The impact of information and communication technologies on bilateral trade in services

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Abstract: This paper examines the impact of information and communication technologies (ICT) on bilateral trade in services. Two sets of measurements are included in our estimation models: (1) trade determinants - GDP, population, common language and distance and (2) ICT determinants - fixed broadband, fixed telephone, internet and mobile-cellular phone. Each ICT variable is disaggregated to estimate and compare for their individual impacts using three variations of service trade: (a) service trade - (a) sum of service export and service import, (b) service export and (c) service import. Data from 2000 to 2013 on the USA and 34 partnering countries are tested on a total of six models. Two estimation models are used: (1) fixed effect model and (2) pooled ordinary least squares. We find that trade determinants such as GDP, population and common language have significant impacts for all three variations of service trade. Distance shows mixed results. We also find that ICT determinants such as fixed broadband and fixed telephone have significant impacts on service trade, service export and service import. Mobile-cellular phone is insignificant for all three variations of service trade. Finally, the internet is significant for service trade and service export, but not service import.

Keywords: bilateral trade in services; fixed broadband; fixed telephone; information and communicative technologies; internet; mobile-cellular phone; service export; service import; service trade; services; trade.


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1 Introduction

In the past two decades, information technologies and the internet have changed our world at an unbelievable speed (Li and Tang, 2013). Information and communicative technologies (ICT) has become increasingly important in today’s global trade environment. Increased ICT access has decreased transaction and search costs between enterprises and consumers. Such changes have reinterpreted how enterprises go beyond traditional trade zones in the past. Furthermore, ICT has greatly empowered consumers with easier and greater access to information, and allowed enterprises to move towards greater innovation in the way businesses are run. Regulatory boundaries have been broken and cut across countries and trade zones never possible before. Trade in services is one prominent area of which ICT has played a predominant role in propelling its growth globally.

In the past years, we have witnessed the increasing ubiquity of trade in services taking across all platforms globally due to dynamic advancements of ICT. Figure 1 shows the trade in services, in terms of exports and imports, from 1995 to 2014 for a total of 24 countries. The US remains the top exporter and importer of services from 1995 to 2014. The trading volume of services in the US in 2014 was at USD7105 billion compared to USD219 billion in 1995, an increase of 214%. As of 2014, the US is the world’s largest service trader, holding a 14.1% global market share in service export and 9.6% global market share in service import (Thirlwell, 2015).

Figure 1 Trade in services, exports/imports (in millions, US dollars) 1995–2014 (see online version for colours)

As illustrated in Figure 2, we see a constant growth of US trade in services as a percentage of its gross domestic product (GDP) from 1960 to 2015. In 1995, the total value of US trade in services was at USD219 billion, accounting for about 22% of its GDP. By 2015, the total value of US trade in services rose to USD7105 billion, an increment of 214% compared to 1995. By 2015, US trade in services accounted for 28% of its GDP (World Bank, 2016).
Trade in services has been largely confined to developed nations such as the US. Coincidentally, or not, internet access in developed nations such as the US has also held leading positions over the past two decades. The percentage of US population with internet penetration is at 88.6% in 2017, the highest in the world (Internet World Stats, 2017). Based on the aforementioned phenomenon, this study attempts to investigate whether growth in ICT penetration over the years has an impact on trade in services, or is this just a mere coincidence?

Most existing studies use measurements that are not recent enough to reflect advancements in ICT and focus on trade in goods. For example, Freund and Weinhold (2002, 2004), Clarke and Wallsten (2006) and Choi (2010) use the number of internet hosts. Due to the unavailability and incomplete data at the time of their studies, Clarke (2002) uses surveys as their only proxy for their internet data from mid-1999; and Clarke and Wallsten (2006) use survey data from 2001. Choi (2010) is the first to use time-series data from 1990 to 2006, but their study only used one internet variable for their measurement of ICT. Although Vemuri and Siddiqi (2009) claim that it was not only until the time of their study, they were able to use a sufficiently lengthy series of data and included three ICT variables:

1. telephone lines
2. number of personal computers
3. number of internet users - the ICT variables used in their study cannot be considered recent (1985–2005) or sufficient enough to represent recent ICT technologies such as those used in our study such as fixed broadband, fixed telephone, mobile-cellular and the internet.

In a later study by Liu and Nath (2013), they attempt to improve upon previous studies using four ICT variables: total annual investment in telecom, international internet bandwidth (Mega Bits per second), total fixed (wired) broadband internet subscriptions per 100 people and the number of internet hosts per 100 people. However, the study by Liu and Nath (2013) is confined to emerging market economies only. The results of their study may be biased towards emerging market economies and unable to fully represent ICT’s impact on developed nations such as the US.

Tay (2015) improves on the study by Liu and Nath (2013) by focusing on a matured leader of trade in services - the US. Tay (2015) uses four measurements of ICT to...
In this study, we close the gaps in existing literature as aforementioned in the following ways. First, we use recent ICT variables including fixed broadband, fixed telephone, mobile-cellular and the internet. Second, we examine the individual effects of each ICT variable on trade in services. We do so comparing the impact of each of our ICT variables using three variations of service trade:

1. Service trade - sum of service export and service import
2. Service import
3. Service export, separately.

Third, we argue that ICT alone cannot impact trade in services. It is a combination of traditional trade factors along with ICT that contribute to trade in services. It has been long proven in international trade literatures that trade determinants such as GDP, population, common language and distance (Kimura and Lee, 2006; Ceglowski, 2006; Brouthers and Hennart, 2007; Helpman et al., 2008; Anderson, 2010) also impact trade. Thus, in this study, we improve upon existing studies (Clarke, 2002; Freund and Weinhold, 2002, 2004; Choi, 2010) by including two sets of measurements. The first set of measurements is related to trade determinants (GDP, population, common language and distance) and the second set of measurements is related to ICT (fixed broadband, fixed telephone, internet and mobile-cellular phone). Fourth, we posit that our study will provide a better understanding as to how each ICT variable including fixed broadband, fixed telephone, internet and mobile-cellular phone can be better capitalised, developed and applied to boost trade in services, in particular, in developed economies. In addition, the results of this study will also provide a better understanding for countries that are contemplating to improve on their development, access and applications of various ICT tools to boost service export and service import.

To investigate the impact of trade and ICT determinants on bilateral trade in services, we estimate our models using the fixed effects model (FEM) and pooled ordinary least squares (OLS) method. Two sets of measurements are included in our models. The first set of measurements is related to trade determinants (GDP, population, common language and distance). This first set of measurements has been proven robust in existing trade studies since the 1960s (Tinbergen, 1962; Poyhonen, 1963; Bergstrand, 1985; Kimura and Lee, 2006; Ceglowski, 2006; Brouthers and Hennart, 2007; Helpman et al., 2008; Anderson, 2010). Our second set of measurements includes four ICT sub-variables: fixed broadband, fixed telephone, internet and mobile-cellular phone. We disaggregate each ICT variable and estimate as well as compare their impact on three variations of service trade:

1. Service trade - sum of service export and service import
2. Service export
Using data from 2000 to 2013 on the US and 34 partnering countries, we investigate the impact of ICT on these two sets of measurements.

The rest of this paper is arranged as follows: Section 2 reviews the related literature. Section 3 discusses the model, data and measurement issues, Section 4 presents the empirical results and Section 5 discusses and concludes the article.

2 Literature review

It was not until the inauguration of the internet in the late 1990s that literature investigating the impact of ICT and/or the internet became increasingly popular in international trade studies. One of the first studies to emerge in this area was by Clarke (2002). Clarke (2002) investigates whether internet use affects trade in goods using data from 20 low- and middle-income countries in Eastern Europe and Central Asia. They conclude that enterprises with internet connections export more as a share of their total sales than enterprises without connections. Freund and Weinhold (2002) investigate how the internet affects international trade in services. In their study, they consider US exports and imports of 14 service items to and from 31 countries between 1995 and 1999. They find that the internet development in those countries has significant positive effect on bilateral trade with the US. In a subsequent study, Freund and Weinhold (2004) investigate trade in goods of 56 countries using data from 1997 to 1999. Results suggest that a 10% point increase in the growth of web hosts in a country leads to about a 0.2% point increase in export growth. For an average country in their sample, the internet contributed to about a 1% point increase in annual export growth. They also find evidence that trade growth is lower for more distant countries.

Vemuri and Siddiqi (2009) test the proposition that ICT and the internet have on trade in goods. They use the balanced panel data for 64 countries for the years 1985 to 2005. ICT measurements such as telephone lines, number of personal computers and number of internet users are used in their study. To estimate their models, they use the Hausman and Taylor and other panel data methods. International trade activity is compared before and after commercialisation of the internet. The results of their study show positive and significant effects of ICT infrastructure and internet availability for commercial transactions on the volume of international trade in goods.

Choi (2010) tests whether an increase in the internet increases service trade using panel data for 151 countries from 1990 to 2006. The distance variable is omitted and service trade is used as their dependent variable. Only one internet variable is included, that is, internet users per hundred people. Choi (2010) finds that doubling of internet usage in a country leads to a 2–4% increase in trade in services. Furthermore, an increase in a country’s internet access has a positive impact on service trade with other countries.

Mattes et al. (2012) examine the effects of availability and use of ICT on trade using data from the European Union (EU) countries. Although they do not find any significant effect of ICT on EU trade, their results suggest that trade is enhanced if both trading partners are advanced users of ICT. Liu and Nath (2013) examine the effects of ICT on international trade using panel data for 40 emerging market economies from 1995 to 2010. The ICT variables used in their study include internet bandwidth, internet hosts, internet subscriptions and telecom investment. Their results overwhelmingly suggest that internet subscriptions and internet hosts have significant positive effects on both exports and imports in emerging market economies.
More recently, Tay (2015) investigates how the internet impacts trade in education over three time frames: 2000–2006, 2007–2012 and 2000–2012 using 189 countries. Their study finds that the internet facilitates trade in education, the impact of which is between 16.4 and 21% for every 0.01% increase in internet access. Tay (2015) finds mixed results for fixed (wired) broadband over the three time frames. The results explain between 63.2 and 74.9% of the impact of the internet on trade in education.

Upon literature review, we find several gaps of which we attempt to close in this study. First, existing studies by Choi (2010), Clarke and Wallsten (2006) and Freund and Weinhold (2002, 2004) use the number of internet hosts as their main independent variables for ICT. To improve upon the latter studies, on top of using four ICT variables, we also disaggregated them into four categories: fixed broadband, fixed telephone, mobile-cellular and the internet. Second, data and measurements used in existing studies are not recent enough to reflect advancements of ICT or the basket of ICT tools available in recent years. For example, due to the unavailability and incomplete data, Clarke (2002) uses surveys as their only proxy for their internet data from the mid-1999; Clarke and Wallsten (2006) use data from 2001; Vemuri and Siddiqi (2009) use measurements such as telephone lines, number of personal computers and number of internet users. To close such a gap, this study uses recent data on ICT from 2000 to 2013, and ICT measurements such as fixed broadband, fixed telephone, internet and mobile-cellular phone, which we posit better reflects recent advancements of ICT and the basket of ICT tools available in recent years.

Third, although ICT measurements used by Tay (2015) are rather recent, but this study mainly focuses on US trade in education. The results of the study by Tay (2015) may be biased towards trade in education and unable to properly represent trade in services. Thus, this study improves upon the study by Tay (2015) by focusing specifically on trade in services. In addition, we estimate the impact of each of the four aforementioned ICT variables on three sub-variations of service trade, namely,

1. service trade - sum of service export and service import
2. service export
3. service import.

We also investigate further, by comparing the impact of each ICT variable on

1. sum of service export and service import
2. service export
3. service import, separately.

Fourth, we improve upon existing studies by Mattes et al. (2012) which examines ICT impact of trade in European Union (EU) countries, and Liu and Nath (2013) which examines ICT impact on emerging countries, by focusing on a long-standing top trader of both service export and service import for the past two decades - the US. By doing so, we are able to examine whether trade in services, currently, being largely dominated by developed nations such as the US; and if increased access to the internet by a country’s population, both have positive impact on trade in services, or is this just a matter of mere coincidence?
3 Data and methodology

3.1 Data

The data for this study are obtained for the period 2000–2013 from several archival sources. Data on service export and service import are from the US Bureau on Economic Analysis (2000–2013) which comprise of service trade, service export and service import. The list of 34 countries used in this study is illustrated in Appendix A.

Data on trade in services are measured using US international services which consists of services provided by and to the US in international markets through all four modes of supply of services:

1. cross-border supply
2. consumption abroad
3. commercial presence
4. presence of natural persons.

International services statistics include detailed annual information on trade in services, which is trade in the conventional sense, and on services supplied through the channel of direct investment by affiliates of multinational enterprises.

Data on trade in services include nine categories: maintenance and repair services; transport; travel (for all purposes including education); insurance services; financial services; charges for the use of intellectual property; telecommunications, computer, and information services; other business services; and government goods and services. The trade statistics cover both affiliated and unaffiliated transactions between US residents and foreign residents. Affiliated transactions consist of intra-firm trade within multinational enterprises - trade between US parent companies and their foreign affiliates and trade between US affiliates and their foreign parent groups. Unaffiliated transactions are with foreigners that neither own, nor are owned by, the US party to the transaction.

Data on ICT are obtained from International Telecommunication Union (ITU, 2000–2013). ITU is one of the United Nation’s groups with the most reliable source of data for the information and communications technology sector. The ITU develops a composite index to monitor and compare development of ICT across countries called the ICT Development Index, reflecting the level of ICT readiness, ICT intensity and ICT skills in a respective country. Indicators of ICT readiness include fixed-telephone line penetration, mobile-cellular telephone subscriptions, international internet bandwidth (bit/s) per internet user, the percentage of households with a computer and percentage of households with internet access. ICT intensity indicators include percentage of individuals using the internet and fixed (wired)-broadband subscribers per 100 inhabitants. Data are obtained compositely from variable sources including the ITU (2000–2013), World Bank (2000–2013) US Census Bureau (2000–2013), US Central Intelligence Agency (2000–2013) and Internet Live Stats (2000–2013) and Internet World Stats (2000–2013).

Data on the GDP (per capita, in US dollars) and population are obtained from the IMF (2000–2013). Information on common language is obtained from the US Central Intelligence Agency (2000-2013). Distance between partnering countries is calculated using Mapcrown Travel Distance Calculator (2000-2013).
3.2 Methodology

Generally, the FEM and pooled OLS estimation models have been widely used in many existing international trade studies in various contexts. The FEM is the most appropriate way to exploit the panel nature of a data set without making heroic assumptions (Glick and Rose, 2002). Above and beyond econometric robustness, the fixed effect estimator has one enormous advantage. In the FEM, the intercept terms are allowed to vary over the individual unit, but are held constant over time (Tay, 2015). Serlenga and Shin (2007) point out that the fixed effects estimation model is preferable when there is an assumption that there are unobserved individual effects that are uncorrelated with all the regressors as it omits time invariant variables. The FEM, thus, allows us to avoid heterogeneity biasness (Baltagi, 2008).

On the other hand, the pooled OLS estimation technique does not omit time invariant variables that may cause biasness in our results, sometimes also called heterogeneity bias (Serlenga and Shin, 2007; Baltagi, 2008). The use of OLS as an estimation methodology may suffer from heterogeneity bias (Cheng and Wall, 2005). Trade between any pair of countries is likely to be influenced by certain unobserved individual effects. If these effects are correlated with the explanatory variables, which an examination of the OLS residuals supports, this will lead to pooled OLS estimates being biased (Tay, 2015).

Currently, there exists no econometric estimator that would strictly dominate all the others as each holds some advantages and disadvantages over the other. For that reason, we include two estimation methods: the FEM and pooled OLS, as presented in the following sections.

3.2.1 Fixed effects model

In this section, we formulate our models to investigate the impact of ICT on bilateral trade in services using the FEM. Three variations of service trade are applied:

1. service trade - sum of service export and service import
2. service export
3. service import.

Thus, our dependent variable consists of three variations of bilateral trade in services from/to country, u to/from country, j, where, t = 2000...2013.

The first variation for our FEM is where our dependent variable is the sum of service export and service import. Equation (1) shows the first variation, where \( \log TS_{u \leftrightarrow j} \) is the sum of service export and service import from/to country, u, to/from country, j, and time, \( t = 2000...2013 \).

\[
\log TS_{u \leftrightarrow j} = \sum_{j=1}^{34} \left( a_{u \leftrightarrow j} + \theta_{j-u} \right) \tag{1}
\]

\( \sum_{j=1}^{34} \left( a_{u \leftrightarrow j} + \theta_{j-u} \right) \) is the sum of service export and service import from/to country, u, to/from country j, at time, t. The total number of countries is where \( j = 1...34 \).

Equation (2) shows the second variation, where \( \log SE_{v \leftrightarrow j} \) is the service export from/to country, u to/from country, j, and, time, \( t = 2000...2013 \).
\[ \log \text{SE}_{u+j, t} = \sum_{j=1}^{34} a_{u+j, t} \]  

(2)

\[ \sum_{j=1}^{34} a_{u+j, t} \]  
is the service export from/to country, \( u \), to/from country \( j \), at time, \( t \). The total number of countries is where, \( j = 1 \ldots 34 \).

Equation (3) shows the third variation, where \( \log \text{SI}_{j+u, t} \) is the service import from/to country, \( j \) to/from country, \( u \), and, time, \( t = 2000 \ldots 2013 \). The total number of countries is where, \( j = 1 \ldots 34 \).

\[ \log \text{SI}_{j+u, t} = \sum_{j=1}^{34} \theta_{j+u, t} \]  

(3)

where \( \log \sum_{j=1}^{34} \theta_{j+u, t} \) is the logarithm used to represent service import from/to country, \( j \) to/from country, \( u \), in time, \( t \).

We formulate three separate equations for our FEM that take into account the three variations of bilateral trade in services: Eq. (4) - service trade (sum of service export and service import); Eq. (5) - service export and Eq. (6) - service import.

\[ \log \sum_{j=1}^{34} \left( a_{u+j, t} + \theta_{j+u, t} \right) = \beta_0 + \beta_1 \log \text{GDP}_{ujt} + \beta_2 \log \text{POP}_{ujt} + \beta_3 \log \text{FB}_{ujt} \]

\[ + \beta_4 \log \text{FT}_{ujt} + \beta_5 \log \text{MB}_{ujt} + \beta_6 \log \text{INT}_{ujt} + \gamma_u + \gamma_j + u_{ujt} \]  

(4)

where \( \log \sum_{j=1}^{34} \left( a_{u+j, t} + \theta_{j+u, t} \right) \) is the logarithm used to represent the sum of service import and service export from/to country, \( u \) to/from country, \( j \) in time, \( t \).

Equation (5) estimates the impact of ICT and trade on service export as follows:

\[ \log \sum_{j=1}^{34} a_{u+j, t} = \beta_0 + \beta_1 \log \text{GDP}_{ujt} + \beta_2 \log \text{POP}_{ujt} + \beta_3 \log \text{FB}_{ujt} + \beta_4 \log \text{FT}_{ujt} \]

\[ + \beta_5 \log \text{MB}_{ujt} + \beta_6 \log \text{INT}_{ujt} + \gamma_u + \gamma_j + u_{ujt} \]  

(5)

where \( \log \sum_{j=1}^{34} a_{u+j, t} \) is the logarithm used to represent service export from/to country, \( u \) to/from country, \( j \), in time, \( t \).

Equation (6) estimates the impact of ICT and trade on service import as follows:

\[ \log \sum_{j=1}^{34} \theta_{j+u, t} = \beta_0 + \beta_1 \log \text{GDP}_{ujt} + \beta_2 \log \text{POP}_{ujt} + \beta_3 \log \text{FB}_{ujt} + \beta_4 \log \text{FT}_{ujt} \]

\[ + \beta_5 \log \text{MB}_{ujt} + \beta_6 \log \text{INT}_{ujt} + \gamma_u + \gamma_j + u_{ujt} \]  

(6)

where \( \log \sum_{j=1}^{34} \theta_{j+u, t} \) is the logarithm used to represent service import from/to country, \( j \) to/from country, \( j \), in time, \( t \).
Implicitly, ICT, by itself, cannot stimulate trade. Thus, having a set of ICT measurements alone is insufficient to reflect all the various aspects of its impact on trade in services as it has been long proven in international trade literatures that other trade determinants such as GDP, population, common language and distance (Kimura and Lee, 2006; Ceglowski, 2006; Brouthers and Hennart, 2007; Helpman et al., 2008; Anderson, 2010) also impact trade. It is a combination of trade determinants, along with ICT determinants that act as stimuli.

Both GDP per capita \((\log \text{GDP}_{ujt})\) and population \((\log \text{POP}_{ujt})\) are included as independent variables to control for income effects and country size. Moreover, they represent two commonly used determinants in international trade studies. Thus, these two trade determinants have been included in the right-hand side of our Eqs. (4–6). The first trade determinant, \(\log \text{GDP}_{ujt}\) refers to the GDP per capita of services trade from/to country, \(u\) to/from country, \(j\) in time, \(t\). We expect that when the market size of a foreign economy is large that there are greater potential to trade with that country. Moreover, the higher level of income in a country, the higher the tendency to adopt different ICT technologies, which in turn, increases the bilateral trade in services. The coefficient of \(\beta_1\) is expected to be positive. The second trade determinant, \(\log \text{POP}_{ujt}\) refers to the population from/to country, \(u\) to/from country, \(j\) in time, \(t\). We expect that the higher the population of a country in relation to other countries, the greater the percentage of its population to adopt different ICT technologies. This, in turn, increases bilateral trade in services. The coefficient of \(\beta_2\) is expected to be positive.

Also, on the right-hand side of Eqs. (4–6), our ICT variables have been disaggregated into four sub-variables:

1. fixed broadband subscriptions (\(\text{FB}_{ujt}\))
2. fixed telephone (\(\text{FT}_{ujt}\))
3. mobile phones subscriptions (\(\text{MB}_{ujt}\))
4. internet subscriptions (\(\text{INT}_{ujt}\)).

Other control variables have also been included in the right-hand side of our equations - country fixed effects (\(\gamma_u\)), \(\gamma_j\), time-specific effects (\(\gamma_t\)) and random disturbance effects (\(\epsilon_{uitt}\)). The coefficients \(\beta_3\) and \(\beta_4\) are expected to be positive, whereas the coefficients of \(\beta_5\) and \(\beta_6\) are expected to be negative.

### 3.2.2 Pooled ordinary least squares

In this section, we formulate models to investigate the impact of ICT on bilateral trade in services using the pooled OLS methodology. Three variations of service trade are applied:

1. service trade - sum of service export and service import
2. service export
3. service import.

Thus, our dependent variable consists of three variations of bilateral trade in services from/to country, \(u\) to/from country, \(j\), where, \(t = 2000\ldots2013\).

The first variation for our pooled OLS model is where our dependent variable is the sum of service export and service import. Equation (7) shows the first variation, where
log AS\textsubscript{u\rightarrow j, t} is the service trade - sum of service export and service import from/to country, u \rightarrow from/to country, j, and time, t = 2000…2013.

\begin{equation}
\log AS_{u\rightarrow j, t} = \sum_{j=1}^{34} (V_{u\rightarrow j, t} + P_{j \rightarrow u, t}) \tag{7}
\end{equation}

where \(\sum_{j=1}^{34} (V_{u\rightarrow j, t} + P_{j \rightarrow u, t})\) is the sum of service export and service import from/to country, u \rightarrow from/to country j, at time, t. The total number of countries is where \(j = 1…34\).

Equation (8) shows the second variation, where \(\log AE_{u\rightarrow j, t}\) is the service export from/to country, u \rightarrow from/to country, j, and time, t = 2000…2013.

\begin{equation}
\log AE_{u\rightarrow j, t} = \sum_{j=1}^{34} V_{u\rightarrow j, t} \tag{8}
\end{equation}

where \(\sum_{j=1}^{34} V_{u\rightarrow j, t}\) is the service export from/to country, u \rightarrow from/to country j, at time, t. The total number of countries is where, \(j = 1…34\).

Equation (9) shows the third variation, where \(\log AI_{j \rightarrow u, t}\) is the service import from/to country, j \rightarrow to/from country, u, and, time, t = 2000…2013. The total number of countries is where, \(j = 1…34\).

\begin{equation}
\log AI_{j \rightarrow u, t} = \sum_{j=1}^{34} P_{j \rightarrow u, t} \tag{9}
\end{equation}

where \(\sum_{j=1}^{34} P_{j \rightarrow u, t}\) is the logarithm used to represent service import from/to country, j \rightarrow to/from country, j in time, t.

We formulate three separate equations for our pooled OLS methodology that take into account the three variations of bilateral trade in services: Eq. (10) - service trade (sum of service export and service import); Eq. (11) - service export and Eq. (12) - service import.

\begin{equation}
\sum_{j=1}^{34} (V_{u\rightarrow j, t} + P_{j \rightarrow u, t}) = \beta_0 + \beta_1 \log GDP_{u, t} + \beta_2 \log POP_{u, t} + \beta_3 \log CL_{u, t} + \beta_4 \log DIST_{u, t} + \beta_5 \log FB_{u, t} + \beta_6 \log FT_{u, t} + \beta_7 \log MB_{u, t} + \beta_8 \log INT_{u, t} + \gamma_u + \gamma_j + u_{ij} \tag{10}
\end{equation}

where \(\sum_{j=1}^{34} (V_{u\rightarrow j, t} + P_{j \rightarrow u, t})\) is the logarithm used to represent the sum of service import and service export from/to country, u \rightarrow from/to country, j in time, t.

Equation (11) estimates the impact of ICT and trade on service export as follows:

\begin{equation}
\sum_{j=1}^{34} V_{u\rightarrow j, t} = \beta_0 + \beta_1 \log GDP_{u, t} + \beta_2 \log POP_{u, t} + \beta_3 \log CL_{u, t} + \beta_4 \log DIST_{u, t} + \beta_5 \log FB_{u, t} + \beta_6 \log FT_{u, t} + \beta_7 \log MB_{u, t} + \beta_8 \log INT_{u, t} + \gamma_u + \gamma_j + u_{ij} \tag{11}
\end{equation}
where $\sum_{j=1}^{34} \gamma_{u-j,t}$ is the logarithm used to represent service export from/to country, u to/from country, j in time, t.

Equation (12) estimates the impact of ICT and trade on service import as follows:

$$\sum_{j=1}^{34} p_{j-u,t} = \beta_0 + \beta_1 \log GDP_{u,t} + \beta_2 \log POP_{u,t} + \beta_3 \log CL_{u,t} + \beta_4 \log DIST_{u,t} + \beta_5 \log FB_{u,t} + \beta_6 \log FT_{u,t} + \beta_7 \log MB_{u,t} + \beta_8 \log INT_{u,t} + \gamma_u + \gamma_j + \gamma_t + u_{u,t}$$

Equation (12)

where $\sum_{j=1}^{34} p_{j-u,t}$ is the logarithm used to represent service import from/to country, j to/from country, j in time, t.

As mentioned in Section 3.2.1, ICT, by itself, cannot stimulate trade. We include a total of four trade determinants for our pooled ordinary least squared method:

1. GDP
2. Population
3. Common language
4. Distance.

Common language and distance are time invariant variables that have been excluded in our FEM in Section 3.2.1, but are now embedded into our pooled ordinary least squared estimation model. Thus, a total of four trade determinants are included in the right-hand side of our equations. The first trade determinant, $\log GDP_{u,t}$ refers to the GDP per capita of services trade from/to country, u to/from country, j in time, t. We expect that the larger the market size of a foreign economy, the greater potential to trade with that country. Moreover, the higher the level of income in a country, the higher the tendency of that country’s population to adopt different ICT technologies, which in turn, increases bilateral trade in services. The coefficient of $\beta_1$ is expected to be positive. The second trade determinant, $\log POP_{u,t}$ refers to the population from/to country, u to/from country, j in time, t. We expect that the higher the population of a country in relation to other countries, the greater the percentage of its population to adopt different ICT and internet technologies which, in turn, increases bilateral trade in services. The coefficient of $\beta_2$ is expected to be positive. The third trade determinant is a dummy variable: common language $(CL_{u,t})$. If a partnering country has a common language, either English or Spanish with the US, then a value of 1 is assigned, which otherwise, would assume a value of 0. It is hypothesised that existence of a common language between two partnering countries enhances bilateral trade in services. The reason being that the existence of a common language between the US and a partnering country is much likely to lower the search and communication costs and hence boost trade. In order to incorporate such a linguistic tie, we include a dummy variable for the countries which use the same language. Thus, the coefficient of $\beta_3$ is expected to be positive. Traditionally, trade models not only use distance to model trade costs in terms of transport costs (Bouheas et al., 1999), but also public infrastructure (Zarzoz and Lehmann, 2003). Our fourth trade determinant, $\log DIST_{u,t}$ refers to the log of physical distance of country u from j. We expect distance to be a trade barrier. Thus, the coefficient of $\beta_4$ is expected to be negative since it is a proxy for all possible trade costs.
A second set of measurements that predict the impact of ICT on bilateral trade in services are included on the right-hand side of our estimation models. These ICT variables have been disaggregated into four sub-variables including
1. fixed broadband subscriptions (FB)})
2. fixed telephone (FT)
3. mobile phones subscriptions (MB)
4. internet subscriptions (INT).

Other control variables have also been included in the right-hand side of our equations - country fixed effects (γu), and (γj), time-specific effects (γt) and random disturbance effects (uit). The coefficients β5 and β6 are expected to be positive, whereas the coefficients of β7 and β8 are expected to be negative.

4 Empirical results

4.1 Fixed effects models estimation

Models (a–c) in Table 1 present the estimation results for our fixed-effects model for service trade, service export and service import, respectively. Coefficients of determination (R²) are 0.706, 0.659 and 0.459 for service trade, service export and service import, respectively. Our model fits the data well, explaining 70.6% of service trade, 65.9% of service export and 45.9% of service import.

**Table 1**   Fixed effects model, 2000–2013

<table>
<thead>
<tr>
<th>Models</th>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variables</td>
<td>Service trade</td>
<td>Service export</td>
<td>Service import</td>
</tr>
<tr>
<td>a Log (GDP)</td>
<td>0.780*** (13.143)</td>
<td>0.831*** (11.702)</td>
<td>0.522*** (5.474)</td>
</tr>
<tr>
<td>b Log (POP)</td>
<td>0.258*** (12.357)</td>
<td>0.306*** (12.253)</td>
<td>0.235*** (6.955)</td>
</tr>
<tr>
<td>c Log (FB)</td>
<td>0.130*** (3.858)</td>
<td>0.143*** (3.528)</td>
<td>0.215*** (3.971)</td>
</tr>
<tr>
<td>d Log (FT)</td>
<td>0.293*** (6.706)</td>
<td>0.301*** (5.743)</td>
<td>0.356*** (5.022)</td>
</tr>
<tr>
<td>e Log (MB)</td>
<td>−0.025 (0.468)</td>
<td>−0.064 (−0.976)</td>
<td>−0.123 (−1.399)</td>
</tr>
<tr>
<td>f Log (INT)</td>
<td>−0.249*** (−3.153)</td>
<td>−0.241*** (−2.551)</td>
<td>−0.108 (−0.843)</td>
</tr>
<tr>
<td>Constant</td>
<td>−4.429*** (−6.010)</td>
<td>−5.736*** (−6.501)</td>
<td>−3.516*** (−2.955)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.706</td>
<td>0.659</td>
<td>0.490</td>
</tr>
<tr>
<td>No. of countries</td>
<td>34</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Observations</td>
<td>447</td>
<td>447</td>
<td>451</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>2.301</td>
<td>2.348</td>
<td>1.948</td>
</tr>
<tr>
<td>F-test</td>
<td>179.914</td>
<td>144.847</td>
<td>73.073</td>
</tr>
</tbody>
</table>
Table 1  Fixed effects model, 2000–2013 (continued)

<table>
<thead>
<tr>
<th>Models</th>
<th>Fixed effects model (FEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a)</td>
</tr>
<tr>
<td>Dependent variables</td>
<td>Service trade</td>
</tr>
<tr>
<td>VIF values</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>d</td>
</tr>
<tr>
<td></td>
<td>e</td>
</tr>
<tr>
<td></td>
<td>f</td>
</tr>
</tbody>
</table>

*Significant at 10%, **significant at 5%, ***significant at 1%, ****significant at 0.01%

Notes: $t$-Statistics are in parentheses; The explanatory variables are as follows: (a) GDP = gross domestic product, (b) POP = population, (c) FB = fixed broadband internet subscribers (per 100 people), (d) FT = fixed-telephone line penetration (per 100 people), (e) MB = mobile-cellular telephone subscriptions, (f) INT = percentage of population who used the internet (from any location) in the last 12 months; VIF values are reported for each of the explanatory variables (a)–(f).

The coefficient values for GDP are 0.780, 0.831 and 0.522 for service trade, service export and service import, respectively. GDP is also positive and highly significant at the 0.01% level for service trade, service export and service import. The coefficient values for population are 25.8, 30.6 and 23.5% for service trade, service export and service import, respectively. Population is also positive and highly significant at the 0.01% level for service trade, service export and service import.

The coefficient values for fixed broadband are 0.130, 0.143 and 0.215 for service trade, service export and service import, respectively. Fixed broadband subscribers are all positive and significant at the 0.01% levels. This implies that a 0.01% increase in fixed broadband internet subscribers per 100 people increases service trade by 13%, increases service export by 14.3% and increases service import by 21.5%.

The coefficient values for fixed telephone line penetration (per 100 people) are 0.293, 0.301 and 0.356 for service trade, service export and service import, respectively. Fixed telephone line penetration per 100 people are all significant and positive at the 0.01% levels. This implies that a 0.01% increase in fixed telephone penetration per 100 people increases service trade by 29.3%, service export by 30.1% and service import by 35.6%.

The coefficient values for mobile-cellular telephone subscriptions are $-0.025$, $-0.064$ and $-0.123$ for service trade, service export and service import, respectively. Mobile-cellular telephone subscriptions pose negative values and all appear insignificant for service trade, service export and service import.

The coefficient values for the internet are $-0.249$, $-0.241$ and $-0.108$ for service trade, service export and service import, respectively. The internet poses negative values and is significant at the 0.01% level for service trade and significant at the 1% level for service export. However, it is insignificant for service import. This implies that for every 0.01% increase in the percentage of population who uses the internet (from any location) in the last 12 months, internet, service trade increases by 24.9%
for every 1% increase in the percentage of population who used the internet from any location in the last 12 months, internet service export increases by 24.1%.

We test for heterogeneity in our FEM using two tests:
1. Variance inflation factor (VIF)

According to Kutner et al. (2005), a VIF value higher than 10 indicates multicollinearity. There are no signs of multicollinearity since all our VIF values for models (a–c) are between 1.534 and 7.696. Our second test for multicollinearity using the Durbin-Watson test also shows no signs of heterogeneity since all our values are less than 2.50 (1.948–2.348).

### 4.2 Pooled ordinary least squares estimation

We begin by estimating the gravity equation using OLS. Initially, the observations are pooled for service trade, service export and service import in the dataset. Coefficients of determination ($R^2$) are 0.742, 0.672 and 0.515 for service trade, service export and service import, respectively. The model fits the data well, explaining 74.2% of the variation in trade flows for service trade, 67.2% of the variation in trade flows for service export and 51.5% of the variation in trade flows for service import. The results of our OLS estimations are presented in Table 2, models (d–f).

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Pooled ordinary least squares, 2000–2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Models</strong></td>
<td><strong>Pooled ordinary least squares (OLS)</strong></td>
</tr>
<tr>
<td>Dependent variables</td>
<td>Service trade</td>
</tr>
<tr>
<td>a Log (GDP)</td>
<td>0.932**** (15.408)</td>
</tr>
<tr>
<td>b Log (POP)</td>
<td>0.241**** (11.955)</td>
</tr>
<tr>
<td>c Log (CL)</td>
<td>0.435**** (6.554)</td>
</tr>
<tr>
<td>d Log (DIST)</td>
<td>−0.043**** (−4.319)</td>
</tr>
<tr>
<td>e Log (FB)</td>
<td>0.117**** (3.645)</td>
</tr>
<tr>
<td>f Log (FT)</td>
<td>0.387**** (8.908)</td>
</tr>
<tr>
<td>g Log (MB)</td>
<td>−0.021 (−0.412)</td>
</tr>
<tr>
<td>h Log (INT)</td>
<td>−0.310**** (−4.112)</td>
</tr>
<tr>
<td>Constant</td>
<td>−6.949**** (−8.733)</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.742</td>
</tr>
<tr>
<td>No. of countries</td>
<td>34</td>
</tr>
<tr>
<td>Observations</td>
<td>447</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>2.371</td>
</tr>
<tr>
<td>$F$-test</td>
<td>157.068</td>
</tr>
<tr>
<td>VIF values</td>
<td>a 7.503</td>
</tr>
<tr>
<td>b 1.596</td>
<td>b 1.596</td>
</tr>
</tbody>
</table>
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Table 2  Pooled ordinary least squares, 2000–2013 (continued)

<table>
<thead>
<tr>
<th>Models</th>
<th>Pooled ordinary least squares (OLS)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(d)</td>
<td>(e)</td>
<td>(f)</td>
<td></td>
</tr>
<tr>
<td>Dependent variables</td>
<td>Service trade</td>
<td>Service export</td>
<td>Service import</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>1.467</td>
<td>c 1.467</td>
<td>c 1.455</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>1.169</td>
<td>d 1.169</td>
<td>d 1.170</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>5.962</td>
<td>e 5.962</td>
<td>e 5.969</td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>4.837</td>
<td>f 4.837</td>
<td>f 4.893</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>7.689</td>
<td>g 7.689</td>
<td>g 7.744</td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>7.665</td>
<td>h 7.665</td>
<td>h 7.599</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at 10%, **significant at 5%, ***significant at 1%, ****significant at 0.01%

Notes: t-Statistics are in parentheses; The explanatory variables are as follows: (a) GDP = gross domestic product, (b) POP = population, (c) CL = common language, (d) DIST = distance, (e) FB = fixed broadband internet subscribers (per 100 people), (f) FT = fixed-telephone line penetration (per 100 people), (g) MB = mobile-cellular telephone subscriptions, (h) INT = percentage of population who used the internet (from any location) in the last 12 months; VIF values are reported for each of the explanatory variables (a)–(h).

We find that trade determinants such as GDP, population and common language have a significant impact on trade in services in all three variations:

1. trade service
2. service export
3. service import.

The coefficient values for GDP are 0.932, 0.919 and 0.63 for service trade, service export and service import, respectively. GDP is positive and highly significant at the 0.01% levels for service trade, service export and service import. The coefficient values for population are 0.241, 0.306 and 0.212 for service trade, service export and service import, respectively. It is positive and highly significant at 0.01% for service trade, service export and service import.

The coefficient values for common language are 0.435, 0.264 and 0.303 for service trade, service export and service import, respectively. Service trade is significant at the 0.01% level, whereas service export and service import are significant at the 1% level.

The coefficient values for distance are −0.043, −0.002 and −0.059 for service trade, service export and service import, respectively. They all hold negative signs, as expected. The levels of significance for service trade and service import are 0.01%. Distance shows mixed results for trade in services. Distance is significant at 0.01% for both service trade and service import, but insignificant for service export. Distance, however, shows mixed results. Distance is significant for service import, but not service export. Results on the impact of distance on trade have evolved from a great level of significance to mixed results in recent years. On the contrary to existing literature (Eaton and Kortum, 2002; Limao and Venables, 2001; Obstfeld and Rogoff, 2001), we find that distance is insignificant for service export in the US. One plausible explanation for this is that the level of advancements of ICT development and access are positively correlated to...
increasing volumes of global trade. Technological progress are likely to have lowered search and transaction costs, bridging large distances leading to the insignificance of distance ‘costs’ of a developed economies like the US. Furthermore, the US has the highest percentage of its population with internet access at 86.75% in 2014 worldwide and has held the top positions.

The coefficient values for fixed broadband are 0.117, 0.133 and 0.209 for service trade, service export and service import, respectively. They are significant and positive at the 0.01, 1 and 0.01%, respectively. This implies that a 0.01% increase in fixed broadband internet subscribers per 100 people increases service trade by 11.7% and service import by 20.9%, and a 1% increase in fixed broadband subscribers per 100 people increases service export by 13.3%. The impact of fixed broadband is higher on service import than service export. Our OLS results for fixed broadband yield highly similar patterns to our FEM models (a–c).

The coefficient values for fixed telephone line penetration per 100 people are 0.387, 0.338 and 0.446 for service trade, service export and service import, respectively. They are all significant and positive at the 0.01% levels. This implies that a 0.01% increase in fixed telephone penetration per 100 people increases service trade by 38.7%, service export by 33.8% and service import by 44.7%. The impact of fixed telephone line penetration per 100 people is higher for service import (44.7%) than service export (33.8%).

The coefficient values for mobile-cellular telephone subscriptions are −0.021, −0.052 and −0.133 for service trade, service export and service import, respectively. Although mobile-cellular telephone subscription holds the expected negative sign, it is insignificant for service trade, service export and service import. The OLS results for mobile-cellular telephone subscription yield similar trends to that of our FEM results in models (a–c).

The coefficient values for the internet are −0.310, −0.279 and −0.147 for service trade, service export and service import, respectively. The internet holds negative values and is highly significant at the 0.01 and 1% levels for service trade and service export, respectively. However, it is negative and insignificant for service import.

We test for heterogeneity in our pooled OLS estimation models (d–f) using two tests:

1. VIF

There are no signs of multicollinearity since all our VIF values for models (d–f) are between 1.169 and 7.689. Our second test for multicollinearity using the Durbin-Watson test also shows no signs of heterogeneity since all our values are less than 2.50 (2.038–2.371).

4.3 **Comparison of the three variations of services trade**

Table 3 presents the summary of the estimated coefficients for

1. service trade
2. service export
3. service import.
Table 3  Summary of estimated coefficients for different types of transactions

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Service trade</th>
<th>Service export</th>
<th>Service import</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log (GDP)</td>
<td>0.932**** (15.408)</td>
<td>&gt; 0.919**** (12.130)</td>
<td>&gt; 0.630**** (6.275)</td>
</tr>
<tr>
<td>Log (POP)</td>
<td>0.241**** (11.955)</td>
<td>&lt; 0.306**** (12.108)</td>
<td>&gt; 0.212**** 6.249</td>
</tr>
<tr>
<td>Log (CL)</td>
<td>0.435**** (6.554)</td>
<td>&gt; 0.264*** (3.180)</td>
<td>&lt; 0.303*** (2.726)</td>
</tr>
<tr>
<td>Log (DIST)</td>
<td>−0.043**** (−4.319)</td>
<td>&gt; −0.002 (−0.122)</td>
<td>&lt; −0.050**** (−3.556)</td>
</tr>
<tr>
<td>Log (FB)</td>
<td>0.117**** (3.645)</td>
<td>&gt; 0.133*** (3.298)</td>
<td>&lt; 0.209**** (3.924)</td>
</tr>
<tr>
<td>Log (FT)</td>
<td>0.387**** (8.908)</td>
<td>&gt; 0.338**** (6.203)</td>
<td>&lt; 0.446**** (6.092)</td>
</tr>
<tr>
<td>Log (MB)</td>
<td>−0.021 (−0.412)</td>
<td>−0.052 (0.800)</td>
<td>−0.133 (−1.531)</td>
</tr>
<tr>
<td>Log (INT)</td>
<td>−0.310**** (−4.112)</td>
<td>&gt; −0.279*** (−2.952)</td>
<td>&gt; −0.147 (−1.167)</td>
</tr>
<tr>
<td>Range of adjusted $R^2$</td>
<td>0.742</td>
<td>&gt; 0.672</td>
<td>&gt; 0.515</td>
</tr>
</tbody>
</table>

*Significant at 10%, **significant at 5%, ***significant at 1%, ****significant at 0.01%

Notes: t-Statistics are in parentheses; The explanatory variables are as follows: (a) GDP = gross domestic product, (b) POP = population, (c) CL = common language, (d) DIST = distance, (e) FB = fixed broadband internet subscribers (per 100 people), (f) FT = fixed-telephone line penetration (per 100 people), (g) MB = mobile-cellular telephone subscriptions, (h) INT = percentage of population who used the internet (from any location) in the last 12 months; Range of adjusted $R^2$ is the minimum and maximum values of adjusted $R^2$ obtained for the regression equations for each type of transaction.

We find that GDP for service trade has a greater impact on service export whilst it has a greater impact on service export than service import. As for population, we find that service export has a greater impact than service trade whilst it has a greater impact on service export than service import. Common language has a greater impact for service trade than service export. Common language has a greater impact on service import than service export. One implication of this is that having a common language is more important for service import than service export. Distance is an important variable for total service. However, distance is insignificant when it comes to service export. Distance plays a greater role for service import than service export.

Three of our ICT variables show great significance on service trade:
1. fixed telephone lines, fixed broadband and the internet, with the exception of mobile-cellular phones.

In comparison, we find that fixed broadband has a greater impact on service trade than service export. Fixed broadband has a greater impact on service import than service export.

Fixed telephone lines show a greater impact on service trade than service export whilst it has a greater impact on service import than service export. Mobile phones show no significance for all three variations of service trade. Finally, the internet shows a greater impact on service trade than service export whilst it shows a greater impact on service export than on service import. Overall, our model best explains service trade, followed by service export, and finally, service import.
5 Conclusion

In this study, we investigate one of the largest and most long-standing traders of services: the US. Intuitively, due to its high population with access to the internet - at 88.6% in 2017, the highest in the world - it would appear that developed nations such as the US would be better able to reap the benefits of ICT to improve its trade in services.

Results from our study provide strong evidence to our proposition that trade in services, being largely dominated by developed nations such as the US and increased access to the internet by a country’s population have positive impact on trade in services, and is not a matter of ‘mere coincidence’. Furthermore, our inclusion of two sets of variables - one, related to trade, and the other, related to ICT - provide evidence that ICT alone, cannot impact trade, and that it is a combination of these two sets of variables, that concomitantly impact bilateral trade in services.

The results of this study also suggest that ICT affects service export and service import differently, depending on the type of ICT application. It appears that fixed broadband, fixed telephone lines and the internet are still the strongest factors contributing to trade in services. Mobile-cellular phones still have a lot of room to contribute to trade in services, whether in terms of service export or service import.

The results of our study also strongly suggest that trading with countries whose population has a greater access to ICT, along with having a common language will improve and boost service export and service import. Distance does not appear to be correlated to service export. Developed countries such as the US can boost its service export by trading with countries even farther away as geographic distance is an insignificant factor. Traditionally, trade theories have suggested trading with countries of near proximity. However, in this adage of ICT advancements, distance does not appear to be as strong a barrier to trade as two decades ago.

The conclusions of this study leave us with six main points. First, the wealthier a country, the greater the population of a country and having a common language between two trading partners are significant factors to boosting trade in services. Second, the greater the access of a country’s population to ICT, the lesser its sensitivity to distance. A plausible explanation for the latter is that ICT access reduces fixed entry costs to a market and, thus, stimulates trade in services. As Liu and Nath (2013) and Freund and Weinhold (2004) discuss, the use of ICT may reduce fixed entry costs such as information search costs, advertising and establishment of distribution network costs. Third, mobile-cellular technology has still plenty of room for development, application and growth in service trade, service export and service import. Fourth, the application of mobile-cellular technologies may not be as diverse as we initially posited when it comes to service import and service export. This also allows for greater room for development, application and growth for mobile-cellular technologies in the area of service import and service export. Fifth, our study suggests that various ICT technology access and application in service import still lags behind that of service export. We suggest development and application of modern ICT tools such as mobile-cellular phones in addition to having a common language to boost trade. Finally, trade factors such as GDP (wealth of a nation), population (size of a nation) and having a common language, along with ICT access and applications in fixed telephone lines, fixed (wired) broadband and internet are factors that play immediate importance to service export for developed economies.
Appendix A. List of countries (34)

Argentina, Australia, Belgium-Luxembourg Bermuda, Brazil, Canada, Chile, China, France, Germany, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Japan, Republic of Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Philippines, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, United Kingdom, Venezuela.

References


