Does Service Trade Raise Service Income? 21st Century Evidence from Cross-Country Analysis

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Abstract Services sector has become the largest and fastest growing sector of the world economy and service trade has been growing at a higher rate than merchandise trade since early 1980s. The 21st century will see this trend to strengthen over time. Using a rich data set of bilateral service trade this paper estimates the causal effect of service trade on service per capita income for 95 countries in 2000, 2005 and 2010. I first show that the estimate of the geographic component of overall service trade share, which is obtained from the gravity equation of bilateral service trade, is a very powerful instrument for the actual service trade share. I find that the impact of service trade on per capita service income is economically and statistically significant at 1% to 5% level. A one-percentage-point increase in service trade share causes a 0.1 to 0.4 percent increase in service per capita income. The result is robust to the inclusion of various geographical and institutional controls specific to service sector.

Key Words: Service trade, income per capita, growth, international trade, gravity model

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1. Introduction

The relationship between trade on one hand and income and growth on the other is both empirically and theoretically complicated. For example, Rodriguez and Rodrik (2001) have theoretically established that within a group of endogenous growth models exists no unambiguous relationship exists between trade liberalisation and growth. In static models, restrictions on trade in service, like restrictions on trade in goods are generally expected to reduce welfare because the reduction of the consumer surplus due to the higher price of the domestic service outweighs the increase in producer surplus and government revenue (Mattoo, Rathindran & Subramanian, 2006). Yet, if a country is a large importer of services, the restrictions on trade can be welfare-enhancing because the country may gain from its improved terms of trade.

Similarly, empirical studies are far conclusive on the causal link between trade and income and growth. Frankel and Romer (1999) and Irwin and Tervio's (2002) important studies try to address the reverse causality issue associated with the potential effect of income on trade, using geographical factors in the gravity equation to construct an instrument for trade. They found evidence that trade causes growth. However, these effects of trade on growth were obtained with low instead of robust precision, which was the point of criticism made by Rodriguez and Rodrik (2001) and Rodriguez (2007). They argue that while geography is an important determinant of income, it is only one of the channels through which the former affects the latter.

Geography impacts income via its effect on a country's public health and consequently its human capital, its agricultural productivity, and its institutional quality. For example, geography largely determines the extent to which a country is exposed to colonialism, migration, and wars, and consequently impacts the quality of its institutions and its income (Hall & Jones, 1999). Countries located completely or partially in tropical regions are also more likely to be subject to many infectious diseases than other regions, which may seriously impact their economic development (Gallup, Sachs & Mellinger, 1998 & Sachs, Warner, Åslund & Fischer., 1995). A country's geographical location also determines the availability of its land endowments and consequently its agricultural productivity and economic growth (Engerman & Sokoloff, 1997). In order to address Rodriguez and Rodrik's (2001) critique, Noguer and Siscart (2005) later included additional geographical controls for disease, resource endowment, agricultural productivity, and institutions, and found that the causal positive

effect of trade on per capital income was robust, statistically significant at a 5% level, but its magnitude had decreased.

This chapter uses comprehensive cross-country data of the service trade in 2000, 2005, and 2010 to investigate the extent to which trade in services raises service per capita income. The focus on the service sector is motivated by the following reasons. Firstly, nowadays the service sector represents the largest component of GDPs in both developed and developing economies, and its importance has increased over time. According to the statistics from the WB's WDI database, service has been the largest sector in the world economy for a long time. In 2014, 71% of the world's GDP was produced in the tertiary sector, while the manufacturing and agricultural sectors only account for 16% and 4% of the world's GDP respectively. The service sector is not only the largest sector of the economy, but it is also the fastest growing sector. The importance of the service sector is increasing in the economy's level of development. The service sector shares in the GDPs of low-income, middle-income and high-income economies in 2014 is 47%, 56%, and 74% respectively. Importantly, the service sector growth is considered to contribute more to poverty reduction than the growth in agriculture or manufacturing sector (WB, 2012b).

Since the 1980s the service trade has been growing at a higher rate than trade in goods (UNCTAD Handbook of Statistics, 2012). Trade of services as a percentage of the GDP is about 20% of the GDP in high-income countries, while it is about 8% in low- and medium-income countries (WB and UN COMTRADE databases). The fact that the service sector is the largest component of the world's GDP coupled with the growing rate of service trade certainly raises the question of whether (and the extent to which) the service trade might result in higher income and standard of living or whether it is a case of countries with higher incomes engaging in more service trade. This research question becomes more relevant in light of the national trade and growth strategies adopted by many countries in the aftermath of the 2007-08 economic and financial crisis. Specifically, an important component of their strategies is to develop service trade because the service sector has demonstrated relative resilience during times of the crises in terms of a lower magnitude of decline, less synchronisation across countries, and earlier recovery from crises (UNCTAD, 2010).

Secondly, the results of this study on the relationship between service trade and service income also provide additional substantive inputs to the ongoing negotiations in which WTO members are currently involved in order to take further steps towards the liberalisation of the service

trade. While the General Agreement on Trade in Services (GATS) was already enforced in 1995, it remains a loose framework for world trade in services, and still requires development. For example, WTO members of GATS still need to develop specific rules for trade in services such as disciplines in safeguards, subsidies, and domestic regulations. They also need to negotiate their specific commitments to different sectors of service. The pace at which the GATS' framework is going to be developed will certainly depend on the perception of potential gains that liberalisation in service trade will bring.

Despite the rapidly growing importance of the service sector and service trade in the economy, trade in services and its effect on economic growth and development have not been extensively analysed using a cross-country analysis. Most of the studies focus on the relationship between service trade and income from a dynamic model. In other words, they look into the effect of trade liberalisation of service on growth of income. Mattoo et al. (2006) apply cross-country regressions of the growth rate of per capita Gross National Product (GNP) on standard growth control variables and different measures of openness for telecommunications and financial services. The authors found that openness in services influences long run growth performance. Arnold, Javorcik, and Mattoo (2011) and Arnold, Javorcik, Lipscomb, and Mattoo (2015) are two major recent contributions to the literature on the trade-income/growth nexus in service using firm-level data. Arnold et al. (2011) document evidence that services sector reform improves performance of Czech firms in the downstream manufacturing sector. Arnold et al. (2014) establish empirical evidence that India's policy reforms in services during the period 1993-2005 have a significant positive effect on the productivity of Indian manufacturing firms.

To the best of my knowledge this research study is the first attempt to quantify the causal effect of the service trade on service income using a large sample of countries spanning the three recent periods, namely 2000, 2005, and 2010. I propose that if trade raises income at the aggregate level then service trade must also raise service income in the first place. Since the service sector represents the largest and increasing component of GDPs and the service trade has also been increasing over time, it is important to investigate the extent to which service trade causes service income. Methodologically, this research follows Frankel and Romer (1999), Irwin and Terviö (2003), and Noguer and Siscart (2005) to address the endogeneity due to reverse causality running from service income to service trade. For this purpose, in the second stage regression channels are controlled in addition to service trade via which geography affects income by including variables such as the distance to the equator, ethnic

fraction, the percentage of population living in the tropics, labour quality, and internet access. As mentioned above, these additional control variables allow for factors that affect service income, not via their effect on service trade but rather via their effects on agricultural productivity, the health of the population, and institutional quality.

This research's findings illuminate the crucial role of the importance of export in services in enhancing nations' wellbeing. The study findings show that trade in the service sector enhances service income. The causal effect of service trade on service income is statistically significant at the 1% level. As our estimation shows, a 1% point increase in the service trade share increases the per capita service income by 0.1% to 0.4%. The positive effect of service trade on service income is consistent and robust after I included various geographical and institutional controls specific to the service sector in order to address Rodriguez and Rodrik's (2001) comment that geographical variables also affect income directly via their effect on a country's productivity and health.

This paper is organised as follows. Section 2 deals with a review of related literature, while section 3 elaborates on the methodological frame work adopted for the study. Section 4 presents the main findings of the analysis, while section 5 presents the conclusions.

2. Trade in Services and Growth

International trade has been always believed to be one of the major factors that enhance economic growth. A number of studies claimed finding strong evidence of a causal link between trade and economic growth (Dollar, 1992; Ben-David, 1993; Sachs et al., 1995 & Edwards, 1993). Like commodity trade in general, the literature reveals that service trade has a powerful influence on growth via several channels (Francois, 1990a & 1990b & Hoekman & Matto, 2008).

The international trade literature asserts the positive impact of exports on economic growth (Rassekh, 2007; Noguer & Siscart, 2005; Irwin & Terviö, 2002 & Frankel & Romer, 1999). This claim is plausible given the fact that exports facilitate efficiency of production, better resource allocation, economies of scale, and efficient management style. Exports also enable imports of capital goods and essential raw materials, that in turn help to increase investments and output.

Services such as telecommunications help the dissemination and diffusion of knowledge at a much lower cost.[1] Trade in services and its effect on economic growth and development have not been extensively analysed using cross-country gravity analysis. However, there are a number of sub-sector or country-specific papers that study the effects of service trade on economic growth (Hoekman & Mattoo, 2008; Borrmann, Busse & Neuhaus, 2006; Arnold, Javorcik & Mattoo, 2011 & Arnold, Javorcik, Lipscomb & Mattoo, 2015).

There is a very close link between trade in services and trade in goods.[2] For example, an increase in manufacturing exports is expected to boost services exports due to the network effect as services such as transport, travel, communication, and business services are used as inputs. This is especially compelling since incorporation of knowledge-based business, financial, transport, and communication services in manufacturing production processes enhance productivity and hence international comparative advantages (Eichengreen & Gupta, 2013). Additionally, the financial sector development affects exports because it affects firms' supply responses. Access to finance at a reasonable cost is important for export development for the simple reason that firms find it easier and less costly to finance working capital needs and upgrading and new innovative activities (Biggs, 2007; Aghion & Griffith, 2005).

Many empirical studies on the impact of service trade and growth can be broadly classified as case studies of specific countries, and focus on the impact of a component of the service sector (say the financial or communication sector) or liberalisation of the service sector on economic growth (Mattoo et al., 2006; Pagano, 1993; King & Levine, 1993; Guiso, Sapienza & Zingales, 2004; Berthelemy & Varoudakis, 1996 & Chandavarkar, 1992).

Earlier studies on the relationship between trade and income are criticised on the grounds that they have drawbacks in establishing the causality between trade and income. Most investigations were criticised for the poor data quality and endogeneity since countries whose incomes are high for reasons other than trade may trade more (Edwards, 1993; Levine &

[1] The existence of the internet cuts communication costs significantly. In addition, business services such as accounting, engineering, consulting, and legal services are also important for growth, to the extent that they help to reduce the transaction costs associated with the operation of financial markets and the enforcement of contracts.

[2] The main differences between trade in goods and trade in services are: 1. services are intangible and perishable (i.e., non-storable); 2. in contrast to the exclusively cross-border mode for trade in goods, services can be provided at the location of the service supplier, at the location of the service consumer, or at neither of these two locations; 3. international trade in services usually requires movement of one or more factors of production, such as the commercial presence of a supplier at the location of the service consumer (movement of capital), or the transfer by the service supplier of personnel to the location of the service consumer (movement of labour); and 4. the national regulation level of trade in services is more extensive and diverse than the trade in goods.

Renelt, 1992 & Rodriguez & Rodrik, 2001).[3] For example, countries with higher incomes may be better able to afford conducive infrastructure, overcome the informational search costs, or have relatively more tradable goods (López, 2005). The use of countries' trade policies as a proxy for trade share in the regression does not solve the problem as these policies are also likely to be correlated with factors that are omitted from the income equation (Sala-i-Martin,1991).

There are a variety of theoretical models that have been proposed to analyse the link between financial depth and economic growth, and they have pointed to a positive connection between financial development and economic growth (King & Levin, 1993; Kletzer & Bardhan, 1987; Levine, 2005; and Roubini & Sala-i-Martin, 1992). Wise liberalisation of both the telecommunications and the financial services sectors is associated with an average growth rate 1.5% above the countries whose sectors aren't liberalised (Mattoo et al, 2006). Studies show that there is a correlation between inward FDI and changes in policies towards financial and infrastructure services (Eschenbach & Hoekman, 2006).

Firm performance and the performance of service input industries have statistically significant positive relationships (Arnold, Mattoo & Narciso, 2006). The import of foreign factors that characterise services sector liberalisation could have positive effects because they are likely to bring technology with them. In other words, if greater technology transfer (the source of endogenous growth) accompanies services liberalisation, the stronger the growth effect will be. Moreover, studies show that the presence of foreign service providers as the measure of services policy is the most robust services variable affecting total factor productivity in user firms (Arnold, et. al., 2011).

3. Data and method

3.1 Data

This research used data from bilateral service trade between 95 countries for the years 2000, 2005, and 2010. The bilateral service trade data is available from the UN COMTRADE database, while the data on population, GDP, share of service to GDP, latitude, and distance from the equator is from WDI database. The service GDP variable is constructed by multiplying

[3] The critics of endogeneity problem in trade and growth literatures are addressed in the recent empirical literatures through the use of the instrument-variable (IV) regressions approach (Frankel & Romer, 1999; Irwin & Terviö, 2002; and Noguer & Siscart, 2005). This methodology allows to delve with endogeneity of trade openness to uncover the impact of international trade on per capita income. Noguer & Siscart (2005) further addressed the criticism of weak instrumentation by introducing latitude, tropics and institution as variables.

the share of the service to GDP ratio with the GDP. This research uses the WB's index on the ease of doing business as a proxy for institutional quality. This index comprises of the following contents: ease of starting a business; dealing with construction permits; getting electricity; registering property; getting credit; protecting minority investors; paying taxes; trading across borders; enforcing contracts; and resolving insolvency. Given the range parameters it captures, the overall index is a good instrument to better measure a country's institutional quality. The data on distance between pair-countries and other geographical characteristics comes from CEEPI. I captured skilled labour force (quality of labour of the nation) using the Human Development Report Office's education index (lowest 0 and highest 1). Data for the telecommunications network comes from the WB database. Table 1 provides the descriptive statistics of the main variables.

Table 1: Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
Log (Service_GDP$_i$)	24.03	2.21	20.14	30.04
Log (Service_Trade$_i$)	18.33	3.03	5.89	25.39
Log (Distance $_{ij}$)	8.24	1.05	4.11	9.88
Log (Pop $_i$)	2.86	1.67	-2.21	7.20
Log (Area $_i$)	12.22	2.38	3.22	16.65
Log (Pop $_j$)	2.83	1.67	-2.95	7.20
Log (Area $_j$)	12.18	2.35	3.22	16.65
Landlocked $_{ij}$	0.25	0.43	0	1
Latitude$_i$	19.84	25.27	-41.81	67.47
Tropical Area$_i$	0.50	0.48	0	1
Tropical Population$_i$	0.49	0.48	0	1
Doing Business Easiness	58.61	13.81	26.95	88.83
Labour Quality$_i$	0.60	0.19	0.18	0.92
Ethnic Fraction$_i$	43.59	30.40	0	93
Broadband Internet$_i$	8.60	11.23	0	38.09

3.2. Estimation Method

As indicated in Frankel and Romer (1999), Irwin and Terviö (2002), and Noguer and Siscart (2005), a country's geographic attributes such as distance, landlocked, common border, population, and country size convey important information on the 'expected' volume of its trade with other countries. Interestingly, these variables are not important determinants of a country's income. Additionally, a country's income doesn't affect these attributes. As a result, these geographic attributes can be taken as exogenous instruments for identifying trade's impact on income. Given that here the research's objective is to identify geographic influences on overall trade and a significant portion of countries' trade is with their immediate

neighbours, the research also includes interaction terms of all of the variables with the common-border dummy.[4]

This research study follows the econometric strategy used in those studies to identify the effects of service trade on service income. Firstly, an instrument for international trade using geographic variables was constructed and the following gravity-like equation of bilateral service trade was estimated:[5]

$$
\begin{aligned}
T_{ij} \equiv Log\left(\frac{Trade_{ij}}{Gdp_i}\right) &= \alpha_0 + \alpha_1 Log\left(Distance_{ij}\right) + \alpha_2 Log(Pop_i) \\
&+ \alpha_3 Log\left(Pop_j\right) + \alpha_4 Log(Area_i) + \alpha_5 Log\left(Area_j\right) + \alpha_6 Landlocked_{ij} \\
&+ \alpha_7 Border_{ij} + \alpha_{17} Log\left(Distance_{ij}\right) * Border_{ij} + \alpha_{27} Log(Pop_i) \\
&* Border_{ij} + \alpha_{37} Log\left(Pop_j\right) * Border_{ij} + \alpha_{47} Log(Area_i) * Border_{ij} \\
&+ \alpha_{57} Log\left(Area_j\right) * Border_{ij} + \alpha_{67} Landlocked_{ij} * Border_{ij} + \varepsilon_{ij} \\
&= \boldsymbol{\alpha}' \boldsymbol{X}_{ij} + \varepsilon_{ij} \qquad (1)
\end{aligned}
$$

where the right-hand side variables are defined as follows :

$Trade_{ij}$: the value of bilateral trade between exporter *i* and importer *j*.

$Distance_{ij}$: the bilateral distance between them.

Pop_i and Pop_j : the population of exporter *i* and importer *j*, respectively.

$Area_i$ and $Area_j$: the land areas exporter *i* and importer *j*, respectively.

$Border_{ij}$: dummy variable on whether the two countries share a common border.

$Landlocked_{ij}$: dummy variable on whether either the exporter or the importer or both are landlocked countries.

It is important to note that the research's use of the gravity equation for service trade is justified both theoretically and empirically. Anderson, Milot, and Yotov (2014) set up a model of service trade in which a gravity equation was derived. Empirically, the gravity has been used successfully in many studies to investigate what determines the volume of bilateral service trade (Kimura & Lee, 2006 & Anderson et al., 2014).[6]

[4] The inclusion of interactions with the border dummy allows for the possibility that GDPs, populations…etc of neighbouring countries have much larger effects on a country's service trade share than GDPs, populations…etc of non-neighbouring countries. We also estimated using alternative specification where exclude the interaction terms in the first stage and the results remain essentially the same.

[5] In an alternative specification the research also excludes all the interactions from the first-stage specification as one of the robustness checks. See Appendix Table 2 for details on the correlation matrix of the dependent and explanatory variables of the first-stage regression.

[6] Specifically, Kimura and Lee (2006) rely on the gravity equation to investigate what determines bilateral services, trade, and goods between 10 OECD member countries and other economies for the years 1999 and 2000, while Anderson et al. (2014) estimate geographical barriers to trade in nine service categories for Canada's provinces from 1997 to 2007.

A gravity equation (1) allows us to construct the estimate the following component of country i's overall trade share:

$$\hat{T}_i = \sum_{j \neq i} e^{\hat{\alpha}' x_{ij}} \qquad (2)$$

Thus, the constructed trade share is the sum of geographical components of bilateral trade with each of the foreign trading partners that are estimated from gravity of bilateral trade (1).

Next, the constructed trade share in the following second stage gravity specification was used:

$$Log\left(\frac{Serv_{Gdp_i}}{Pop_i}\right) = \beta_1 + \beta_2 Log(\hat{T}_i) + \beta_3 Log(Pop_i) + \beta_4 Log(Area_i) + \boldsymbol{\beta_5 Controls_i} + \epsilon_i \qquad (3)$$

where ***Controls$_i$*** denotes a vector of control variables such as region dummies (i.e. Latin America, East Asia, and SSA), latitude of the country, the share of population living in tropics, and institutional quality measures. They can be included in a second-stage gravity equation (5.3) individually or together. As Noguer and Siscart (2005) pointed out, the inclusion of these control variables addresses Rodriguez and Rodrik's (2001) critique that geographical independent variables in the first-stage gravity equation of bilateral trade affects income via its effects on trade and on health, productivity, and institutions.

4. Results

Constructing the instrument

Since this research relies on the 2SLS estimator, the quality of the instrument for the actual service trade share is of critical importance to identify the effect of service trade on service income. I now examine whether or not his instrument is a good one. The results of the first-stage regression equation (1) are presented in Table 2 for three different years, namely 2000, 2005, and 2010. Columns 1, 3, and 5 show the estimated coefficients and the standard errors on the variables other than the common border dummy and its interactions. The estimates of the common border and the interactions are shown in the second column. The results show that the first-stage regression generally performs well. Bilateral distance reduces trade, and either or both the exporter and the importer being landlocked reduces trade. The effect of the size of trading partner j strongly promotes bilateral service trade. The population of trading partner j promotes service trade, while the population of trading partner i reduces it. Note that

the effect of size on trade is expected to be nonlinear. The size of small economies is expected to increase trade because their domestic markets are small. Yet, when the size reaches a certain level, the domestic market becomes large enough that the country trades with itself, and its trade with the world decreases.[7]

Table 2: Bilateral Service Trade

	2000		2005		2010	
	Variables	Interactions	Variables	Interactions	Variables	Interactions
Log(Distance $_{ij}$)	-0.97***	0.57	-1.29***	0.95***	-1.23***	0.55
	(0.09)	(0.96)	(0.06)	(0.44)	(0.06)	(0.46)
Log (Pop $_{i}$)	-0.11	-0.87***	-0.01	-0.53***	-0.13***	-0.41**
	(0.07)	(0.24)	(0.06)	(0.14)	(0.06)	(0.17)
Log(Area $_{i}$)	-0.08	0.97***	-0.17***	0.28	-0.14***	0.35*
	(0.05)	(0.45)	(0.04)	(0.20)	(0.04)	(0.20)
Log (Pop $_{j}$)	1.04***	-0.10	0.78***	-0.29	0.93***	-0.25
	(0.07)	(0.22)	(0.06)	(0.28)	(0.06)	(0.16)
Log(Area $_{j}$)	-0.37***	-0.10	-0.33***	0.09	-0.38***	0.10
	(0.05)	(0.16)	(0.04)	(0.14)	(0.04)	(0.13)
Landlocked $_{ij}$	-1.38***	1.08***	-0.62***	0.38*	-0.18	0.03
	(0.17)	(0.33)	(0.12)	(0.23)	(0.13)	(0.22)
Constant	16.84***	-10.49***	20.61***	-7.35	20.47***	-5.96
	(0.92)	(3.20)	(0.72	(1.64)	(0.71)	(1.80
Observations	844		1435		1382	
R-squared	0.39		0.38		0.44	
MSE	2.14		2.21		2.14	

Note: Dependent variable: log of bilateral service trade to service GDP ratio. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 3 indicates the results of the regression of the actual service trade share on the constructed service trade share. For all three samples, the instrument is found to be an important and precise determinant of the actual service trade share. It is important to point out that compared to Frankel and Romer (1999), the instrument of constructed service trade share provides much more information about actual service trade share than that contained in country size. The t-statistics of the coefficient estimates on service trade share takes values ranging between 11 and 22, which are three times larger than the corresponding t-statistics obtained by Frankel and Romer (1999). These t-statistics correspond to F-statistics ranging between 121 and 484. These F-statistics are large enough to eliminate any concern that the finite-sample bias of instrumental variables is unlikely to be a serious problem in the IV

[7] Note that the same results were also obtained by Franker and Romer (1999) from their first-stage regression using aggregate trade data. This research established that this is not due to the multicollinearity among size variables. When the size measures are included separately in gravity equation (1), their sign remains the same in all cases.

regression. [8] Furthermore, the instrument is strong, as judged by the first stage F-statistics that are by far larger than 10 (Stock & Yogo, 2005 & Staiger & Stock, 1997).

Table 3: The relationship between actual and constructed service trade

Independent variables	2000	2005	2010
Constructed trade share	0.77***	1.13***	1.18***
	(0.07)	(0.05)	(0.07)
Ln population	-0.10	-0.19*	0.19
	(0.13)	(0.11)	(0.16)
Ln area	0.04	0.36***	-0.03
	(0.12)	(0.11)	(0.14)
Constant	3.84***	-2.93**	-2.45
	(1.15)	(1.22)	(1.52)
Observations	75	96	101
R-squared	0.66	0.85	0.78

Note: The dependent variable is the actual trade share. Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1

The strength of the research's instrument can be determined by examining Figures 1 to 3 that show the correlation between the actual service trade share (after controlling for size measures) and its instrument, and the constructed service trade share for 2000, 2005, and 2010. All the figures show a strong positive relationship between the actual service trade share and its instrument for all three years. Figures 1 to 3 show that after controlling for size measures, the actual service trade share and its instrument are strongly correlated. The correlations between the actual trade share and the constructed trade share, after controlling for sizes, ranges between 0.78 and 0.85 for the three years 2000, 2005, and 2010, respectively. All the results taken together clearly lend credence to the use of geographical variables of the gravity equation to construct the instrument for the actual service trade share.

Analysis of the Second-Stage Regression

The results of the second-stage regression are presented in Table 4. For the purpose of comparison, Panel A presents the OLS regression results, while Panel B reports the 2SLS regression results.

Table 4: Relationship of service trade and service per capita Income

	2000			2005			2010		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: OLS									
Log (ServiceTrade $_{ij}$)	0.31***	0.28***	0.37***	0.28***	0.22***	0.25***	0.29***	0.24***	0.24***
	(0.09)	(0.09)	(0.08)	(0.05)	(0.06)	(0.05)	(0.04)	(0.04)	(0.05)

[8] The values of the t-statistic and the F-statistic of the coefficient estimates of constructed trade share in Franker and Romer (1999) are only 3.63 and 13.1, respectively.

Log (Pop_i)	-0.37**	-0.28*	-0.22	-0.14	-0.09	-0.11	-0.38***	-0.32***	-0.31***
	(0.16)	(0.15)	(0.14)	(0.12)	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)
Log ($Area_i$)	0.18	0.14	0.10	-0.01	-0.04	0.04	0.26**	0.19*	0.23**
	(0.16)	(0.14)	(0.14)	(0.12)	(0.12)	(0.11)	(0.10)	(0.10)	(0.10)
$Latitude_i$	0.01*			0.01*			0.01		
	(0.00)			(0.01)			(0.01)		
Tropical $Area_i$		-1.31***			-1.19***			-0.99***	
		(0.41)			(0.39)			(0.32)	
Latin America $_i$			0.23			-0.10			-0.09
			(0.47)			(0.40)			(0.3)
East $Asia_i$			-2.10***			-1.94***			-1.19**
			(0.50)			(0.47)			(0.46)
SSA_i			-1.82***			-1.62***			-1.38***
			(0.67)			(0.44)			(0.41)
Constant	5.48***	6.12***	5.02***	6.09***	7.36***	6.35***	5.54***	6.86***	6.29***
	(1.59)	(1.48)	(1.40)	(1.28)	(1.27)	(1.19)	(1.04)	(1.05)	(1.05)
Observations	74	74	74	95	95	95	95	95	95
R-Squared	0.27	0.34	0.45	0.41	0.44	0.55	0.51	0.54	0.59
Panel B: 2SLS									
Log ($\hat{T}_i$)	0.50***	0.43***	0.52***	0.33***	0.26***	0.31***	0.42***	0.34***	0.41***
	(0.11)	(0.10)	(0.10)	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)
Log (Pop_i)	-0.36**	-0.29*	-0.21	-0.14	-0.10	-0.11	-0.42***	-0.38***	-0.33***
	(0.16)	(0.15)	(0.15)	(0.12)	(0.12)	(0.11)	(0.12)	(0.12)	(0.12)
Log ($Area_i$)	0.18	0.15	0.09	-0.01	-0.03	0.03	0.26**	0.25**	0.25**
	(0.16)	(0.15)	(0.14)	(0.13)	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)
$Latitude_i$	0.01			0.01			0.01		
	(0.01)			(0.01)			(0.01)		
Tropical Population$_i$		-1.18***			-0.99**			-0.55*	
		(0.42)			(0.42)			(0.37)	
Latin $America_i$			0.23			-0.10			-0.09
			(0.47)			(0.40)			(0.3)
East $Asia_i$			-2.10***			-1.94***			-1.19**
			(0.50)			(0.47)			(0.46)
SSA_i			-1.82***			-1.62***			-1.38***
			(0.67)			(0.44)			(0.41)
Constant	-1.17	4.48***	2.96*	3.43*	5.84***	4.68***	3.15**	5.37***	3.79***
	(2.49)	(1.62)	(1.57)	(1.77)	(1.37)	(1.29)	(1.35)	(1.20)	(1.28)
Observations	74	74	74	95	95	95	95	95	95
R-Squared	0.22	0.31	0.4	0.4	0.44	0.54	0.46	0.52	0.52
Ratio of 2SLS/OLS	**1.62**	**1.54**	**1.4**	**1.18**	**1.21**	**1.24**	**1.43**	**1.4**	**1.71**

Note: The dependent variable is the per capita service income. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

For each year the research study's OLS and IV regressions include the actual service trade share, two size measures, and either the latitude of the country, or the percentage of the country in the tropics, or a set of dummies for East Asia, Latin America, and SSA. All these controls are included to address Rodriguez and Rodrik's (2001) critique, according to which geographical variables affect income via their effect on trade and their effects on a country's disease environment, its resource endowments, its agricultural productivity, and its quality of institutions. For example, a country's latitude is a good control for its institutional quality, due to the fact that Europeans who usually brought with them their style of institutions to their settlement countries favoured high-latitude countries. Similarly, the percentage of people living in tropics determine a country's vulnerability to tropical diseases that may affect health of its people and thus its economic development. The inclusion of region dummies allows for

the fact that some components of the effects of service trade on service per capita income may be region-specific.

The results of this research's OLS regressions show that the gravity-based model performs generally well. A country's latitude has a positive effect on its per capita service income for 2000, 2005, and 2010. This finding is consistent with Hall and Jones' (1999) argument that countries located in high latitude were more likely to be subject to European settlements that introduced better institutions. The percentage of people living in the tropics is found to have negative effect on per capita service income. This finding is line with Gallup et al. (1998) and McArthur and Sachs's (2001) argument that countries with a large share of their population living in tropics are more vulnerable to tropical diseases that negatively impact their economic development. This research's explanatory variable of interest, the actual service trade share, has an expected strong positive effect on per capita service income. This effect is statistically significant at a 1% level for all gravity specifications. Specifically, a 10% increase in service trade share is associated with a 2% to 3% increase in per capita service income. The OLS regression results also show that on average service per capita income is largest in countries located in Latin America and much lower in countries located in SSA and East Asia especially.

The OLS results are likely to be subject to endogeneity bias due the reverse causality running from service income to service trade. The 2SLS regressions address this problem of endogeneity. Panel B shows that the constructed service trade share has a positive effect on the service per capita income. This positive effect is robust to the inclusion of different control variables, and holds for 2000, 2005, and 2010. A 10% increase in the constructed service trade share causes a 2.6% to 5.2% increase in service per capita income. Importantly, this effect is statistically significant at a 1% level, with the t-statistics of its coefficient estimates ranging from 3 to 6. The IV regression results also confirm what the research established earlier using the OLS regressions: the impact of service trade on service per capita income is largest in countries located in Latin America while it is much lower in countries located in SSA and East Asia especially.

I will now analyse the sensitivity of his estimate of the effect of service trade on service per capita income to a variety of controls for a country's institutional quality. The four additional controls for institutional quality are measures of the ease of doing business, of labour quality, a dummy variable on whether or not the country has ethnic fraction and finally a measure of access to broadband internet per 100 individuals. All four of these variables represent different

aspects of a country's institutional quality that may affect service trade. For example, the WB's index on the ease of doing business measures the extent to which a country's regulations are friendly to business, including business related to service trade.

The use of measures of labour quality and broadband internet access as controls for institutional quality is justified by the fact that service sector performance critically depends on human capital, the quality of the telecommunications network, and the quality of institutions (Shingal, 2010). Finally, the ethnic fraction dummy is included to control for institutional quality, especially for African countries where the ethnic divisions have been the major reason for their persistent underdevelopment (Easterly & Levine, 1997).

Table 5: Relationship of service trade and service per capita income (*Role of geography, institutions, internet, and labour quality)*

	2005					2010				
VARIABLES	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Log ($\hat{T}_i$)	0.16***	0.09*	0.25***	0.11**	0.08**	0.18***	0.08**	0.19***	0.07**	0.09***
	(0.06)	(0.05)	(0.06)	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)	(0.03)	(0.03)
Log (Pop_i)	-0.02	0.05	-0.14	-0.09	0.03	-0.17**	-0.03	-0.29**	-0.18**	-0.14**
	(0.11)	(0.09)	(0.12)	(0.08)	(0.07)	(0.08)	(0.08)	(0.12)	(0.07)	(0.06)
Log ($Area_i$)	0.012	-0.03	-0.05	0.04	0.03	0.15**	0.04	0.20*	0.16**	0.11*
	(0.11)	(0.09)	(0.11)	(0.08)	(0.07)	(0.07)	(0.07)	(0.11)	(0.06)	(0.06)
$Latitude_i$	0.003	0.01	0.01	-0.01	0.01*	0.003	0.01	0.01	-0.01*	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Tropical $population_i$	-0.14	0.02	-0.85	-0.23	-0.32	-0.39	-0.43	-1.25**	-0.22	-0.37
	(0.49)	(0.39)	(0.51)	(0.36)	(0.33)	(0.34)	(0.33)	(0.49)	(0.30)	(0.27)
Latin $America_i$	0.25	0.31	0.30	0.14	0.51	0.74*	0.88**	0.65	0.42	0.77**
	(0.55)	(0.45)	(0.55)	(0.42)	(0.35)	(0.41)	(0.41)	(0.62)	(0.36)	(0.32)
East $Asia_i$	-1.41**	-0.92*	-0.47	-1.06**	-0.18	-0.56	0.07	0.56	-0.15	0.22
	(0.57)	(0.48)	(0.78)	(0.44)	(0.48)	(0.46)	(0.45)	(0.77)	(0.40)	(0.41)
SSA_i	-0.93	0.11	-0.80	-1.41***	0.23	0.02	0.40	-0.38	-0.81**	0.20
	(0.60)	(0.51)	(0.60)	(0.44)	(0.43)	(0.45)	(0.45)	(0.65)	(0.40)	(0.37)
Ease of doing $business_i$	0.03***				0.01*	0.08***				0.02**
	(0.01)				(0.01)	(0.01)				(0.01)
Labour $quality_i$		6.97***			5.33***		7.03***			4.43***
		(0.92)			(1.01)		(0.73)			(0.92)
Ethnic $fraction_i$			-0.01		-0.01			-0.01		-0.001
			(0.01)		(0.01)			(0.01)		(0.003)
Broadband $internet_i$				0.14***	0.02				0.11***	0.03**
				(0.02)	(0.02)				(0.01)	(0.01)
Constant	4.29***	2.11*	8.269***	6.85***	2.24**	1.42	2.21**	7.25***	6.34***	2.50***
	(1.30)	(1.17)	(1.295)	(0.91)	(1.12)	(0.96)	(0.90)	(1.25)	(0.70)	(0.89)
Observations	93	94	67	94	65	95	95	70	95	70
R-squared	0.62	0.75	0.77	0.78	0.92	0.81	0.81	0.75	0.85	0.94

Note: The dependent variable is the service per capita income. Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1

The IV regression results with additional controls for institutional quality are presented in Table 5. Note that the results are only presented for the years 2005 and 2010 because the WB's data on the ease of doing business are only available from 2004. Additional variables such as controls for institutional quality are included first separately and then together. As expected, all measures of institutional quality, except the dummy on ethnic fraction, are found to have positive effects on the service per capita income. The positive effects of service trade share on service income hold for every gravity specification. A 1% point increase in service trade share causes a 0.1% to 0.2% increase in service income. In all regressions, this positive effect of service trade share is statistically significant at the 1% level in most of the cases. Taken together, all the results show that the effect of service trade on service income is robust and economically and statistically significant.

I also checked the stability and consistency after controlling for country and time fixed effects and arrive to similar conclusion. The inference I made in the previous sections remains the same (Table 6).

Table 6: Estimation results of the fixed effect models

	Fixed Effect				
VARIABLES	2SLS	2SLS	2SLS	2SLS	2SLS
Log($\widehat{T_{it}}$)	0.07**	0.07**	0.08***	0.06**	0.07**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Log(Pop_i)	-1.09**	-1.09**	-1.10**	-1.19***	-0.54
	(0.43)	(0.43)	(0.46)	(0.46)	(0.47)
$Institutions_i$					0.02***
					(0.01)
Labour $Quality_i$			2.84***		3.24***
			(1.017)		(0.97)
Internet $users_i$				-0.002	-0.001
				(0.003)	(0.002)
Merchandise trade to GDP $Ratio_i$	-0.02	-0.0148	-0.17	0.04	-0.27
	(0.30)	(0.30)	(0.31)	(0.30)	(0.29)
Constant	18.17***	18.17***	16.31***	19.26***	9.84**
	(4.29)	(4.29)	(4.63)	(4.54)	(4.81)
Observations	264	264	259	260	255
N	113	113	112	112	111
Year dummy	Yes	Yes	Yes	Yes	Yes

Note: The dependent variable is the service per capita income. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

I also conduct robustness analysis by disaggregating service trade as transport and travel, total

commercial services and total of other services.[9] The result further affirms that service trade in deed increase income (Table 7 and 8).

Table 7: 2SLS regression results – services disaggregated

VARIABLES	2005			2010		
	Transport and travel	Total commercial services	Other services Total	Transport and travel	Total commercial services	Other services Total
Log ($\hat{T}_i$)	0.14*	0.14***	0.17***	0.18***	0.14**	0.14***
	(0.07)	(0.05)	(0.06)	(0.06)	(0.05)	(0.05)
Log (Pop_i)	0.05	0.001	0.01	-0.10	-0.17**	-0.16*
	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)
Log ($Area_i$)	-0.01	0.03	-0.001	0.14**	0.18**	0.16**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
$Latitude_i$	0.01	0.01*	0.01	0.01**	0.01**	0.01*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Latin $America_i$	0.60**	0.73**	0.74**	0.62**	0.92***	0.88***
	(0.30)	(0.31)	(0.34)	(0.28)	(0.31)	(0.31)
East $Asia_i$	-0.84***	-1.03***	-1.18***	-0.25	-0.27	-0.29
	(0.31)	(0.33)	(0.35)	(0.32)	(0.31)	(0.32)
SSA_i	-0.30	-0.43	-0.29	-0.64*	-0.63**	-0.725**
	(0.35)	(0.37)	(0.36)	(0.32)	(0.31)	(0.31)
$Institution_i$	0.05***	0.04***	0.04***	0.04***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	4.18***	4.29***	4.69***	4.62***	4.97***	5.18***
	(0.71)	(0.70)	(0.74)	(0.73)	(0.714)	(0.725)
Observations	90	87	94	85	85	86
R-squared	0.82	0.83	0.82	0.84	0.85	0.85

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

[9] The total commercial services include the sum of communications, construction, insurance, financial, computer & information, royalties & license fees, personal, cultural & recreational and other business services. On the other hand, other services Total include the sum of total commercial services and Government services.

Table 8: 2SLS regression results – services disaggregated

VARIABLES	Transportation	Travel	Finance	Insurance	Construction	Computer and information	Communication	Royalty	Personal, Cultural and Recreational	Other services	Government Services
						2010					
Log ($\hat{T}_i$)	1.46***	0.57***	0.59***	0.65***	0.68***	0.48***	0.48***	0.71***	0.56***	0.45***	0.76***
	(0.52)	(0.10)	(0.09)	(0.13)	(0.17)	(0.07)	(0.10)	(0.12)	(0.12)	(0.06)	(0.13)
Log (Pop_i)	-0.58	-0.22	-0.22	-0.35**	-0.29	-0.22	-0.24	-0.34**	-0.13	-0.45***	-0.40**
	(0.41)	(0.15)	(0.16)	(0.14)	(0.21)	(0.15)	(0.18)	(0.15)	(0.15)	(0.14)	(0.18)
Log ($Area_i$)	-0.09	0.10	0.07	0.28*	0.148	0.07	0.17	0.01	0.21	0.22*	0.24
	(0.35)	(0.14)	(0.15)	(0.14)	(0.19)	(0.14)	(0.16)	(0.14)	(0.14)	(0.12)	(0.17)
Constant	12.91***	7.36***	9.07***	7.96***	8.61***	9.03***	8.15***	10.22***	7.12***	8.62***	9.29***
	(3.37)	(1.14)	(1.18)	(1.22)	(1.59)	(1.02)	(1.32)	(1.01)	(1.34)	(1.09)	(1.47)
Observations	74	65	69	59	57	64	64	57	54	81	60
R-squared		0.37	0.30	0.36		0.46	0.17	0.46	0.45	0.42	0.25
						2005					
Log ($\hat{T}_i$)	0.71***	0.58***	1.05***	0.83***	0.96**	0.67***	0.68***	0.95***	0.69***	0.46***	1.18***
	(0.15)	(0.13)	(0.22)	(0.17)	(0.43)	(0.13)	(0.18)	(0.17)	(0.17)	(0.07)	(0.19)
Log (Pop_i)	-0.15	-0.05	-0.06	-0.07	-0.18	-0.11	-0.08	-0.37**	-0.51**	-0.25*	-0.13
	(0.17)	(0.15)	(0.19)	(0.16)	(0.22)	(0.15)	(0.18)	(0.15)	(0.20)	(0.14)	(0.19)
Log ($Area_i$)	-0.10	-0.01	0.17	0.12	0.12	0.03	0.18	0.14	0.14	0.01	0.24
	(0.16)	(0.14)	(0.18)	(0.16)	(0.20)	(0.14)	(0.17)	(0.15)	(0.19)	(0.13)	(0.20)
Constant	8.79***	6.27***	4.81**	6.42***	6.59**	8.07***	5.94***	7.90***	10.41***	8.50***	5.44***
	(1.50)	(1.47)	(1.93)	(1.51)	(2.57)	(1.32)	(1.83)	(1.34)	(1.51)	(1.25)	(2.035)
Observations	86	77	65	68	65	62	68	63	64	86	85
R-squared		0.14		0.11		0.19		0.18		0.18	

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

5. Conclusion

The 21st century's world economy is predominantly service related. This trend is likely to strengthen over time. In 2014, 71% of the world's GDP was produced in the service sector. The service sector is not only the largest sector in the economy but is also its fasting-growing sector. Despite these facts, the empirical literature on the effect of service trade on a country's real income is missing. Using a rich data set of bilateral service trade, this paper estimates the causal effect of service trade on service per capita income for 95 countries in 2000, 2005, and 2010. This research study first shows that the estimate of the geographical component of the overall service trade share, which is obtained from the gravity equation of bilateral service trade, is a very powerful instrument for measuring the actual service trade share. This research has established that the impact of service trade on per capita service income is economically and statistically significant at the 1% level. A 1% point increase in the service trade share causes a 0.1% to 0.4% increase in the service per capita income. The result is robust with the inclusion of various geographical and institutional controls specific to the service sector.

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Annexure

A1. Quality of the instrument constructed

Figure 1: Relation between the actual trade share and the constructed trade share in 2000 after controlling for size measures

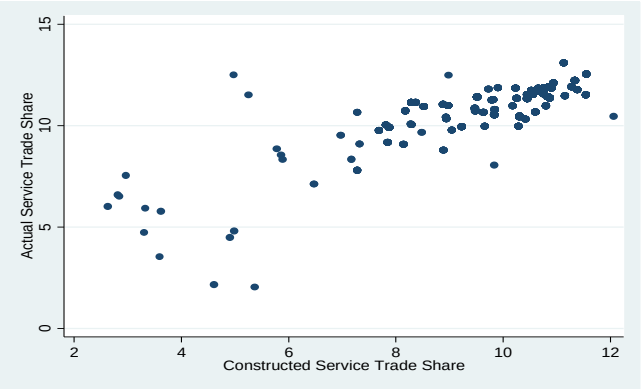

Figure 2: Relation between the actual trade share and the constructed trade share in 2005 after controlling for size measures

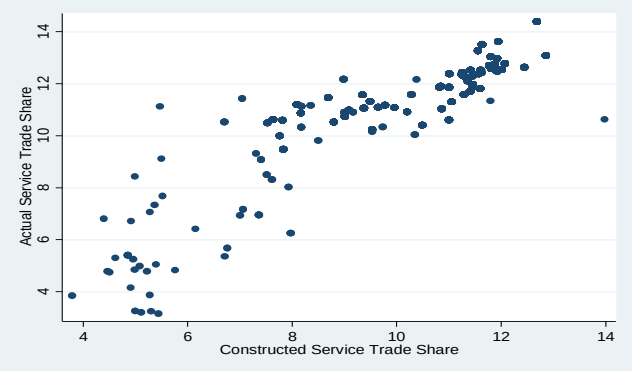

Figure 3: Relation between the actual trade share and the constructed trade share in 2010 after controlling for size measures

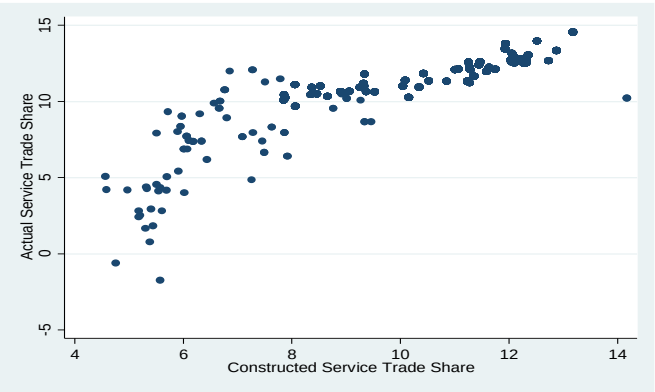

Table 6: Correlation matrix of variables used in the first-stage regression

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14
V1: Log ($ServiceTrade_{ij}$)	1													
V2: Log ($Distance_{ij}$)	-0.47	1												
V3: $Contig_{ij}$	0.25	-0.38	1											
V4: Log (Pop_i)	-0.31	0.24	0.002	1										
V5: Log ($Area_{i)}$	-0.35	0.23	0.01	0.78	1									
V6: Log (Pop_j)	0.21	0.23	0.002	-0.10	-0.11	1								
V7: Log ($Area_j$)	0.07	0.22	0.02	-0.10	-0.09	0.78	1							
V8: Landlocked $_{ij}$	0.08	-0.27	0.12	-0.17	-0.14	-0.16	-0.135	1						
V9: $Log(Distance_{ij})*Contig_{ij}$	0.24	-0.35	0.99	0.01	0.03	0.01	0.0307	0.111	1					
V10: Log (Pop_i)*$Contig_{ij}$	0.18	-0.29	0.88	0.10	0.09	-0.003	0.00843	0.0769	0.903	1				
V11: Log ($Area_i$)*$Contig_{ij}$	0.24	-0.29	0.88	-0.003	0.004	0.10	0.0884	0.0744	0.899	0.760	1			
V12: Log (Pop_j)*$Contig_{ij}$	0.23	-0.35	0.99	0.03	0.05	-0.001	0.0189	0.109	0.992	0.933	0.858	1		
V13: Log ($Area_j$)*$Contig_{ij}$	0.25	-0.35	0.99	-0.001	0.02	0.03	0.0481	0.109	0.992	0.862	0.930	0.974	1	
V14: $Landlocked_{ij}$ * $Contig_{ij}$	0.16	-0.27	0.62	-0.03	-0.03	-0.04	-0.0299	0.316	0.581	0.460	0.453	0.575	0.574	1

A2. List of countries in the sample

Afghanistan, Albania, Algeria, Argentina, Azerbaijan, Australia, Austria, Bahamas, Bangladesh, Belarus, Belgium, Bhutan, Bolivia, Botswana, Brazil, Bulgaria, Burundi, Cameroon, Cambodia, Canada, Chile, China, Cote d'Ivoire, Congo Rep., Colombia, Costa Rica, Croatia, Czech Republic, Cyprus, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, Fiji, France, Germany, Guinea, Georgia, Ghana, Guatemala, Guyana, Honduras, Hungary, Indonesia, India, Ireland, Iceland, Iran, Italy, Jamaica, Jordan, Japan, Kenya, Korea Rep., Lebanon, Lithuania, Luxembourg, Latvia, Madagascar, Maldives, Malaysia, Malawi, Mali, Malta, Mauritania, Mauritius, Morocco, Moldova, Mexico, Mongolia, Mozambique, Namibia, Nigeria, Nicaragua, Netherlands, Norway, Nepal, New Zealand, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Poland, Portugal, Paraguay, Romania, Russian Federation, Rwanda, Senegal, Singapore, Slovak Republic, Saudi Arabia, Spain, Slovenia, Sri Lanka, Sudan, Sweden, Switzerland, Swaziland, Syria, Togo, Thailand, Tunisia, Turkey, Tanzania, Uganda, Ukraine, Uruguay, United Arab Emirates, United Kingdom, United States, Venezuela, Vietnam, South Africa, Zambia and Zimbabwe.