide array of provisions affecting digital trade on issues such as market access on digital products, electronic authentication, consumer protection, cross-border data flows, data localization, and treatment of source code.

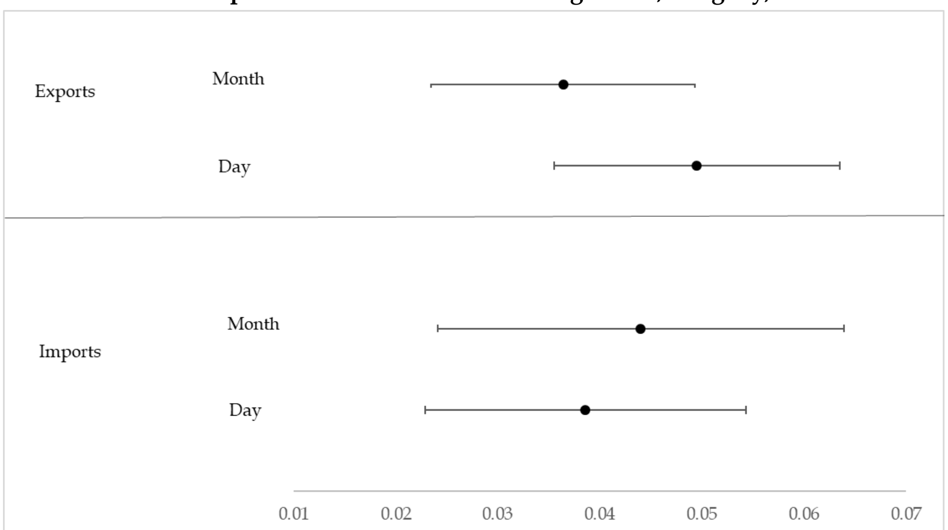
Latin America and the Caribbean has been quite active in this arena, having signed several RTAs – of varying depth – including the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), which is considered state of the art in terms of provisions involving cross-border data flows. The CPTPP allows the transfer across borders by electronic means of information, including personal information, for the conduct of business. Although it still leaves some room for governments to regulate these flows, it states that regulation cannot be used as a disguised trade barrier. Close in spirit to the CPTPP, the recent United States-Mexico-Canada Agreement (USMCA), includes a digital trade chapter – which NAFTA did not have – that restricts data localization policies. The Mexico-Panama RTA also includes commitments regarding cross-border data flows, although it specifies that it should be done in accordance with personal data protection. Other RTAs in the region have non-binding commitments regarding data flows. This is for instance the case with several agreements involving Colombia (such as Colombia-Canada, Chile-Colombia, Costa Rica-Colombia, and Colombia-Northern Triangle) and involving APEC countries (US-Chile, Panama-Singapore, Peru-Canada, and Peru-Korea).

An IDB study looks for those e-commerce provisions contained in Chapter 14 of the TPP in agreements signed by the region countries after 1995 that are classified as free trade areas and notified to the WTO (Giordano et al., 2017). Nearly 70% of these PTAs include at least one e-commerce provision and 52% have a standalone e-commerce chapter. In addition, 85% of the PTAs involving extra-regional partners (China, EU, US) include either a chapter or provisions on e-commerce, while 56% of the intraregional ones do. The region's PTAs contain 3.4 provisions on e-commerce on average per agreement, less than a third of the e-commerce provisions included in the TPP, and most commitments (89% of the total number of provisions) were assumed during the last decade (2006–2017).

Importantly, these barriers matter and to a significant extent. Thus, available empirical evidence indicates that stricter data policies negatively affect total factor productivity of downstream firms in sectors that rely on electronic data as well as imports of data-intensive sectors over the internet, particularly in countries with more developed digital markets (Ferracane et al., 2018; and Ferracane and van der Marel, 2018). On the other hand, some of these policies may pursue worthy objectives at the domestic level, linked to cybersecurity or consumer privacy, whose benefits are hard to quantify. The digital era, therefore, confronts policymakers with the need to balance the free flow of information with security considerations and protection of consumer privacy.

Furthermore, the own expansion of digital trade is creating policy challenges. As discussed above, the growth in cross-border e-commerce has implied an exponential increase in the number of international lower-value parcels that must clear customs. This creates pressure on customs limited resources and their ability to conduct proper risk management on these flows. More specifically, these continuously growing volumes of transactions can result in customs delays. There is suggestive evidence that this may be indeed the case. In particular, larger number of shipments seem to have been associated with longer customs processing times in Uruguay over the period 2003-2016 (Volpe Martincus and Salas Santa, 2019c) (Figure 16).

Figure 16
Number of Shipments and Customs Processing Times, Uruguay, 2003-2016

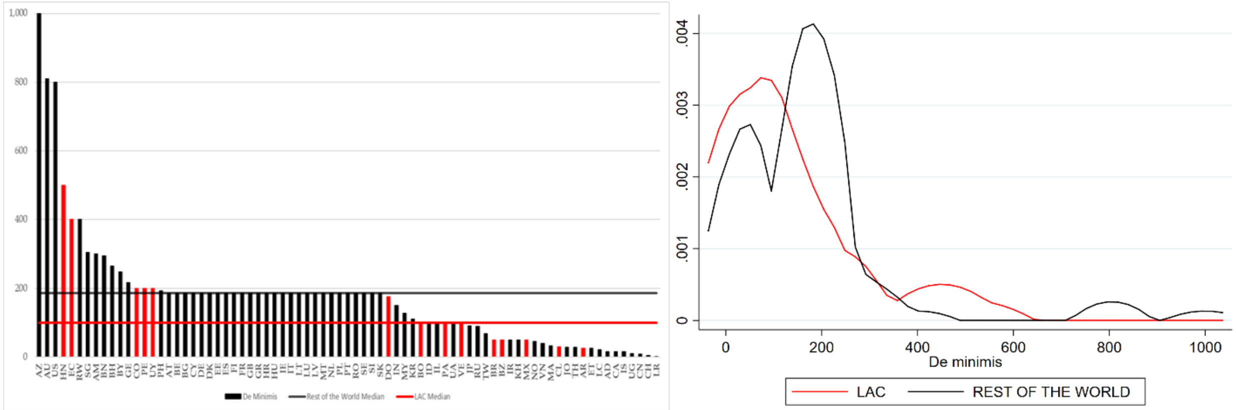


Source: Authors' calculations based on data from Uruguay's DNA.
The figure reports OLS estimates of the elasticity of the customs processing times to the volume of shipments based on an equation whose dependent variable is the natural logarithm of the mean customs processing times across shipments at the customs-product-country-period (month/day) level and whose main explanatory variables are the natural logarithm of the total number of shipments and the mean assignment to physical inspection at the same levels along with customs-product-country and customs-period and product-country-period fixed effects. Standard errors clustered by customs-product-country are used for inference purposes. For each variable, the dot corresponds to the point estimate and the horizontal line corresponds to the confidence interval at 95%.

To deal with this situation, several measures are called for including standardization of procedures and forms, electronic interconnection between customs and postal (and logistic) operators and between the latter among themselves to allow for advanced cargo information, and automation of risk management for the shipments in questions (e.g., as being implemented in Europe).

Also related to this issue is the setting of the *de minimis* value, which is the threshold value of the merchandise below which it does not pay imports duties or taxes. Countries have different *de minimis* rules and some countries even have a zero threshold, so that all imports pay duties, regardless of their value. With some exceptions such as Honduras and Ecuador, Latin American and Caribbean countries tend to have relatively low *de minimis* values (Figure 17).

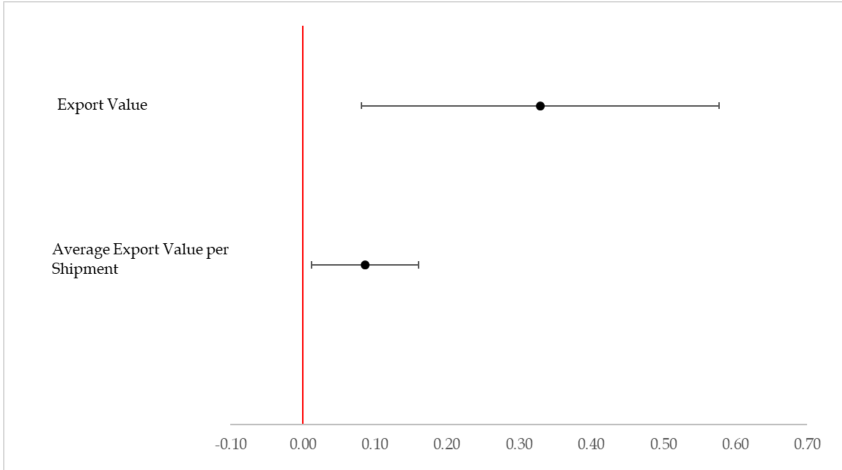
Figure 17
Distribution of *De Minimis* Values across Countries, LAC vs. Rest of the World, 2017



Source: Authors' calculations based on data from the Global Express Association (GEA).
The figure on the right panel is a kernel density estimate of the distribution of *de minimis* values for both LAC and other countries. According to the Kolmogorov-Smirnov test-based procedure proposed by Delgado et al. (2002), the distribution of *de minimis* values across countries for the rest of the world stochastically dominates that of their LAC counterpart.

A low *de minimis* value forces customs to process larger and growing number of shipments, which, as seen above, can unnecessarily make clearance times longer and thereby negatively affect trade (Volpe Martincus et al., 2015). Firm-level evidence from Colombia consistently indicates that average destination-specific exports would increase around 30% in response to a doubling in *de minimis* values across countries and this increase would partially come from larger shipment sizes, particularly at the lower end of the respective distribution (Figure 18). Admittedly, on the other hand, a high *de minimis* value can imply a loss in tariff revenue and lead to unlawful practices such as smuggling. Hence, cross-border e-commerce poses a new policy dilemma between ensuring speed and efficiency in the clearance process for an increasing number of small shipments versus identifying abuse or misuse of *de minimis* for illicit trade purposes.

Figure 18
The Effect of De Minimis Values on Firm-Destination Exports, Colombia, 2017



Source: Authors' calculations based on data from Colombian tax and customs agency DIAN and the Global Express Association (GEA).
The figure reports OLS estimates of the elasticity of firms' exports to given destinations to the respective de minimis value. These estimates are obtained based on a gravity-type equation at the firm-destination level for 2017 whose dependent variable is either the natural logarithm of the export value or the average export value per shipment and whose main explanatory variable is the natural logarithm of the destination de minimis value. Control variables, whose estimated coefficients are not reported, include the natural logarithm of the destination's GDP, GDP per capita, and distance to Colombia, a binary indicator that takes the value of one if Colombia and the destination share a common language and zero otherwise, and a binary indicator that takes the value of one if Colombia and the destination have a trade agreement and zero otherwise. Firm fixed effects are included. Standard errors are clustered by destination for inference purposes. For each variable the dot corresponds to the point estimate whereas and the horizontal line corresponds to confidence interval at 95%.

To sum up, digital technologies are associated with the emergence of new trade frictions which add to the traditional ones and call for a comprehensive policy approach which address both conventional and new barriers and their interactions.

5 Using New Technologies to Facilitate and Promote Trade

Although some countries impose restrictions to digital trade, most governments are also actively trying to promote it. Moreover, they are also incorporating digital technologies in trade policy-related administrative procedures to facilitate their completion. These efforts are illustrated next through three specific examples, both from the region and beyond.

5.1 Facilitating Trade through Technology: Artificial Intelligence and Risk Management and Blockchain and Authorized Economic Operators Programs[37]

[37] The case study on artificial intelligence and risk management is based on Giordani (2018).

E-commerce is associated with a reduction in intermediation (i.e., disintermediation) and specifically with deconsolidation of shipments, which now are delivered more directly to the end-user. As seen above, this leads to a substantial increase in the number of small parcels that need to be processed and inspected by customs. Further, these parcels are often exempted from tax and duties, which makes valuation a crucial issue in avoiding fiscal frauds. In this regard, pricing databases typically available to customs to detect such frauds are virtually useless for cross-border e-commerce due to its vast product diversity, large number of online sellers, and fast-changing prices.

In response to this situation, EU is working in implementing new digital technologies to improve their customs risk management systems, in general, and increase their effectiveness, in particular, i.e., reduce their errors, both the false positives – inspections executed but resulting in legal shipments – and false negatives – missed inspections to illegal shipments. In this context, five European countries (Belgium, Estonia, Netherlands, Norway, and Sweden) launched a project, PROFILE, which aims to improve data source and analytics for risk assessment.

The Dutch customs – in collaboration with IBM - is specifically leading a component that seeks to deploy artificial intelligence to automatically cross-check e- commerce-related customs declarations against online information.[38] The first step of this project, which is currently in preparation, consists of developing a web-crawling system that will gather the description of the goods from declarations, search the product on the web, find its selling price on the e-commerce platforms, compare it with the value declared in the declaration, and return a risk indicator of green/red flag to the targeting customs officer.[39]

New technologies are also being used to support trade facilitation efforts in the region. Thus, Costa Rica, Mexico, and Peru have Authorized Economic Operators (AEO) programs that jointly have certified as trusted operators almost 670 export and importing firms accounting for non-trivial shares of these countries' total trade – more than 50% in the case of Mexico – and accordingly granted these firms several advantages in the customs processing of their shipments (Volpe Martincus, 2016). These countries have been actively pursuing mutual recognition agreements (MRAs) of their AEO programs. In this context, they recently launched a project backed by the IDB and Microsoft called CADENA, which uses blockchain to make these MRAs more secure and efficient. Implementation of such agreements imply data sharing on recent AEO certifications among the various parties, something that can be very complex if done as it typically is, by email among the different customs. By using blockchain, these various customs will have access to the same information logged only once, securely and in one place. This also ensures that traders will enjoy the advantages associated with the MRAs from the moment they receive their AEO certification.

[38] This initiative will be introduced as a pilot focusing on shipments coming from China.

[39] In so doing, real e-commerce purchases were made to observe how the senders describe the item and how the Dutch Customs assesses the risk and decides on the duties to be paid. This led to reflect on the possible frauds scenarios and how to address them.

CADENA has been introduced as a pilot to first and foremost enable the various stakeholders learn about blockchain's operation and assess possible further uses, e.g., it could be expanded to automate the entire AEO certification process and improve risk management in customs.[40] In this regard and in addition to the general debate on the potential limits of this technology, it should be acknowledged that there are still questions around whether customs have the capabilities to operate blockchain-based systems, how to best make blockchain-based systems interact with the single windows, and whether small businesses are ready to use blockchain altogether.

5.2 *Promoting Exports through Technology: E-Commerce Programs*

Several export promotion agencies including those in LAC have responded to SMEs' struggles to export online by mounting a variety of programs aimed to help SMEs use e-commerce to export. Thus, a recent USAID mapping of countries' policies to boost e-commerce has found that in 25 out of the 40 surveyed economies the national export promotion agency has been offering some training programs for firms to learn to use e-commerce to reach foreign buyers and even provide marketplaces (Suominen, 2018).

This is for instance the case with Business Finland's "Ecom Growth" program. This program has three main goals: (i) develop e-commerce know-how; (ii) increase the number of firms selling cross-border and boost sales and exports of participating firms – thus strengthening internationalization – taking advantage of digital technologies to reach customers cost-effectively around the world; and (iii) expand the number of jobs in the sector. The initiative is primarily targeted to SMEs trading online. These firms can be manufacturers of goods, so-called smart retail companies (producing innovative technologies or services for online and/or retail companies), or online stores that are already selling consumer goods cross-border. Firms have to apply to the program and are selected according to a set of criteria based on the information gathered during the registration process. Once selected, they must pay a fee according to its size that covers the three-year program period and must commit to actively use the services provided in that period. These services include activities aiming at: (i) growing international ecommerce know-how (e.g., clubs to share experiences and information among online retailers, thematic coaching, and assistance to develop a path for internationalization and the company's value proposition, and define e-commerce strategies and management); (ii) identifying market opportunities and preparing for market entry (e.g., market research, localization requirements for different markets, market-specific coaching - boot camps in Finland -, and support to produce appropriate marketing communications for the target market); (iii) succeeding in target markets (e.g., identifying and meeting potential customers and partners in negotiations, seminars and

[40] In particular, the pilot is helping the stakeholders to learn about the challenges surrounding blockchain's use, such as those related to the interoperability of blockchain platforms, alignment of incentives among all parties in a supply chain to adopt this technology, and governance of the data in this environment.

conferences abroad, joint participations in trade fairs, boot camps in the target markets, and meetings with potential buyers -marketplaces, e-tailers, resellers, importers- and service providers - including logistics, storage, marketing-); and (iv) developing the e-commerce ecosystem (e.g., cross-innovations such innovation cooperation with different parties, including mobile development, payment solutions, gamification, media, databiz know-how, international-level Finnish eCom event, improving the prerequisites for e-commerce, highlighting the retail barriers, eCommerce Day, articulation with other Team Finland growth programs). About 100 firms are currently participating in this digital trade initiative – i.e., at its full capacity- which, at this stage, has the US, UK, Germany, Russia, and Sweden as target markets.

In the region, PROCHILE has two complementary programs to promote Chilean firms' engagement in e-commerce: "Exporta digital" and "Chile B2B" launched in 2018.[41] "Export Digital" (or "theory component") provides firms with training on e-commerce through online tutorials on how to do e-commerce, how to put in place a virtual store, what are the most convenient platforms, how to attract customers to the virtual store, how to set logistic arrangements, what payment methods are used in the relevant markets, along with practical recommendations based on successful experiences from peers. From April 2018 to October 2018, the portal received more than 6,500 visits from more than 2,500 unique users. This online training is complemented with capacity building activities in person that are tailored to firms' specific needs according to their size and export experience. "Chile B2B" is, in turn, a digital marketplace (in preparation) that seeks to promote exports of goods and services from Chile. Targeted firms are primarily firms that already used PROCHILE services in the past ("PROCHILE customers") and have exported at least U$S 40,000 of goods or at least U$S 10,000 of services over the past three years (i.e., known firms with export experience). In the first round 1,600 exporting firms meeting these criteria were invited through an email and through campaigns carried by PROCHILE's regional offices throughout the country. Up to date, around 520 firms registered, mainly from the Metropolitan region, Valparaiso and O'Higgins and from the food and beverage and agricultural sectors. Starting in 2019, foreign buyers also meeting specific criteria (e.g., firms that already imported from Chile, members of binational chambers of commerce, etc.) and recruited by PROCHILE's overseas offices will be invited to join the platform. Thus, on both sides, supply and demand, firms will be verified and certified by PROCHILE. This is expected to ensure a perception of security and trust in the arrangement and reduce the perceived entry costs. The

[41] PROMPERU-sponsored "PYME Peruanas al Mundo" (Peruvian SMEs onto the World) is a full-scale training and information portal for Peruvian SMEs that want to export or import using ecommerce. The online courses are extensive, covering such topics as use of platforms, marketing, and other areas. PYME Peruanas al Mundo also has seminars in various Peruvian cities. PROMPERU has also established strategic partnerships with DHL and various digital and content service providers to help SMEs engage in trade. In Costa Rica, the national export promotion agency PROCOMER has an alliance with Alibaba, i-Gourmet, and Amazon that offer Costa Rican SMEs discounts for using their services.

platform will be disseminated through social media campaigns and in relevant international marketing events, among other channels.

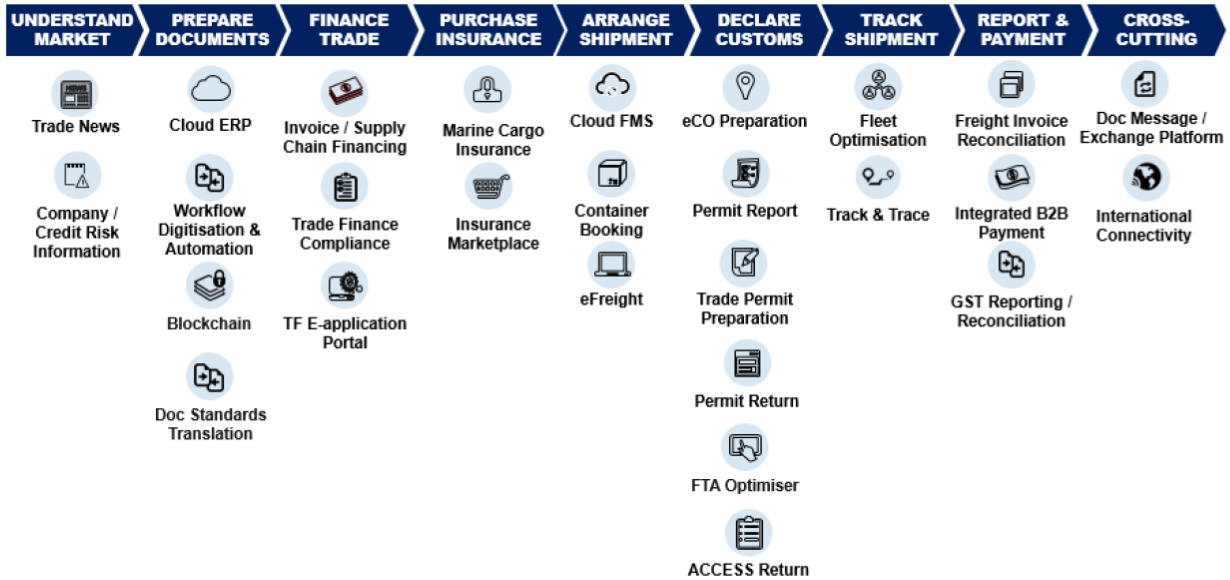
5.3 *Facilitating and Promoting Trade at Once through Technology: An Innovation Journey Toward a Networked Trade Platform*

Singapore has always been one of the countries leading the way in terms of trade facilitation initiatives. In 1989 the country pioneered the introduction of an electronic national trade single window, *TradeNet*, that provided exporting, importing, and logistic firms with a single digital B2G platform to submit a single digitized declaration to fulfill all trade-related regulatory requirements from all relevant border agencies. In recent years, nine million declarations worth U$S 900 billion of trade were channeled annually through this platform. Noteworthy, 99 percent of the associated permits were processed within 10 minutes and 100 percent of the implied taxes and duties were collected electronically (Leong, 2018).

In 2007 and as a result of multiagency initiative involving the Singapore Customs and the Economic Development Board among others, the national single window was expanded to support B2B services through *TradeXchange*, a national platform integrating government, firms, and logistic providers' trade and logistic IT systems for sea, air, and land and made available the interface specifications to allow other parties to join it (e.g., banking and financing companies). This platform allowed relevant players to pass on documents and information on industry-accepted standardized formats covering areas such as trade permit preparation and application for trade finance and maritime cargo insurance, thereby contributing to greater efficiency and clearer visibility to business across the supply chain (WCO, 2014).

In 2018 Singapore formally launched the Networked Trade Platform (NTP), which combines and builds upon *TradeNet* and *TradeXchange.* The NTP is a single-stop-interface that further streamlines and digitizes end-to-end processes and enables firms to connect and interact with all business partners, stakeholders, and regulators in Singapore on trade-related transactions and with their counterparts abroad (Singapore Customs, 2018a). In addition to government services, the NTP offers: (i) so-called value added-services pertaining to preparation of customs declarations and permits, digitization, arrange and track shipments, trade finance, and, distinctively, market insights; (ii) includes a novel set of functions that allow firms to communicate through fora, communities, and blogs, search for commercial opportunities, and specifically source business partners and customers; and (iii) has a built-in innovation space, a developer portal in which it is possible to design and introduce new services that facilitate a dynamic adjustment to the evolving businesses' needs (Figure 19). Hence, the NETP innovatively combines functionalities of an electronic single window and a digital marketplace and, as such, has the potential to facilitate and promote trade. As of 2018, approximately 800 firms from several industries have already registered with the platform (Singapore Customs, 2018b).

Figure 19
Singapore's Networked Trade Platform: Value-Added Services



Source: Singapore Customs (2018a).

6 Concluding Remarks: Opportunities, Challenges, and Policies in a Digital World

New technologies can affect, and are already affecting, multiple dimensions of international trade as it has been known: the why (e.g., evolving comparative advantage); the who (e.g., new firms participate in trade and new consumers are reached); the what (e.g., new goods and services are traded), and; the how (e.g., through online platforms that reduce trade costs). Given the networked nature of both trade and technologies, these complex developments are likely to accumulate and accelerate over time, leading to unpredictable 3hanges in international trade patterns. Still, one thing is certain in this changing context: inaction would not be neutral and could mean exclusion.

More precisely, the digital transformation creates new opportunities for businesses and people to engage in and benefit from international trade, but this comes with a series of policy challenges. First, access to high- quality internet connections is a prerequisite to be part of this transformation in general and digital trade in particular. This calls for additional and renewed efforts to improve the subpar internet connectivity of countries in the region and other relevant factors (e.g., the reliability and cost of power supply). Second, to date there is no accurate measurement (and not even universally accepted definitions) for some of the economic phenomena through which such digital transformation manifests itself. E-commerce is a particular case in point. Generating consistent data and using them to produce rigorous diagnosis is necessary for effective policymaking in this area. Third, new technologies create a series of policy dilemmas that did not exist in the past. Take, for instance, the case of e-commerce. A balance must be struck between

facilitating the data flows that underpin transactions and protecting consumer's rights to privacy. Similarly, when deciding on the *de minimis* values, there is a trade-off between ensuring speed and efficiency in the clearance process for an increasing number of small shipments and effectiveness in identifying illicit trade. Policymakers should be aware of these and other dilemmas raised by the new technologies and, given their emerging character, proceed with caution using existing evidence and consulting with different actors. No roadmaps are available. Last but not least, the systematic and dynamic nature of these phenomena requires working at both the regional level (as some countries have already been doing, e.g., CPTPP, Pacific Alliance, and USMCA) by incorporating or upgrading relevant provisions in trade agreements, and the multilateral level (within the framework of the WTO) by renewing the impulse to move forward with the negotiations toward new rules that effectively address the challenges created by new technologies.[42]

[42] As of January 2019, 76 countries (the European Union plus other WTO members) agreed to start negotiations on global rules to regulate e-commerce transactions.

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