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Original Paper

Estimating the Effect of the Internet on International Trade in Services

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Abstract

This paper assesses the relationship between the Internet and international trade in services. While there are similarities and discriminating differences between trade in services and goods, it is widely believed that the recent rapid internet penetration has benefitted trade in services more than trade in goods. The study carries out an empirical assessment of the contribution of the internet to services export and import for a total of 63 developed and developing countries over the period of 2000-2014. As most explanatory variables are likely to be jointly endogenous with services export and import, we run GMM regressions developed for dynamic panel data.

Our results are, in general, consistent with the previous findings that growth in internet users and GDP as well as measures of trade openness all has positive impact on services export and import. For instance, a 1% increase in internet users in the partner countries leads to 0.27% and 0.08% increase in services export and import, respectively, in the combined group of reporting countries. The impact of internet on services export appear larger for developed countries, 0.52%, and insignificant for developing countries. The estimated coefficients of population appear significant while carry unexpected signs. Finally, the real effective exchange rate is significant for the services import only.

Keywords

trade in services, digitized services, digitization process, Internet users

1. Introduction

The service sector has grown so rapidly that it has become a significant component of all major economies' GDP. It comprises more than two-third of world economy, 72 percent of the GDP in high-income countries, 53 percent in middle-income countries, and 46 percent in low-income countries, Cattaneo, O. et al. (2010). In 2016, world services exports reached US$4.9 trillion which was one third of merchandise exports, UNCTAD (2017). This sector is not only a key contributor to competitiveness and economic growth, but also instrumental to trade in merchandises.

Trade in services has also grown in tandem with the growth of services sector, globalization, and advancement in growth of Information and Communication Technology (ICT). World trade in services as a percentage of GDP has grown from 9.3 percent in 2000 to 13 percent in 2014, IMF, IFS (2015). The potential from trade in services is immense and goes beyond easier access to health care, educational services, transportation, accounting and legal service sectors, etc. The impact of trade in

service on economic growth and income distribution is different from that of trade in goods. Trade in services can enhance the link between producers and consumers and influence efficiency with which resources are allocated globally. Trade in services is also a catalyst in merchandise trade for both physical as well as electronic deliveries. Moreover, it facilitates disseminating information which is essential for the accumulation of human capital and economic growth.

Trade in services has grown more rapidly than trade in merchandise, except for services exports by developing countries. During the period of 2000-2014, total merchandise imports grew by 127% and 391% and total merchandise exports grew by 134% and 410% for Developed and Developing countries, respectively (data from World Development Indicators). In comparison, during the same period, total services imports grew by 165% and 477% and total services exports grew by 200% and 337% for Developed and Developing countries, respectively (data from UN Comtrade). For the list of countries, see Table 1.

In 2014, the last year of our data set, total services imports grew at the rate of 5.67% and 10.90% for the groups of developed and developing countries and the corresponding figures for total services exports were 4.95% and 8.23% (same sources as above).

Despite the higher growth rate in developing countries, developed countries still carry out more than 80% of world total (imports plus exports) services trade, leaving nearly 20% for the group of developing countries. For the latter group, the share has risen from 13% in 2000 to 20% in 2014.

Much of the growth in services trade is attributed to globalization as well as advancement in Information and Communication Technology (ICT), in particular, the Internet. The unprecedented growth of the internet has shown to have significant impact on two types of products: 1) some goods and services which have traditionally been delivered in physical forms can now be transmitted across networks in digital bits. This category includes digitizable media products such as films, various types of printed material, video games and various recorded information like softwares, 2) many services in areas such as consulting, communication, financial, educational, and medical industries can now be digitally produced and transmitted across networks. The policy-driven liberalization of services trade has also been a key factor in explaining varying degrees of growth of the service sector for both developed and developing economies.

International trade in services is expected to grow even faster as transactions costs continue to decline due to the efficiency of online search and the Internet-based digital delivery. In addition, digitization of many forms of information products takes place in an ever growing speed. For instance, a piece of art or historic documents which were accessible for viewing by a visit to the site or many products such as data or a music file stored in CD which needed physical delivery can now be transmitted through digital networks. Digital networks have altered and significantly facilitated the ways in which businesses are conducted by producers, consumers, intermediaries, governments, etc. In sum, the Internet coupled with globalization of services trade and digitization of many services products offer, at least a partial, explanation of why trade in services has grown faster than trade in merchandize (Note 1).

The rest of this paper is organized as follows: Section 2 reviews the literature covering the impact of the Internet on trade in goods and services. Section 3 explains the sources of the selected data sets and offers a summary statistics. Section 4 describes the analytical framework and methodology of the analysis. Section 5 provides a summary interpretation of the estimated parameters of the models. Finally, Section 6 suggests some policy implications involving the impact of the Internet on international trade in services.

2. Literature Review

A significant segment of the international trade literature addresses the characteristics differences between trade in services and goods, Martin (2000). The differences are due to the key characteristics of services such as: the requirement that for most services production and consumption take place simultaneously; some services can be stored digitally; and for services that cannot be stored, both producers and consumers need to be present at the same time and possibly in the same location; and many services are an integral part of trade in goods, Breinlich, H. and Chiara, C. (2011). On the other hand, other authors such as Bhagwati et al. (2004) elaborate the similarities between trade in services and goods and suggest that the gains from trade in producer services can be addressed using the same theoretical framework as those used for trade in goods.

The unprecedented growth in international trade in services in both developed and developing countries has been attributed to the pace of globalization as well as advancement in ITC, in particular the internet, Wymbs, C. (2000). Globalization has attracted enormous attention from the public, media, and policy makes and academics. Attempts by sovereign nations as well as coordination by international bodies for globalization as well as its impact on trade, GDP, and distribution of job and income are well documented, OECD, International Trade in Services.

A parallel line of research attempts to shed light into the impact of universal advancement in ICT on online shopping, e-commerce, and the overall trade flow. For instance, Yousefi (2015) investigates whether the growing cross-border e-commerce increases the volume of international trade or merely replaces the traditional mode of physical delivery. The study carries a comparative statistical analysis of total trade and trade in digitizable products by a total of 71 developed and developing countries over the period of 1998-2012. The study suggests that developing countries have in the recent past penetrated into developed countries' markets and made up for the decline in their market share of world total trade as well as trade in digitizable products. As a result, electronic delivery of digital products appears benefitting developing countries by gaining deeper access to international markets. A sizable part of the e-commerce literature focuses on the efficiency of e-markets in comparison with the conventional markets, Smith M. D. et al. (2000), Brynjolfsson et al. (2000, 2010), Bergen, M. (2004), Bakos, Y. (1998, 2001), Kauffman, J. R. et al. (2001). The efficiency hypothesis, which is central to the current literature, is made because e-markets offer a platform in which exchanges are facilitated immensely by digital networks in which businesses and consumers are connected in real time. The new phenomenon has been argued to bring new opportunities for businesses by making them more competitive in the global marketplace and offering consumers more choices and competitive prices, Brynjolfsson et al. (2000). An extensive review of the literature by Smith et al. (2000) suggest that the online markets which are based on frictionless flow of information have all the characteristics of nearly an efficient market, or at least more efficient than the conventional markets. The hypothesis has been supported by a significant body of empirical studies. Finally, whether and how online market efficiency brings about a "net increase" in trade and boosts welfare of its stakeholders appear as a promising research agenda, Yousefi (2014).

From the wider e-commerce literature, two branches of research emerge involving the internet and services. First, the internet as a ubiquitous apparatus for easier exchange of information is capable of reducing transaction costs and increase trade. Second, because of the characteristics of the service industry the internet can boost trade in services more than trade in goods. Freund and Weinhold (2004) examine the effect of the Internet on international trade. The study uses trade data of 56 countries from 1997 to 1999 and finds that the Internet reduces the fixed cost of entry into online markets thereby

positively impacting trade in both goods and services.

There are other researchers who question whether and to what extent effects of the Internet on trade continue to hold across countries at different stages of development. Clarke, G. R. G., and Wallsten, S. J. (2006), for instance, hypothesize that the Internet may affect developed and developing countries differently. Their empirical study uses year 2001 data of 98 high and low-income countries looking at exports to three different country groups: developing, developed, and all countries. The study carries out, in addition to OLS, 2SLS estimation techniques to account for an omitted relevant explanatory variable as well as endogeneity issue arising from unclear direction of causality between Internet use and export behavior. They find that Internet penetration is positively correlated with exports from developing to developed countries but not to other developing countries! Likewise, Internet penetration does not appear to be correlated with exports from developed neither to other developed nor developing countries. The cross country results of the paper suggest that the recent growth of Internet penetration can explain some of the growth in trade confirming the findings of Freund and Weinhold (2004). A recent updating of the seminal paper by Freund and Weinhold (2004) has been carried out by Lin. F. (2014) by using bilateral trade data from nearly 200 countries over the period of 1990-2006. The study suggest that: 1) a 10% increase in Internet users leads to 0.2%-0.4% increase in international trade, and 2) the effect of the Internet on export side appears to be larger than that on the import side.

Trade in services is an indispensable input into nearly all other sectors of the economy contributing to productivity growth and GDP. As a result, the impact of the Internet on trade in services is expected to be relatively greater because transmittable services can be traded nearly at no cost. This is, in part, due to massive Internet penetration and continued subscription growth. As the number of subscriptions rises, the opportunity of online trading grows even faster in according to the so-called Metcalfe's Law: "the value of the network is equivalent to the square of the number of nodes connected to it". In addition, digitization of information products becomes more cost-effective which makes it easier to save, retrieve, and distribute it through the Internet. The process, in turn, expends the scope and rate of growth of trade in services.

Freund and Weinhold (2002) carry out an empirical study to find how the Internet development contributed to increased exports of services to the United States. Given the lack of bilateral services trade data, the study uses United States' "Other Private Services" of 14 industries data with 31 trading partner counters. To measure the Internet penetration, the study adopts a proxy containing the number of top-level domain names attributed to each country. The study suggests that a 10-percent increase in the Internet variable abroad boosts growth by 1.7 percentage points in the short run. The results imply that the growth effect is the result of the Internet's direct effect on improved efficiency, productivity, and volume of trade in goods and services.

Services come in many different forms and packages in an ever evolving services market environment (Note 2). They can be used in a cross section of different service industries as well as in goods manufacturing, distributions, retailing, etc. As such, collection and compilation of services data by relevant national agencies have proven to be not as straight forward as one might expect. The need for a collaborative uniform approach to trade in services has long been existed and it has become more urgent due to rising share in total trade and its growth potential. Given the continued impetus of world trade in services, the need for international rules has become increasingly greater than before, WTO (2013).

The General Agreement on Trade in Services (GATS) as the first multinational trade agreement on trade in services was one of the major achievements of the Uruguay Round of trade negotiations, from

1986 to 1993. This was almost half a century after the entry into force of the General Agreement on Tariffs and Trade (GATT) in 1947, covering primarily trade in merchandise (Note 3). The GATS follows a threefold objective: (a) ensuring increased transparency and predictability of relevant rules and regulations, (b) providing a common framework of disciplines governing international transactions, and c) promoting progressive liberalization through successive rounds of negotiations. The latter objective is tantamount to improving market access and extending national treatment to foreign services suppliers across a widening range of sectors.

Pursuant to Article I: 2, the GATS identifies four modes of services supply:

(a) from the territory of one Member into the territory of any other Member (Mode 1—Cross-border trade);

(b) in the territory of one Member to service consumer of any other Member (Mode 2—Consumption abroad);

c) by a service supplier of one Member, through commercial presence, in the territory of any other Member (Mode 3—Commercial presence); and

(d) by a service supplier of one Member, through the presence of natural persons of a Member in the territory of any other Member (Mode 4—Movement of natural persons).

This study's aim is to take a fresh look at the impact of Internet use on the growth of international trade in services. Such impact is unlikely to be uniform across different trading countries especially many developing countries are inadequately prepared to capture the full benefits of digitization and online trading (Note 4). To account for such disparity, we estimate separately the impact on developed and developing countries' trade in services. The distinction is to account for the difference in the "stage of development" of the two groups of countries. In addition, many developing countries have not made commitment to allow for "market access" and "national treatment" against foreign services where electronic delivery is feasible. Such differences are explained in detail in Mattoo et al. (1999) and Panagariya, A. (2000). For data on trade in services, we follow the definitions of the office for National Statistics, which is somewhat less restrictive (ONS, 2007). For example, it includes industries and activities whose output can be stored on physical objects such as disks, paper or DVDs (computer programs, consultancy reports, etc.).

3. Features of Data

Data are taken from UN Comtrade (http://comtrade.un.org.data). There are 11 main Extended Balance of Payment Services (EBOPS) categories of services: transportation; travel; communications; construction; insurance; finance; computer and information; royalties and license fees; other business services; personal, cultural and recreational services; government services (Note 5). The "Total Services Trade" data is separately reported as "Total Services category" (of EBOPS code 200) and is not a simple summation of the 11 main subcategories (Note 6), see, "2014 International Trade Statistics Yearbook Volume II Trade by Product" (http://comtrade.un.org/pb/downloads/2014/ITSY2014VolII.pdf).

The services trade data are aggregate, as opposed to bilateral. That is, "trade partners" of a country is the rest of the world, defined in the database, and it is not a simple summation of the countries in the table (Note 7).

There are 35 developed and 28 developing countries included, covering from 2000 to 2014, for which all variables are available for all economies and all years. For the data set, no sampling scheme is employed other than excluding the economies with missing values. The 63 countries together make up

a substantial part of the world economy. In 2014, for instance, the group's contribution to the global GDP (77,825.28 billion in terms of current US$) was 80.78%. The list of developed economies is determined according to the World Bank classification of high-income economies, see Table 1.

The services trade data of this study has two primary caveats: i) services sectors as listed above encompass a wide range of major service sectors but not "all" services sectors; ii) the services trade data is aggregate as opposed to bilateral trade between two nations. An obvious drawback is the fact that aggregate data masks some useful information pertaining to bilateral trade data which is unfortunately difficult to come by. The choice of aggregate data has been driven primarily by the availability of such data for the said number of countries and the period of time. For the purpose of this study, we did not make a distinction between different service sectors and had to assume that the Internet facilitates trade in all sectors to the same extent, a hypothesis that can be challenged. Nonetheless, the format of the data set allows us to assess whether and to what extent the impact of the Internet on services trade is different between developed and developing countries.

The data set exhibits many important features of international trade in services. While the share of developed countries of world total services imports has fallen from 90.13% in 2000 to 80.75% in 2014, for developing countries the share has risen from 9.87% to 19.25% during the same period. For the two groups of countries, the shares of world total services exports follow trends similar to services imports even though at somewhat a muted rate.

When the total services imports and exports added together, the share of world total services trade has fallen from 90.97% in 2000 to 84.71% in 2014 for developed countries and risen from 9.03% to 15.29% during the same period for developing countries. The trends continue to follow the same opposing directions even after the great recession of 2008-2009. Not surprisingly, we observe the same trends for the share of world total trade (sum of services and merchandise). The share has fallen from 86.63% in 2000 to 75.64% in 2014, and risen from 13.37% to 24.36% (nearly twice) during the same period for developed and developing countries, respectively. It sounds reasonable to conclude that developing countries, as a group, are making up for the decline in the market share of developed countries, for trade in services as well as merchandise.

Growth in services trade took off in the early 1980's and has since become a more dynamic component and a bigger part of the world total trade. Trade in services has grown faster, albeit from a relatively modest level, than merchandise trade and, as our data illustrates, developing countries have been a major contributor to such a phenomenon. During the period of 2000-2014, total merchandise imports grew by 127% and 391% and total merchandise exports grew by 134% and 410% for developed and developing countries, respectively. In comparison, during the same period, total services imports grew by 165% and 477% and total services exports grew by 200% and 337% for developed and developing countries, respectively. It should, however, be noted that merchandise trade still constitutes a substantial part of trade. For instance, in 2014, merchandise imports and exports of developing countries were more than 75% of total imports and exports, leaving the share of trade in services roughly at 25%. The figures for developing countries were even more skewed in favor of merchandise trade: 84% and 90% merchandise and 16% and 10% for services imports and exports, respectively.

It is noteworthy to highlight that among the two groups of countries, the US and China stand out with sizeable shares of world total trade in services. The US share of total services imports and exports have been the largest among the 35 developed countries, 18.12% and 23.92% in 2000, which have fallen to 13.12% and 18.31% in 2014, respectively. In addition to the U.S., Japan, and U.K. should also be causing the downward trends of developing countries. China, on the other hand, has been

single-handedly the driving force behind the upward trends in developing countries total imports and exports trade in services: 2.97% and 2.52% in 2000 and 10.69% and 5.60%, in 2014, respectively.

The Internet data is from World Development Indicators (WDI). Internet users are individuals who have used the Internet from any location via a computer, mobile phones, personal digital assistant, games machine, digital TV, etc., in the last 12 months. The Internet user figures have grown steadily and without interruption over the period of 2000-2014 for all 63 countries in our data set. It has risen from 21.99 (per 100 people) in 2000 to 79.27 in 2014 (nearly 4 times) for developed countries and from 2.55 to 37.46 (roughly 15 times) for developing countries during the same period. Among developed countries, many European nations such as Denmark, Finland, Luxembourg, Netherlands, Norway, Sweden, and United Kingdom have registered 90+% Internet users. Remarkable high rates of growth of the Internet users can be found among developing nations. For instance, for China the rate has grown from1.78 in 2000 to 49.30 in 2014, a hefty jump of 28 times.

This study, like similar studies, suffers from the problems involving the Internet data. First, while the Internet users as individuals constitute a wide network of internet connections within a country, it does not include connection by firms, governments and other entities. Moreover, the data fails to provide information about the purpose of use—business vs. entertainment—or other traits such as the speed, intensity of use, etc. In addition, Lin, F. (2014) indicates concerns over not being able to differentiate between the interconnected overall infrastructure and the Internet use. Despite all the drawbacks, our measure of the "Internet users" can be assumed a suitable proxy for the "overall Internet use" in a country, which facilitates trade in services. Clarke and Wallsten (2006) reran regressions using Internet users as a measure of Internet use and found similar coefficients estimates, the coefficients on the Internet users were statistically significant and positive for developing countries and statistically insignificant for high-income countries. Similarly, Freund and Weinhold (2002) by using the number of internet users to replace the number of Web Hosts attributed to each country in their regressions produced similar estimates. Data sets on GDP, total population, and real effective exchange rates are collected from WDI (Note 8, Note 9, Note 10).

4. Analytical Framework

The study adopts a model from Freund and Weinhold (2014). The model is modified in several important ways: i) we did not include a distance variable because our time-series, cross-section services trade data are aggregate overall trade partner countries, ii) we include a dummy variable to capture the general economic decline of 2008 great recession, iii) we include "internet user" as it pertains directly to connectedness among trade partner countries as opposed to Web site hosts measures used in previous studies. As mentioned in Freund and Weinhold (2014), internet penetration in one country is expected to have a smaller effect on bilateral trade than simultaneous internet penetration in all countries with a multiplying effect on trade, iv) Trade liberalization especially in services, export promotion policies, and greater technological advances have paved the way for higher trade in services. As a result, the effects of these advances may be captured by some of the regressors, which lead to an omitted variable problem.

Because our services trade data are in aggregate form, the estimators are expected to capture the impact on the traditional mode of service delivery as well as delivery in digital form. Understandably, it would've been ideal if we could gather data separately for traditional mode of service delivery and its online counterpart. The problem is that trade on goods and services—physical and digital deliveries—are all facilitated with some kind of services and its separation remains an insurmountable

task, to say the least. Consequently, we use cross-country services trade data on cross-border delivery in both traditional as well as digital modes of an aggregate of 11 service categories, Mode 1.

Previous papers such as Freund and Weinhold (2002) and Clarke, G. R. G., and Wallsten, S. J. (2006) have documented that even if trade in services export is correlated with Internet use, the direction of causality is still unclear. That is, although Internet penetration makes it a cheaper and more effective tool to use, increase in trade in services, in turn, requires firms to adopt Internet to facilitate trade and expand market access. In addition, it is possible that the internet is not statistically correlated with the services trade, but with another variable such as per-capita-income, population, and educational level, etc. which are actually omitted from the regression. In this case, the estimated statistical correlation may indeed be reflective of an omitted relevant variable(s).

Our empirical analysis uses services data set of 63 countries—35 developed and 28 developing—over the period of 2000-2014. As most explanatory variables are likely to be jointly endogenous with services exports and imports, we use the GMM estimators developed for dynamic panel data models (Arellano & Bond, 1991; Arellano & Bover, 1995). With the GMM approach, we run regression equations in differences as well as regression with combined differences and levels into one system.

Following Arellano and Bover (1995), Blundell and Bond (1998), and Chang et al. (2009), we also retain the system approach. Indeed, this estimator is more suitable when the explanatory variables are highly persistent over time, like in the case of growth models (Bond et al., 2001), or when the heterogeneity is relatively important.

4.1 Methodology

The Services Export and Import models are specified as:

$$\log(SE_{it}) = \delta_i + \alpha_1 \log(IntUse_{j,t}) + \alpha_2 \log(GDP_{j,t}) + \alpha_3 \log(POP_{j,t}) + \alpha_4 \log(REER_{j,t}) + \alpha_5 \frac{TT_{ij,t}}{GDP_{j,t}} + \alpha_6 \frac{ST_{ij,t}}{TT_{ij,t}} + \varepsilon_{i,t} \quad (1)$$

$$\log(SI_{it}) = \varphi_i + \beta_1 \log(IntUse_{i,t}) + \beta_2 \log(GDP_{i,t}) + \beta_3 \log(POP_{i,t}) + \beta_4 \log(REER_{i,t}) + \beta_5 \frac{TT_{ij,t}}{GDP_{i,t}} + \beta_6 \frac{ST_{ij,t}}{TT_{ij,t}} + \eta_{i,t} \quad (2)$$

- *SE* and *SI* are services export and services import with the rest-of-the-world, respectively, in billions of constant 2010 $US;
- *i* and *j* are the individual indexes, and *t* is the time index;
- δ_i and φ_i are the individual fixed effects;
- *IntUser* is the number of internet users per 100 people;
- *GDP* is in billions of constant 2010 $US;
- *POP* is population;
- *REER* is the index of real effective exchange rate, with $REER_{2010}$=100, where

  $$\log(REER_{i,t}) = -\log(REER_{j,t}),$$

  since the partner economy's *REER* is obtained by inversing the reporter's *REER*;
- $\frac{TT_{ij,t}}{GDP_{j,t}}$ (or $\frac{TT_{ij,t}}{GDP_{i,t}}$) is the share of total trade between country *i* and country *j* as a percentage of

country *j*'s GDP (or country *i*'s GDP) at time *t* ;

- $\frac{ST_{ij,t}}{TT_{ij,t}}$ is the share of services trade between economy *i* and economy *j* as a percentage of total trade between the two countries. The three measures represent a degree of openness of the trading countries.

In model (1), the dependent variable is the reporting country's services exports, and the independent variables are the partner country's internet users, GDP, population, measure of trade openness, and the real effective exchange rate between the reporting country and the partner countries, where the internet users, GDP, population and the real effective exchange rate are all in logged term, while the two openness measurements are in percentages. The same variables, except the inverse of the real effective exchange rate, are employed with model (2) in which the dependent variable is the reporting country's services imports. There are variables commonly used in the literature for investigating internet effects on trade in services (see, e.g., Choi, 2010; Clarke & Wallsten, 2006; Freund & Weinhold, 2002; Huchet-Bourdon et al., 2011, etc.); According to the literature, e.g., Choi (2010), the explanatory variables can all be in log format, except the categorical variables and dummy variables; this can provide a case for taking log of the *Openness* measurements too. However, one consideration about this transformation is that *GDP* is already a regressor in the model and *Openness* is a percentage of *GDP*; if *Openness* enters into the model in its log format, the log(*GDP*) term can be cancelled out. Thus, in the above regressions the *Openness* variables will be entered as percentages.

A final remark about our dataset is that, the "partners" of "reporting" country, which can be called "the-rest-of-the-world", is determined by the availability of the set of country-specific data. Accordingly, the explanatory variables such as "partners GDP", "partners population", etc., are obtained by summing up the corresponding variables of the countries in the dataset, i.e., the 62 countries in the sample other than the reporting country.

5. Empirical Results

Given the panel dataset, several alternative estimations such as pooled OLS, fixed effect, random effect, as well as panel GMM procedure with lagged terms (i.e., instrumental variables) can be used (Note 11). The test results in Table 1 and Table 2 provide information about which of the alternative estimators to employ.

Table 1 is a set of panel unit root tests on the joint stationarity of the panel data, where LLC is for Levin, Lin and Chu (2002), IPS is for Im, Pesaran and Shin (2003), M-W is for Maddala and Wu (1999), and all three test the null hypothesis of non-stationarity. For each model, there are two set-ups for each test "Intercept included" and "Intercept & Trend included". The results are consistent across different tests by rejecting the null hypothesis and suggesting that the penal datasets are jointly stationary.

Having checked that the data is stationary, we implement a set of tests for individual and time fixed effects, respectively, to obtain evidences for including/not including the fixed effects. The test results in Table 2, for the Breusch-Pagan Lagrange Multiplier test with the null hypothesis of "no significant fixed effects", show that the individual and the time fixed effects are significant in both models by rejecting the null at 5% significant level, which suggests that the model should include both individual and time fixed effects.

Table 3 presents the estimation results with the individual fixed effects, while on the time dimension

we only use a "year 2009 dummy" instead of the "time fixed effects". The estimation is launched with three groups of data set, respectively—all 63 countries, the 35 developed countries, and the 28 developing countries. Two results stand out: i) the effects of "internet user" are generally significant for both SE and SI models across all country groups; ii) the time dummy turns out insignificant across all three group, not shown in the table.

According to the literature, however, several factors can cause endogeneity problems in the regression models. Those factors include bi-directional causality between services trade and internet usage as well as omitted variables, among other causes. To remedy such problems, we employ GMM estimation method. For the selection of instrumental variables, the lagged dependent variable or lagged independent variables are widely used in literature; see, e.g., Choi (2010). In this case, the second and the third order lagged dependent variable, the second and the third order lagged $\log(GDP)$ as well as the second and the third order lagged $\log(POP)$ are used as the instrumental variables, Baum et al. (2012). Furthermore, to keep the GMM estimators valid the following constraints need to be tested (Hayashi, 2000): 1) the set of the dependent variable, the independent variables and the instrumental variables need to be jointly stationary; 2) the instrumental variables are exogenous.

For condition (1), Table 1 shows test statistics confirming the stationarity of the data for both models; for condition (2), the Sargan *p-value* statistics in Table 4 show the results of the exogeneity tests, of which the null hypothesis is that "the over-identifying restrictions" are valid. The Sargan test results are stable across different models and different country groups suggesting that the null hypothesis cannot be rejected. That is, that the primary variables do satisfy exogeneity condition. With the two conditions satisfied, the GMM estimation results with individual fixed effects are shown in Table 4. The estimates with both the Individual Fixed Effects and the Time Fixed Effects are not as stable as in the fixed effect estimation, table now shown.

From the Individual Fixed Effects regressions, Table 3, the estimated coefficients of $\log(IntUse)$, $\log(GDP)$, $\frac{TT}{GDP}$, and $\frac{ST}{TT}$ are statistically significant with positive effects in both SE and SI models for the developed, developing, and the combined group of countries, with an exception of SE model for developing countries. The results confirm theoretically expected relationships and also support the previous empirical findings in the literature. In particular, the use of the Internet has the potential in facilitating market access and reducing fixed costs of trade in services. However, the population variable, $\log(POP)$, illustrates a varying degree of significance across different groups, while it carries a negative sign which is inconsistent with theoretical expectations. As much as it is hard to explain, other empirical studies have also come up with a similar counter-intuitive result, e.g., Choi (2010), etc.

The GMM estimations with the Individual Fixed Effects are provided in Table 5. The estimated coefficients of $\log(GDP)$, $\frac{TT}{GDP}$, and $\frac{ST}{TT}$ are all statistically significant and positive in both models and all groups of countries, with an exception of that for the $\log(GDP)$ variable in SI model for developed countries. The results are very much similar between the Fixed Effects and GMM regressions. However, the signs of the estimated coefficient of $\log(IntUser)$ are positive and statistically significant only in SE model for the developed country and combined country groups. The results raise two questions: i) why the number of internet users in developed countries has a positive impact on SE not SI? ii) why the number of internet users in developing countries affects neither SE nor SI? One might allude to the "generality of scope" of the Internet users variable or impediments

with the services trade infrastructure of developing countries, including legal and institutional setting. In reality, in many developing countries services industry is still behind in broadband Internet connection or the business environment is not quite supportive of globally competitive business practices.

Table 1. Panel Data Unit-Root Tests

Tests	Model (1)				Model (2)			
	Intercept		Intercept & Trend		Intercept		Intercept & Trend	
	Test Stat	p-value	Test Stat	p-value	Test Stat	p-value	Test Stat	p-value
LLC	-17.351	0.000	-24.675	0.000	-11.006	0.000	-15.678	0.000
IPS	-25.359	0.000	-26.001	0.000	-17.686	0.000	-17.527	0.000
M-W	791.230	0.000	793.230	0.000	427.520	0.000	431.420	0.000

Table 2. Breusch-Pagan Lagrange Multiplier Test for Fixed Effects

Models		Individual Fixed Effects		Time Fixed Effects	
		χ^2	p-value	χ^2	p-value
All	Model (1)	5586.100	0.000	12.444	0.000
Countries	Model (2)	3404.400	0.000	3.403	0.065
Developed	Model (1)	2927.400	0.000	15.968	0.000
Countries	Model (2)	2059.300	0.000	5.265	0.022
Developing	Model (1)	2368.600	0.000	5.847	0.016
Countries	Model (2)	965.680	0.000	2.570	0.109

Table 3. Individual Fixed Effects Estimation

	All Countries		Developed Countries		Developing Countries	
	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)
$\log(IntUser)$	0.159*	0.088***	0.359***	0.112***	-0.151	0.062***
	(0.080)	(0.012)	(0.080)	(0.019)	(0.136)	(0.018)
$\log(GDP)$	3.091***	1.123***	3.480***	1.046***	2.360***	1.258***
	(0.409)	(0.066)	(0.423)	(0.095)	(0.702)	(0.093)
$\log(POP)$	-4.004**	-0.260*	-9.438***	-0.259•	4.355•	-0.255
	(1.433)	(0.111)	(1.473)	(0.150)	(2.471)	(0.171)
$\log(REER)$	-0.514	0.574***	-0.467	0.671***	-0.505***	0.546***
	(0.426)	(0.055)	(0.418)	(0.082)	(0.725)	(0.077)
$\frac{TT}{GDP}$ (%)	0.184***	0.004***	0.269***	0.003***	0.086**	0.008***
	(0.019)	(0.000)	(0.028)	(0.001)	(0.028)	(0.001)
$\frac{ST}{TT}$ (%)	0.029***	0.030***	0.035***	0.028***	0.028***	0.037***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Adj. R^2	0.657	0.799	0.751	0.758	0.672	0.835
F-statistic	312.789***	634.981***	259.649***	280.729***	148.519***	359.828***
	(6, 876)	(6, 876)	(6, 484)	(6, 484)	(6, 386)	(6, 386)

- Significant codes: 0 “***” 0.001 “**” 0.01 “*” 0.05 “•” 0.1;
- The two numbers in the brackets for the F-statistic of each regression are the two degrees of freedom for the F-distribution.

For interpreting the estimated coefficients, we should bear in mind the “measurement units” of the variables and that “individual country effects” are controlled. For example, the coefficient of $\log(IntUser)$ estimates the marginal effect on the real value of services export of the reporting country of the percentage change in the number of internet users (per 100 people) in the partner countries. Specifically, 1% increase in the number of internet users in the partner countries (62=63-1) leads to 0.16% increase in services export (in billions of 2010 $US) within the combined group and 0.36 in developed country group, respectively. Similarly, 1% increase in *GDP* (in billions of 2010 $US) in the partner countries leads to 3.1% increase in services export in the combined group, and 3.48% and 3.36% in the developed and developing country groups, respectively.

A counter-intuitive negative impact emerges from the population growth, as 1% increase in population in the partner countries leads to 4.00% decrease in services export in the combined reporting country group.

For the real effective exchange rate, after controlling for the countries’ individual effects, 1% increase in the real effective exchange rate in the reporting country leads to 0.51% decrease in services export in the reporting country. This result is in conformity with theoretical prediction as a decline in the exchange rate makes the country’s exports less expensive for the importing countries.

Finally, 1 percentage point increase in the “share of total trade in the partner country’s GDP” or “share of service trade in total trade” leads to, respectively, 0.18% or 0.03% increase in services export in the reporting country. That is, the more open the countries are to trade, the higher is the export of services.

Table 4. GMM Estimation with Individual Fixed Effects

	All Countries		Developed Countries		Developing Countries	
	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)
$\log(IntUser)$	0.266*	0.084•	0.515***	0.174	-0.078	0.024
	(0.118)	(0.048)	(0.103)	(0.125)	(0.190)	(0.040)
$\log(GDP)$	2.784***	1.206***	3.576***	0.878	2.339**	1.371***
	(0.454)	(0.310)	(0.547)	(0.875)	(0.769)	(0.218)
$\log(POP)$	-4.588*	-0.438	-11.645***	-0.377	2.843	-0.156
	(2.324)	(0.398)	(2.448)	(0.663)	(3.795)	(0.588)
$\log(REER)$	-0.168	0.717***	-0.252	0.656*	0.132	0.805***
	(0.373)	(0.095)	(0.328)	(0.308)	(0.676)	(0.107)
$\frac{TT}{GDP}$ (%)	0.136***	0.004**	0.168***	0.003•	0.071*	0.007***
	(0.027)	(0.001)	(0.035)	(0.002)	(0.032)	(0.002)
$\frac{ST}{TT}$ (%)	0.019***	0.030***	0.031***	0.024***	0.024***	0.039***
	(0.005)	(0.003)	(0.007)	(0.005)	(0.006)	(0.003)
Sargan p-value	0.878	0.828	1.000	1.000	1.000	1.000
	(73)	(73)	(73)	(73)	(73)	(73)

- Significant codes: 0 “***” 0.001 “**” 0.01 “*” 0.05 “•” 0.1;
- The number in the brackets for the Sargan-statistic of each regression is the degree of freedom for the Chi-square distribution.

Table 4 illustrates GMM parameter estimates. The Sargan p-value quite clearly indicates that we cannot reject the null hypothesis; i.e., over-identifying restrictions are valid. After controlling for the countries' individual effects and using the second and the third lags of the $\log(SE)$, $\log(GDP)$, and $\log(POP)$ variables as GMM instruments; 1% increase in the number of internet users in the partner countries leads to 0.27% increase in services export in the reporting country in the combined group. Similar to the results from the Fixed-Effect (OLS) Estimation, GMM estimation results show that a 1% increase in the number of internet users in the partner countries leads to 0.52% increase in services export in the reporting country in developed country group, while having no such significant effect in developing countries. Similar positive significant effects on services import and export are reported for $\log(GDP)$, $\frac{TT}{GDP}$, and $\frac{ST}{TT}$, with an exception for $\log(GDP)$ and services import for developed countries. For instance, 1% increase in *GDP* of the partner countries leads to 2.78% increase in services export of the a reporting country and also 1% increase in GDP of a reporting country leads to 1.21% increase in its services import, within the combined group. Our results may indirectly replicate synergic effect on services export and import driven by the initial growth in GDP. In addition, 1% increase in the "share of total trade" and "share of service trade" leads to, respectively, 0.14% and 0.02%, increase in services export in the reporting country. For all the three regressions, changes in "share of total trade" lead to larger effect on services export than that of the same changes in "share of service trade". The results seem to suggest that the share of total trade is a better proxy measure of openness than the share of services trade.

Unexpected estimates appear with the two of the variables: i) an increase in the number of internet users in a reporting country shows no impact services import in that country in either groups of countries, and ii) an increase in population in the partner country leads to decrease in services export in the reporting country within the combined group. It also shows no impact on services import in either group of countries.

Finally, changes in the real effective exchange show an expected positive effect on services import and no effect on services exports. For instance, a 1% increase in the real effective exchange rate in the reporting country, among the combined group, leads to 0.72% increase in its service import. The results are consistent with those in the literature as depreciated currency and GDP growth both give boost to import.

Unlike the estimates from regressions for services exports, changes in one measure of trade openness, "share of total trade" lead to smaller effect on services import than changes in share of service trade, e.g., 1% increase in each leads to, respectively, 0.004% and 0.03% increase in services import in the reporting country. Although we are unable to infer from this paper why the two measures of openness affect services export and services import differently but, at least, it suggests some value in using them both instead of a combined measure.

6. Conclusion

This paper assesses the relationship between the Internet and international trade in services. While there are similarities and discriminating differences between trade in services and goods, it is widely believed that the recent rapid internet penetration has benefitted trade in services more than trade in goods. The study carries out an empirical estimation of the contribution of the internet to services export and import for a total of 63 developed and developing countries over the period of 2000-2014. As most explanatory variables are likely to be jointly endogenous with services export and import, we

run regression equations separately for the services export and import by using GMM approach developed for dynamic panel data settings.

Our results are, in general, consistent with previous findings in the literature that growth in internet and GDP as well as measures of trade-openness all have positive impact on services export and import. For instance, a 1% increase in internet users in the partner countries leads to 0.27% and 0.08% increase in services export and import, respectively, in the combined group of reporting countries. The impact of internet on services export appear larger for developed countries, 0.52%, and insignificant for developing countries. Unlike services export, services imports remain statistically unaffected by changes in internet when we run regressions separately for developed and developing countries. This may be interpreted as poor trade-enabling infrastructure to accompany internet penetration in developing countries to boost services trade.

For instance, within the combined group, 1% increase in GDP of the partner countries leads to 2.78% increase in services export of the a reporting country and also 1% increase in GDP of a reporting country leads to 1.21% increase in its services import. Our results suggest synergic effect on services export and import driven by the initial growth in GDP. The estimated coefficients of population appear significant while carrying unexpected (negative) signs. Finally, the real effective exchange rate is significant for the services import only.

For future research, our cross-country analysis can be extended to assess the impact of the internet on single-country trade on services. Such study, given availability of data, can yield valuable country-specific policy implications.

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Notes

Note 1. UNCTAD estimates that by 2019 the volume of global Internet traffic will increase by 66 times from what it was in 2005, UNCTAD (2017).

Note 2. Views on what is considered to be a "service transaction" are varied, Breinlich, H. and Chiara, C. (2011). The Manual on Statistics of International Trade in Services offers a "narrow" definition of the term "services" (ESA, 2002, p. 7), "Services are not separate entities over which ownership rights can be established. They cannot be traded separately from their production. Services are heterogeneous outputs produced to order and typically consist of changes in the condition of the consuming units realized by the activities of the producers at the demand of the customers. By the time their production is completed, they must have been provided to the consumers".

Note 3. For a list of similarities and differences between GATS and GATT rules, see Appendix 1.

Note 4. According to UNCTAD, there is a risk that digitization, where the network effects benefit the first movers, will lead to further polarization and widening of income inequalities as productivity gains may accrue mainly to a few already advanced economies, UNCTAD (2017).

Note 5. 1) Transportation (code 205), 2) Travel (code 236), 3) Communications services (code 245), 4) Construction services (code 249), 5) Insurance services (code 253), 6) Financial services (code 260), 7) Computer and information services (code 262), 8) Royalties and license fees (code 266), 9) Other business services (code 268), 10) Personal, cultural and recreational services (code 287), 11) Government services, i.e., (code 291).

Note 6. EBOPS code 200 is the total amount of Services Transaction value which may include transactions which cannot be classified clearly in 11 sub components of EBOPS, such as memorandum items which need to be recorded. "*Trade in Services Team, Statistics Division, Department of Economic and Social Affairs*".

Note 7. Trade partner World represents the total exports or imports of the reporter country, not specifying any particular trading partner. "*Trade in Services Team, Statistics Division, Department of Economic and Social Affairs*".

Note 8. GDP figures are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.

Note 9. Total population is based on the *de facto* definition of population, which counts all residents regardless of legal status or citizenship and the figures are midyear estimates.

Note 10. Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.

Note 11. Technically, the pooled OLS, the fixed and the random effect estimations are all special cases of GMM estimation.

Appendix 1

List of Countries

	Developed Countries	Developing Countries
1	Austria	Algeria
2	Bahamas	Armenia
3	Bahrain	Bolivia
4	Canada	Brazil
5	Chile	Bulgaria
6	Croatia	China
7	Cyprus	Colombia
8	Czech Rep.	Costa Rica
9	Denmark	Dominican Rep.
10	Finland	Ecuador
11	France	Georgia
12	Germany	Ghana
13	Greece	Malawi
14	Hungary	Malaysia
15	Ireland	Mexico
16	Israel	Nicaragua
17	Italy	Nigeria
18	Japan	Paraguay
19	Latvia	Philippines
20	Luxembourg	Romania
21	Netherlands	Samoa
22	New Zealand	Sierra Leone
23	Norway	Solomon Islands
24	Poland	South Africa
25	Portugal	Tunisia
26	Russian Federation	Uganda
27	Saudi Arabia	Ukraine
28	Singapore	Zambia
29	Slovakia	
30	Spain	
31	Sweden	
32	Trinidad and Tobago	
33	United Kingdom	
34	United States	
35	Uruguay	

Note. 1) There are 35 developed countries and 28 developing countries included, covering from 2000 to 2014, for which the data are available for all countries, years, and all variables that will be used in the model (and no sampling scheme is employed other than excluding the economies with missing values). Within these 63 economies, the list of developed economies is determined according to the World Bank classification of high-income economies, and the rest of economies are determined as developing economies.

2) For the trade data, the services trade data is from UN Comtrade, and the merchandise trade data is from the World Development Indicators (WDI); the data of other variables are from WDI.

Appendix 2

A Comparison of the Key WTO Rules for Measures Affecting Goods and Services Trade

	National Treatment	Customs Duties	Quotas
GATT Rules for goods trade	General obligation, permitting no exceptions, but applies only to internal measures.	Allowed where Members have not bound their tariffs at zero.	Not allowed except in certain emergencies.
GATS rules for services trade	Not a general obligation, applies only to sectors that a member has explicitly scheduled and there too may be subject to limitations. But applies to all measures affecting the supply a service.	Not allowed if a Member has committed to providing national treatment without limitations.	Allowed, unless a Member has committed to providing market access without limitations.

Appendix 3

Huchet-Bourdon, M. (2016) investigates contribution of openness to economic growth by proposing two new dimensions of countries' openness in world trade, i.e., "export quality" and "export diversification". The study suggests that, in the long run, more outward-oriented countries register better economic growth performance. In particular, the results confirm that countries exporting higher quality and diversified products grow more rapidly (Mattoo, A., & Schuknecht, L., 1999).