The impact of ICT on service trade*

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Abstract

While trade in goods have been extensively investigated over decades, studies on trade in service are relatively new. In this paper we investigated the impacts of information and communication technology (ICT) on service trade. We measured ICT by four dimensions, including the subscriptions of broadband, fixed telephones, mobile phones and Internet. Our sample covered more than 200 countries, from 2005 to 2015. We employed the modified gravity model and found that all four dimensions had significant impact on the proliferation of trade in service, but mobile subscription is the most consistent dimension. Finally the effects of ICT in the exporting country and in the importing country are of the same magnitude.

JEL classification: D12; F14; L66

Keywords: Information and Communication Technology; Service trade

*All opinions expressed in this paper are those of the authors and do not reflect the views of any organizations the authors are affiliated with. All remaining errors are our own.

1 Introduction

International trade has been one of the main drivers of global economic growth. As the structure of international trade has been continuously evolving, trade in services now play an important role. Its share in global GDP rose from 6% in 1960 to 13% in 2017.[1] Besides, Gervais and Jensen (2019) suggest that potential welfare gains from trade liberalization in the service sector are large. This greater importance of trade in services prompts the quest to understand the drivers behind this surge.

There are several possible channels to explain the rise of trade in services such as time zone (Christen 2017) or geography (Anderson *et al.* 2014). In this paper, we focus on perhaps the most instrumental one: *the advance of technology*. More precisely, we look at the impact of information and communications technology (ICT) that could have an impact on the communication and business costs which are crucial in service trade (Fink and Neagu 2005). ICT refers to technologies that provide access to information through telecommunications. It is similar to Information Technology (IT), but focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication mediums.

The rapid development of ICT has transformed the world to the digital economy era, bringing significant benefits (WorldBank 2016). There is an ample evidence in the literature that show the development of ICT lowers communication and trade costs more than ever. For instance, ICT decreases the cost of business as it helps to overcome the restraints of distance and boundaries in the global markets (Spanos *et al.* 2002; Hanna 2010; Nath and Liu 2013; Lin 2014). At the same time, applying ICT can facilitate communication and give the firms access to markets for innovative quality products, product promotion, online selling, networking and lower transactional costs (Kiveu 2013). Moreover, a strong ICT infrastructure enables data sharing across functions and divisions, which supports cross-functional decision-making and allows companies to com-

[1] https://data.worldbank.org/indicator/bg.gsr.nfsv.gd.zs?end=2017&start=1960&view=chart

municate and act more globally. Besides, it provides a base for faster development of business applications due to standardized platforms and common applications (Brown and Ross 1996). Accordingly, ICT development has changed people and enterprises habits of working and doing business globally. They have recently tended to communicate more and exchange information via the many applications of ICT. As a result, the rise of ICT allows people and enterprises to transact and communicate more globally at lower costs.

There is an emerging literature examining the impact of ICT on trade in services. Internet development clearly could facilitate service export. Choi (2010) showed that doubling the Internet usage in a nation results in a 2% to 4% increase in value of services trade. Not only Internet development in the Home country, but also in the trade partners, could play a crucial role in the growth of service trade. Using detailed data on Other Private Services from 31 countries and 14 industries from 1995 to 1999, Freund and Weinhold (2002) showed that a 10% increase in the Internet penetration of the U.S.'s trade partner led to a 1.7% growth in service trade. The role of Internet development is not limited to that of Internet usage. Wang and Li (2017) found that other indices of Internet development such as broadband subscription, the use and skill of ICT had also significant impacts.

In this paper, we contribute to this literature by making use of the most recent and comprehensive dataset to answer two important questions. First, by having a comprehensive list of ICT indices, we could evaluate the impact of the many dimensions of ICT. In this aspect, our paper is similar to Nath and Li (2017). However, instead of using the reduced-form regression, we employ a structural model derived from the famous gravity equation. In addition, our analysis covers a wider range of countries (228 countries compared to 49 countries in Nath and Li (2017)). Second, different from previous papers, we aim to assess the impact of ICT from both the importer and exporter perspective. In other words, our paper combines the findings of Freund and Weinhold (2002) and Choi (2010) in a comprehensive analysis.

The paper is organized as follows. In Section 3, we describe our data. We

then explain our empirical strategy in Section 4. We report our results in Section 5 and make concluding remarks in Section 6.

2 Theoretical model

2.1 Demand

We assume that consumers worldwide have identical and homothetic preferences. More particular, the preferences of consumers in country j follow the constant elasticity of substitution (CES) utility function as follows:

$$U_j = \left(\sum_i \alpha_i^{\frac{1-\sigma}{\sigma}} c_{ij}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

In the above equation, $\sigma > 1$ is the elasticity of substitution among different varieties. In our model, the variety is defined by the country of origin. The elasticity of substitution captures the similarity of varieties: high σ means the varieties are very similar. The parameter α_i is the taste parameter: the consumers prefer goods from countries with high α. Finally, c_{ij} is the quantity of goods imported from country i to country j.

If consumers in country j have a fixed budget E_j then they will buy goods subject to the budget constraint:

$$\sum_i p_{ij} c_{ij} = E_j \tag{2}$$

In the above equation, p_{ij} is the price that consumers in country j pay when buying from country i. This price is the sum of the factory-gate price c_i and the trade costs τ_{ij} between the two countries:

$$p_{ij} = c_j * \tau_{ij} \tag{3}$$

We will discuss the trade costs τ_{ij} in the next section. When we solve for

the consumer's optimization problem (Equations 1 and 2) we have the values of goods shipped from country i to country j as:

$$X_{ij} = \left(\frac{\alpha_i p_{ij}}{P_j}\right)^{1-\sigma} E_j \tag{4}$$

The variable P_j is the consumer price index in country j:

$$P_j = \left(\sum_i (\alpha_i p_{ij})^{1-\sigma}\right)^{\frac{1}{1-\sigma}} \tag{5}$$

2.2 Supply

We impose the market clearing condition, that is the value of output in country i must equal the total expenditures on goods of this country all over the world:

$$Y_i = \sum_j X_{ij} \tag{6}$$

If we define world output $Y = \sum_i Y_i$ then we can rewrite (6) as:

$$(\alpha_i c_i)^{1-\sigma} = \frac{Y_i/Y}{\Pi_i^{1-\sigma}} \tag{7}$$

In the above equation, Π is the multilateral resistance (Anderson and van Wincoop (2003)), defined as:

$$\Pi_i = \left(\sum_j \left(\frac{\tau_{ij}}{P_j}\right)^{1-\sigma} \frac{E_j}{Y}\right)^{\frac{1}{1-\sigma}} \tag{8}$$

2.3 Trade costs

Now we can specify the trade costs τ_{ij}. The traditional formula for the time-variant trade costs can be written as:

$$(1-\sigma)\tau_{ij,t} = \beta_1 lnDIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 LANG_{ij} + \beta_4 CLNY_{ij} + \beta_5 FTA_{ij,t} + \epsilon_{ij,t}$$

in which the terms $DIST_{ij}, CNTG_{ij}, LANG_{ij}, CLNY_{ij}$, denote the bilateral distance and whether the countries share the border, have the same language and colonial ties. The term $FTA_{ij,t}$ takes the value 1 if the two countries have a free trade agreement at time t. The error $\epsilon_{ij,t}$ denotes any other factors that affect the trade costs (such as bilateral tariffs). In the case of service trade, we assume that the trade costs can take the form of communication costs which depend on the level of ICT of both the source and the destination countries:

$$\begin{aligned}(1-\sigma) ln\tau_{ij,t} = \beta_1 lnDIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 LANG_{ij} + \beta_4 CLNY_{ij} + \beta_5 FTA_{ij,t} + \\ + \beta_6 ICT_{it} + \beta_7 ICT_{jt} + \epsilon_{ij,t}\end{aligned} \tag{9}$$

2.4 The gravity equation

If we replace $\alpha_i p_{ij}$ in Equation (4) by Equations (3), (7) and (9) and take the natural logarithmic we will have the gravity equation written in log terms:

$$lnX_{ij,t} = (1-\sigma)\beta_6 ICT_{it} + (1-\sigma)\beta_7 ICT_{jt} + (1-\sigma)\beta_8 I_{it} + (1-\sigma)\beta_9 I_{jt} + F_{jt} + F_{it} + F_t + \epsilon_{ijt} \tag{10}$$

where $F_{jt} = lnE_{jt} - (1-\sigma) lnP_{jt}$, $F_{it} = -(1-\sigma) ln\Pi_{jt}$ and $F_t = -lnY_t$. In order to employ the fixed effects to control for the unobservable variables F_{jt}, F_{it} we will rewrite the above Equation as follows:

$$lnX_{ij,t} = (1-\sigma)\beta_6 ICT_{it} + (1-\sigma)\beta_7 ICT_{jt} + (1-\sigma)\beta_8 I_{it} + (1-\sigma)\beta_9 I_{jt} + F_j + F_i + F_t + \epsilon_{ijt} \tag{11}$$

The Equation (11) is the main specification of our model. As high level of ICT potentially reduces the trade costs, we expect β_6 and β_7 to be significantly negative. Given that $1 < \sigma$, the coefficients of ICT_{it} and ICT_{jt} are expected to be positive.

3 Data

To measure ICT across countries and years, we use data from the International Telecommunication Unions (www.itu.int) on the subscriptions of broadband, fixed telephone and mobile cellular. The data reported the number of subscriptions of these ICT dimensions in 228 countries from 2005 to 2017. In order to compare to previous studies which mostly focused on the impact of Internet on service trade, we also use the percentage of Internet users in these countries.

We also use the value of service trade reported by the World Trade Organization (WTO). This data is the estimate based on the Eurostat estimates. It covers different categories of trade in services such as transportation (Air, Sea, Rail, etc.), Insurance (Life, Goods, etc.), Financial services, Electricity transmission, Postal service, etc.

In addition to the two main datasets mentioned above, we also employ the gravity dataset from le Centre dtudes prospectives et dinformations internationales (CEPII). Furthermore we collect data on the submarine Cable from TeleGeography. They reported all the major transnational cable network. Arguably the existence of the cable network reduced the digital distance between countries.

The summary statistics of key variables are provided in Table 1. In particular,

about one fourth of the people had broadband, although the proportion of people who had access to Internet was two-thirds. Although one person might have had more than 1 cell phone, it is fair to say that the majority of people had cell phones.

[Insert Table 1 here]

3.1 Trade values

Figure 1 shows the total value of global trade in service. We can see that trade in service rose from 2005 until the financial crisis in 2009. After that it increased consistently until the trade collapse in 2016.

3.2 Information and Communications Technology Dimensions

One of the contributions of our paper is that we have a comprehensive list of ICT dimensions. Table 2 shows that they are highly correlated. For instance, the correlation between broadband subscriptions and Internet user and fixed telephone subscriptions are 87%. It implies that all of these dimensions are important indices of the ICT development.

[Insert Table 2 here]

Figure 2 and figure 3 describe the trend and rise of ICT development in all over the world in 2000-2017 [2]. We used the financial crisis in 2009 to divide our sample into two periods: pre-crisis and post-crisis.

Figure 2 reported the development of ICT across countries. In particular, each point corresponded to the average of the ICT dimensions annually. As for broadband subscriptions: in 2005, the average subscription of broadband was around 13%, it went up sharply in 2008, and then dropped in 2009 because of the global crisis. After that, it continued to increase consistently and reached to 30% in 2017 (see Figure 2a). Similar experience applied to the percentage of Internet users. In 2005, there were 53% internet users across countries, except

[2] Although we have data of trade values and ICT up to 2017, the CEPII data is only available until 2015. As a result, our period of analysis will be 2005-2015.

for the sharp decrease in 2009, the percentage of internet users was on the increasing trend over the time, and reach to 78% in 2017 (see Figure 2b). Mobile subscriptions rose tremendously in the pre-crisis period, from 80% to 120%. The financial crisis in 2009 seemed to stop the momentum. Since 2009, these subscriptions stalled at 120% (see Figure 2c). Since fixed telephones and mobile phones are substitutes, it was not a surprise to see the fixed telephone subscriptions mirrored those of mobile phones in the opposite direction. Indeed, the number of fixed telephone subscriptions dropped from almost 50% in 2005 to 40% in 2008 before stabilized at 30% after the financial crisis (see Figure 2d). To summarize, the pre-crisis and post-crisis showed the consistent rise of ICT in the world.

Although the level of ICT on average surged as we saw in Figure 2, their impacts will be diminished if the bottom countries (i.e. countries with the lowest level of ICT) could not catch up with the top countries since ICT provides the means for the exporters and importers to communicate. In Figure 3 we showed the gaps between the top countries and the bottom countries significantly reduced. In each sub figure, we plotted the 90th percentile and 10 percentile of subscriptions for each ICT dimensions. We can see that the gaps in broadband subscriptions between these two groups dropped from 25% in 2005 to 18% in 2017 (see Figure 3a). More impressively was the results for Internet users and mobile phone subscriptions, where the gaps dropped by 20% and 30% respectively (see Figures 3b and 3c). As for fixed telephone subscriptions, the gaps between the top and the bottom countries seemed to be unchanged (see Figure 3d).

4 Specifications

4.1 Benchmark model

In the first specification, we will employ the simplest form of the gravity Equation (11) that we derive in Section 2. In particular we only consider ICT as the only distance between countries. In other words, we impose the conditions that $\beta_8 = \beta_9 = 0$ and $F_i = F_j = 0$. As a result, we have the first specification:

$$log(Service{-}trade)_{ijst} = \beta_0 + \beta_1 * log(ICT)_{it} + \beta_2 * \log(ICT)_{jt} + I_t + I_s + u_{ijst} \quad (12)$$

In this specification 12, $Service - trade_{ijkt}$ is the value of service trade in sector s from country i to country j. The independent variables ICT_{it} are the dimensions of ICT in country i, i.e. the subscriptions of broadband, fixed telephones, mobile phones and the percentage of Internet users. The time fixed effect I_t is included to control for any development that is only time-specific, for instance, the rise of trade in service in general. Moreover, as our analysis in Section 2 is sector specific, we need to control for the sector fixed effect I_s.

4.2 Gravity model

In the previous specification, we impose the condition that $\beta_8 = \beta_9 = 0$. In other words, we implicitly assume that other gravity variables do not have significant impacts on the volume of trade, especially in service trade. This is a strong assumption. For instance, as shown in Equation 4, larger countries will have larger expenditures on service trade. To control for the size of countries, we add the population and GDP per capita of each country in the second specification. Countries will engage in more trading activities if they have common languages, currency, and legal system. In addition, business will be facilitated if the cost of setting business is lowered. Finally, there is evidence that geography (Anderson *et al.* 2014) and time-zone (Christen 2017) matter for service trade. All of these variables are included in the following specification:

$$\begin{aligned} log(Service - trade)_{ijst} &= \beta_0 + \beta_1 * log(ICT)_{it} + \beta_2 * \log(ICT)_{jt} + \beta_3 * I_{it} \\ &\quad + \beta_4 * I_{jt} + + \beta_5 I_{ij} I_t + I_s + u_{ijst} \end{aligned} \quad (13)$$

In this specification, I_{it}, I_{jt} and I_{ij} denote the gravity variables that we mention above.

4.3 Country-pair fixed effects

In the previous specifications, we simplify our gravity equation 11 by assuming that $F_i = F_j = 0$. In this specification we will relax this assumption. There are two purposes of this relaxation. First, it brings us to the full gravity equation 11. Second it will address the endogeneity issue. Indeed, the independent variables ICT can be endogeneously determined. For instance, ICT development can be a timely trend: Internet and mobile phones have become much more affordable than before. Meanwhile, some countries might have policies that promote the development ICT. The fixed effects that we have in the previous specifications can address these issues. In particular, the time fixed effect will pick up any time trend that might affect the development of ICT. In this specification, we add the country-pair fixed effect to pick up any country or country-pair policies that have an effect on ICT. Our final specification will be the following:

$$\begin{aligned} log(Service - trade)_{ijt} &= \beta_0 + \beta_1 * log(ICT)_{it} + \beta_2 * \log(ICT)_{jt} + \beta_3 * GDP_{it} \\ &+\beta_4 * GDP_{jt} + \beta_5 * GDPC_{it} + \beta_6 * GDPC_{jt} + \beta_7 * FD_{it} \\ &+\beta_8 * FD_{jt} + I_t + X_i + X_j + u_{ijt} \end{aligned} \tag{14}$$

Note that in all specifications we cluster the observation by the exporter-importer pair to reflect the fact that the unobserved components within the pair might be correlated.

5 Results

Table 3 reports the estimates of ICT elasticities of trade in service, as in 12. It shows that all dimensions from both importing and exporting countries have significant impact on the value of bilateral trade in service. In particular, a 10 percent increase in the broadband subscription resulted in an increase of 2 percent in the trade value. The impacts of fixed telephone subscriptions, mobile subscriptions and Internet users are even higher, being 3%, 4% and 5%

respectively.

[Insert Table 3 here]

Table 4 shows the impacts of the gravity variables. Columns 1,2,3 and 4 correspond to the regression where the independent variables are broadband subscription, Internet users, fixed telephone subscriptions and mobile phones. All of the impacts are in line with the literature. For instance, a 10% increase in the population (either in the exporting country or in the importing country) raised the value of service trade by 3%. If these people were richer by 10%, they would spend 4% more on service trade. A 10% increase in the geographical distance lowered service trade by 2.5%. Time zone, however, had insignificant impact, possibly because unlike traditional trading activities service trade could take place anytime. Trade in service would prosper if the trade partners shared borders, language and the GATT/WTO memberships. An interesting feature is the impact of the cable connection. Table 4 shows that a cable network that connected two countries would increase the trade in service by 50% [3].

[Insert Table 4 here]

However, our focus is on the impact of ICT. Table 5 shows that in the presence of other gravity variables, all of our ICT dimensions still have significant impacts on the volume of service trade. It is understandable that as we have more controls, the magnitude of the ICT effects is smaller. In particular, it dropped from up to 5% in Table 3 to 1% in Table 5. Also interesting is that the impact of the ICT in the importing countries seemed to be less important relative to that in the exporting countries.

[Insert Table 5 here]

In Table 6 we include the country-pair fixed effect as in the full gravity equation 14. These fixed effect picks up all the variables that are Exporter-Importer

[3]We thank the anonymous referee for suggesting this point

specific. Together with the time fixed effect, they will control for the potential omitted variables that might result in the endogeneity issue. Results in Table 6 shows that now only the mobile subscription has significant impacts on service trade. While many papers in the literature focuses on the number of Internet users as the proxy for the ICT development, this finding shows that mobile subscription has the most consistent impact.

[Insert Table 6 here]

In all of Tables (3, 5 and 6) we notice that the impacts of ICT dimensions in the exporting countries are of similar magnitude of those of the importing countries. It is consistent with the argument that the "digital distance" depend on the development of ICT of all the trading countries.

6 Conclusion

In this paper we studied the impacts of ICT dimensions, namely broadband, Internet, fixed and mobile telephone on trade in service. We found significant impacts from all 4 dimensions. In particular, a 10% increase in the subscriptions of these dimensions resulted in an increase of from 1% to 5% in the value of trade in service. As a result, investment on ICT would be the way forward to boost international trade and global economy. We also find that mobile subscription is the most consistent ICT dimension. Finally the effects from the exporting country and from the importing country are of similar magnitude, suggesting that all countries need to invest on ICT to boost service trade.

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Tables

Table 1. Summary statistics

Variables	Number of observations (1)	Mean (2)	Standard deviation (3)	Min (4)	Max (5)
Value	767,269	177.2	4,583	0	1.289e+06
Fixed broadband subcription per 100 habitants	742,308	22.90	11.19	0	117.1
Fixed telephone subscription per 100 habitants	745,913	32.37	16.26	0	114.7
Mobile cellulars per 100 habitants	745,874	122.1	27.88	0.265	321.8
Percent of individuals using Internet	745,328	65.68	21.25	0.0652	98.32

Notes. Author calculations.

Table 2. The correlations of ICT dimensions

Dimensions	Broadband (Exporter) (1)	Broadband (Importer) (2)	Internet (Exporter) (3)	Internet (Importer) (4)	Fixed telephone (Exporter) (5)	Fixed telephone (Importer) (6)	Mobile (Exporter) (7)	Mobile (Importer) (8)
Broadband(Exporter)	1							
Broadband(Importer)	-0.0220	1						
Internet(Exporter)	0.8669	0.0174	1					
Internet(Importer)	0.0173	0.8679	0.0677	1				
Fixed telephone(Exporter)	0.8765	-0.0639	0.7249	-0.0586	1			
Fixed telephone(Importer)	-0.0624	0.8753	-0.0575	0.7255	-0.0461	1		
Mobile(Exporter)	0.5267	-0.0900	0.5608	-0.0629	0.4253	-0.1169	1	
Mobile(Importer)	-0.0920	0.5303	-0.0658	0.5628	-0.1177	0.4278	-0.1262	1

Notes. Author calculations.

Table 3. Benchmark model

	(1) value	(2) value	(3) value	(4) value
Broadband subscriptions per 100 habitants (Exporter)	0.230***			
	(0.011)			
Broadband subscriptions per 100 habitants(Importer)	0.210***			
	(0.011)			
percentage of Internet users (Exporter)		0.552***		
		(0.025)		
percentage of Internet users (Importer)		0.509***		
		(0.025)		
Fixed telephone subscriptions per 100 habitants(Exporter)			0.311***	
			(0.015)	
Fixed telephone subscriptions per 100 habitants(Importer)			0.290***	
			(0.015)	
Mobile subscriptions per 100 habitants(Exporter)				0.441***
				(0.044)
Mobile subscriptions per 100 habitants (Importer)				0.367***
				(0.043)
N	717154	724020	722466	724541
R-sq	.343	.342	.341	.296

Robust errors in parentheses. This table presents the results of the specification (12)
* p < 0.1, ** p<0.05, *** p<0.01

Table 4. Gravity variables

	(1) Broadband	(2) Internet	(3) Fixed telephones	(4) Mobile phones
Population (Exporter)	0.280***	0.277***	0.278***	0.275***
	(0.008)	(0.007)	(0.007)	(0.007)
Population (Importer)	0.275***	0.273***	0.273***	0.272***
	(0.007)	(0.007)	(0.007)	(0.007)
GDP per cap (Exporter)	0.348***	0.349***	0.355***	0.403***
	(0.016)	(0.017)	(0.017)	(0.013)
GDP per cap (Importer)	0.410***	0.408***	0.408***	0.424***
	(0.017)	(0.017)	(0.017)	(0.013)
geographical distance	-0.235***	-0.244***	-0.247***	-0.259***
	(0.024)	(0.024)	(0.024)	(0.023)
Time zone difference	-0.003	0.001	-0.001	0.004
	(0.006)	(0.006)	(0.006)	(0.006)
Cable connection	0.435***	0.448***	0.427***	0.441***
	(0.040)	(0.040)	(0.040)	(0.040)
Common border	0.599***	0.599***	0.600***	0.592***
	(0.068)	(0.068)	(0.068)	(0.068)
Common language	0.734***	0.724***	0.719***	0.712***
	(0.068)	(0.066)	(0.067)	(0.067)
Common currency	-0.071**	-0.060*	-0.081**	-0.072**
	(0.035)	(0.035)	(0.035)	(0.036)
Common legal system after transition	0.068**	0.067**	0.073**	0.081**
	(0.032)	(0.032)	(0.032)	(0.032)
Common legal system before transition	-0.030	-0.029	-0.042	-0.041
	(0.030)	(0.030)	(0.030)	(0.030)
common GATT membership	0.157***	0.158***	0.188***	0.191***
	(0.028)	(0.028)	(0.027)	(0.027)
common EU membership	0.262***	0.269***	0.256***	0.262***
	(0.027)	(0.027)	(0.027)	(0.027)
Entry procedure (Exporter)	-0.014***	-0.012***	-0.014***	-0.012***
	(0.004)	(0.004)	(0.004)	(0.004)
Entry procedure (Importer)	-0.006	-0.006	-0.006	-0.005
	(0.004)	(0.004)	(0.004)	(0.004)
Entry setup time (Exporter)	-0.000	-0.001	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)
Entry setup time (Importer)	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)

Table 5. Gravity equation

	(1) value	(2) value	(3) value	(4) value
Broadband subscriptions per 100 habitants (Exporter)	0.069***			
	(0.012)			
Broadband subscriptions per 100 habitants(Importer)	0.021*			
	(0.012)			
percentage of Internet users (Exporter)		0.149***		
		(0.033)		
percentage of Internet users (Importer)		0.041		
		(0.031)		
Fixed telephone subscriptions per 100 habitants(Exporter)			0.084***	
			(0.017)	
Fixed telephone subscriptions per 100 habitants(Importer)			0.029*	
			(0.017)	
Mobile subscriptions per 100 habitants(Exporter)				0.103**
				(0.047)
Mobile subscriptions per 100 habitants (Importer)				0.014
				(0.043)
N	530110	536569	535280	536510
r2	.574	.572	.573	.572
r2_a	.573	.572	.572	.571
F	210	209	208	205
p	0	0	0	0

Standard errors in parentheses
* p¡0.1, ** p¡0.05, *** p¡0.01

Table 6. Country pair fixed effects

	(1) value	(2) value	(3) value	(4) value
Broadband subscriptions per 100 habitants (Exporter)	-0.000			
	(0.007)			
Broadband subscriptions per 100 habitants(Importer)	-0.005			
	(0.009)			
percentage of Internet users (Exporter)		-0.007		
		(0.016)		
percentage of Internet users (Importer)		0.008		
		(0.018)		
Fixed telephone subscriptions per 100 habitants(Exporter)			-0.002	
			(0.012)	
Fixed telephone subscriptions per 100 habitants(Importer)			-0.014	
			(0.015)	
Mobile subscriptions per 100 habitants(Exporter)				0.094***
				(0.022)
Mobile subscriptions per 100 habitants (Importer)				0.073***
				(0.025)
N	529644	536191	534936	536165
r2	.698	.698	.698	.698
r2_a	.693	.693	.693	.693
F	32.1	31.8	32.1	32
p	4.35e-140	6.27e-139	4.04e-140	1.18e-139

Standard errors in parentheses

* p¡0.1, ** p¡0.05, *** p¡0.01

Figures

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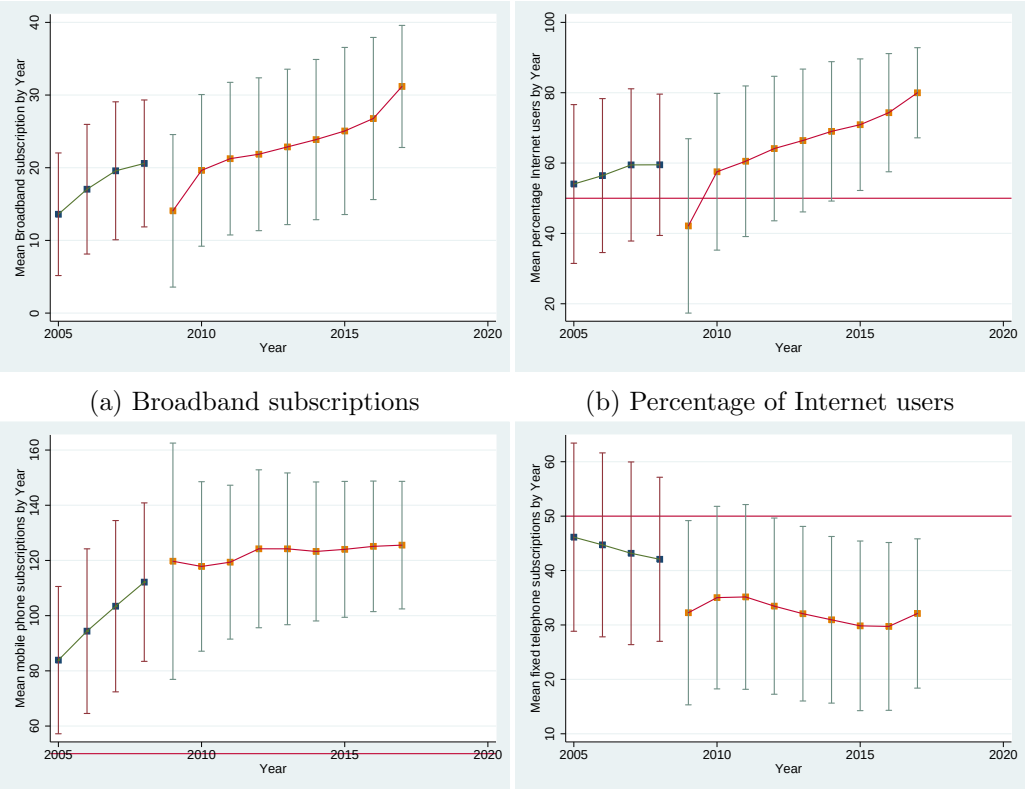
Figure 1. Global trade services in value (trillions USD)



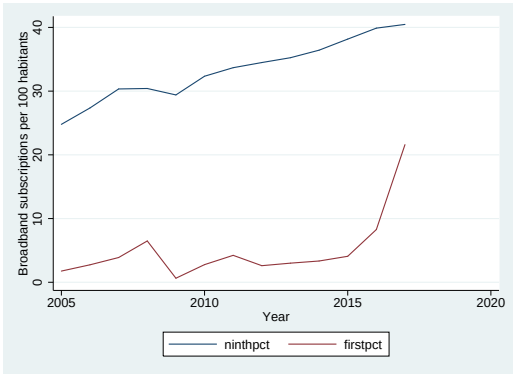
(a) Broadband subscriptions

(b) Percentage of Internet users

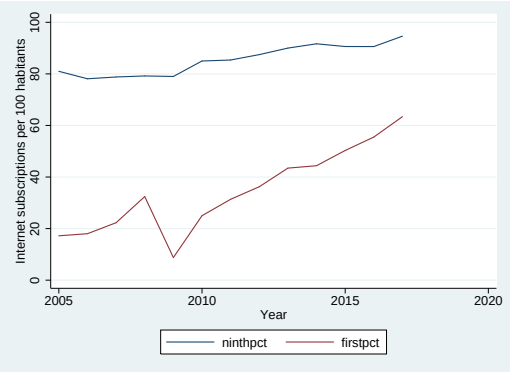
(c) Mobile phone subscriptions

(d) Fixed telephone subscriptions

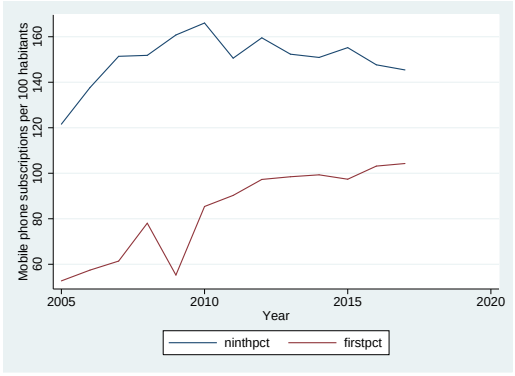
Figure 2. The rise of ICT. Source: Authors' calculation.



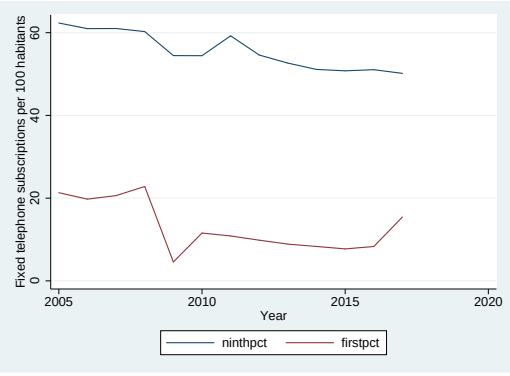
(a) The top and bottom of broadband subscriptions



(b) The top and bottom of Internet users



(c) The top and bottom of mobile phone subscriptions



(d) The top and bottom of fixed telephone subscriptions

Figure 3. The catchup of ICT. The blue lines are the 90th percentile and the red lines are the 10th percentiles. Source: Authors' calculation.