

Estimating Protection in Services Sector: A PPML Analysis

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Abstract

The paper provides the tariff equivalent (AVEs) of the trade regulations in services from the gravity equation estimated at the sectoral level and access protection by comparing the actual trade values against a benchmark (free trader). The AVEs are calculated using the bilateral trade flows in 19 services sectors for 121 countries from the latest version of the Global Trade Analysis Project (GTAP) database for 2014.

We conclude that protection is heterogeneous across the sectors and is indirectly linked with the level of development. The countries with the least protected services are developed countries. On average, the most restrictive sector is the Gas sector with average AVE of 440 percent while the most open sector is Air transport with average AVE of 38 percent. Taking the average of AVEs in all sectors, Luxemburg, Singapore, Belgium, and Ireland are the most open economies while Bangladesh, Zimbabwe, Pakistan, and Tajikistan are more restrictive.

As part of services is implicit in merchandise trade, Services value-added accounts for more than 60 percent of global GDP in 2020; liberalization can have spillover effects and welfare gains. Protection is primarily high in developing (emerging) countries; liberalization of the service sector is expected to increase their competitiveness and global trade share. Further, it can decrease the widening inequality amid the pandemic.

Introduction

The World Trade Organization's General Agreement on Trade in Services (GATS) divides trade-in services into four categories: cross-border supply, consumption abroad, commercial presence, and natural presence. Our analysis is limited to cross-border supply and consumption abroad. Although trade-in service accounts for a lesser percentage of total trade, its relevance must be recognized because services play a critical role in the production and trade of goods, mainly through the facilitation of financial services, engineering, and telecommunications.¹ As a result, policy measures relating to trade in services are essential because any restriction will directly impact trade in goods (Nordås & Rouzet, 2015).²

According to the OECD Services Restrictiveness Index (STRI) database, barriers to service trade are divided into five policy areas: restrictions on foreign entry, barriers to competition, restrictions on people's movement, regulatory transparency, and other discriminatory measures. For example, non-price regulatory mechanisms such as trade policies, investment policies, domestic regimes, migration policies, and competition rules govern cross-border trade in services, whether through e-commerce or physical movement of goods. Non-tariff measures in the services sector also include a value-added tax on courier services and a land-tax surcharge on foreign firms and individuals purchasing real estate. It also covers nationality requirements for executives in domestic service industries, foreign equity limits in the insurance industry, and the capital requirements for starting a telecommunications company.

Unlike its counterpart, trade in services is not subject to tariffs, but restrictions in the form of non-tariff measures (NTMs). Such regulations either restrict supply or make it more costly, hence significantly impacting the flow of services. Thus, reducing trade barriers in the services sector shall improve countries' participation in the global value chain and enable foreign direct investment (FDI) and economic development. According to the 2019 World Trade Report, liberalization of services trade results in welfare gain of between two to seven percent. Moreover, it also leads to mutual gains for trading partners. For example, in the construction industry, removing barriers such as recruitment fees, time-consuming regulatory processes, visas, and work permits, licensing requirements, and ambiguous legal requirements improves international labor mobility, hence, significant remittances (and spillover effects) to exporting countries and low-cost input elements to importing countries.³

¹ Trade-in services reached US\$ 13.3 trillion in 2017 and grew faster than the trade in goods from 2005 to 2017 (World Trade Report, 2019).

² Trade costs in the services sector are double compared to goods, but there was a decline of 9 percent from 2000 to 2017, mainly due to technology and the growth of export in digitalized services (World Trade Report, 2019).

³ The services sector's liberalization requires a relatively more complex policy regime and change in national regulations. For instance, changing the migration laws consists of the ministry of migration, human rights organizations, legal institutions both in the home country and foreign country, employment agencies, recruitment agencies, etc. Also, domestic regulations account for many services trade costs, especially in developing countries, which are not easy to negotiate.

Although services represent more than 60 percent of the global GDP in terms of value-added, the empirical literature on trade protection in services is minimal when compared to merchandise trade.⁴ Among the many reasons, the nature of regulations in the services sector is heterogeneous and complex, making quantification even more challenging. Modeling them differs from that of the goods sector because services are intangible and highly differentiated.⁵ Thus, the different price-based approaches used in the goods sector to estimate the non-tariff measures do not apply to the services sector. Moreover, NTMs in services are difficult to separate since they are disguised in the goods trade. In addition, the services are highly distinguished by economy, firm, and customers' needs. For example, the legal services are different in different countries, and the services vary based on the individual case within the country.

Therefore, the main motivation of this paper is to contribute to the limited discussion by estimating the AVEs of the services sector based on a methodology developed by Park (2002) and adopted by Fontagné et al. (2011, 2016) ; Francois et al. (2003) ; Guillin (2013); and Péridy & Ghoneim, (2013). The two-step procedure includes the estimation of the gravity model, and the computation of the AVEs using the fixed effect information from the first step by setting a benchmark country with the highest fixed effect, assuming a constant elasticity of substitution. Our study is also unique as we use the latest release of GTAP data on bilateral trade in services for 2014 and provides AVEs for 19 services sectors and 121 countries.

This paper contributes to the literature in two ways: first, it uses the latest release of GTAP data for the year 2014 to estimate AVEs for 19 services sectors. To our knowledge, the protection in the services sector has not been investigated using GTAP10 data for 2014. Second, the study uses the Poisson Pseudo-Maximum-Likelihood (PPML), suggested by Santos Silva & Tenreyro (2006). Currently, PPML estimates are the most preferred for estimating gravity equations in trade literature because the PPML gravity estimation with fixed effect is proven to be consistent with the theoretical compatible gravity model of Anderson and Van Wincoop (2003). The AVEs of regulation computed in the paper explain the restrictiveness of regulations in each sector for individual countries.

Section two discuss the existing methods to quantify the effect of regulations in services trade. Section three discusses the econometric process. Section four discusses the data. Section five contains the results and comments, and section six concludes.

2. Estimation of the economic impact of regulations services

The effect of non-tariff measures in services can be quantified in the form of AVEs. Deardorff and Stern (2006) define tariff equivalent of regulations as “the ad valorem tax on foreign service providers that would have caused the same effects as a trade barrier”. A cursory glance at the literature shows that researchers use two main data sources to transform the regulations into AVEs services: the Services Trade Restrictiveness Index (STRI) and the Global Trade Analysis Project

4. Although worldwide trade in services accounts for 10 percent of global GDP, the implicit value of services is found in merchandise trade as services value-added accounts for 64 percent of global GDP in 2020.

⁵ The tariff equivalent in the services sector was estimated between 20 percent and 2000 percent (Benz,2017).

(GTAP).⁶⁷ The former provides information on the regulations in 22 services sectors for OECD members and the latter provides comprehensive data on the bilateral trade flows in 20 services for 121 countries, as of the latest release, GTAP10.⁸

The World Bank and OECD developed STRI indices using the information on the regulations in services sectors. Hence, one approach to estimating the economic impact of the barriers to services in the form of AVEs is using the information on STRI in different econometric modeling, including the gravity model. However, Fontagné et al. (2013) use the methodology and outline the limitations of transforming the qualitative information on regulation into trade restrictiveness indices. They argue that this method is resource-consuming and does not explain the exact economic effect of regulation and its intensity. Furthermore, it may be unlikely to maintain the qualitative information on regulations while assigning arbitrary codes to qualitative data, which is another limitation of this technique. Some recent studies using the STRI information to compute AVEs include Benz & Jaax (2021), but most studies using STRI information are limited to OECD countries.

The second approach to estimating the economic impact of the barriers to services is using computable general equilibrium (CGE). This method adopts a price-based approach or quantity-based approach by introducing a shock to the model and comparing the pre and post-shock scenarios.⁹ In CGE models, the NTMs are generally modeled as tariff equivalent using import and export taxes or as an iceberg cost.¹⁰ Although most CGE modeling research focuses on barriers in goods probably due to data availability; some recent studies used CGE to model the regulations in services, including Ortiz Valverde & Latorre, (2020) and Movchan & Shportyuk, (2010).¹¹

The third but the least popular method is to estimate the trade cost of NTMs in services by relying on a business survey. However, these studies are limited to specific sectors and countries and the findings do not necessarily reflect the overall impact of regulation on trade (Berden et al., 2009; Boughzala & Saidane, 2007).

Notwithstanding, our paper adopts the indirect method, and we intend to investigate trade protection in services, covering a more extensive set of countries and sectors. The indirect methods is a quantity-based estimation, using the trade values in services as a dependent variable in gravity modeling and calculating AVEs by defining a benchmark, assuming constant elasticity of

⁶ <https://data.oecd.org/searchresults/?q=STRI>

⁷ <https://www.gtap.agecon.purdue.edu/databases/default.asp>

⁸ The GTAP database is also widely used for General Equilibrium modelling to access the economic impact of trade policies in goods and services.

⁹ See (Walmsley & Strutt, 2021) for comparison of different approaches in CGE

¹⁰ Both price-based and quantity-based methods can be used in CGE mechanism.

¹¹ Note that CGE does not allow the calculation of AVEs; either calculated AVEs can be incorporated in the CGE model to access the effect of protection on different macroeconomic variables.

substitution across sectors (Park, 2002; Fontagné et al., 2011, 2016; Péridy & Ghoneim, 2013 Guilin, 2013). Unlike the STRI approach, the cost of barriers in the services sector can be estimated without using the policy information. This indirect method has many advantages compared to STRI data: it covers more sectors and countries, and data can easily be updated. Also, this method is free of biases that may arise while quantifying the qualitative policy information. Nevertheless, the data on bilateral trade in services used in this method does not include the sale of services made through foreign direct investment, which can be viewed as a limitation of this method, as noted by Jafari & Tarr (2017).

The indirect approach to estimating the AVEs of NTMs using GTAP data involves two steps. First, the gravity model is estimated using trade in services as a dependent variable. Then, the actual trade in services is compared against a benchmark, using the residual of the gravity equation or the fixed-effect co-efficient obtained from sectoral regression, assuming constant elasticity of substitution. The former is called the residual method, and the latter is the fixed-effect approach. Park, 2002 first estimated the AVEs in services for eight sectors and 51 countries using the residual method and GTAP data. Building on the work of Park, (2002), Fontagné et al., (2011) improve the methodology and estimate AVEs by defining benchmarks using the fixed-effect coefficient instead of regression residuals. Fontagné et al. (2011) prefer the fixed-effect method over the residual method because the residuals of the model are vulnerable to capturing unobserved effects, other than protection. As identified by Fontagné et al., (2011), the “distribution of residual of the estimated equation is sensitive to specification and omitted variables problems which affect the estimation of tariff equivalent” (Fontagné et al., 2011, p.12).¹²

3. Methodology

This paper uses a quantity-based approach or a value-based approach to measure the extent to which regulation restricts the trade compared to the potential trade in services. The quantity-based method is preferred over the STRI approach and is well explained in Fontagné et al. (2013). This paper uses the latest version of GTAP data to measure the latest AVEs and extends the analysis to more sectors and countries. Moreover, the use of fixed effect satisfies the gravity equation for multilateral resistance terms, (Fally; 2015).

3.1 Estimation of the gravity equation

The gravity model is a standard model of empirical trade literature and is extensively used to access the determinants of trade flows. Although most of the research community uses it for the analysis of goods sectors, it also applies to determine trade in services (Walsh, 2008; Kimura & Lee, 2006; Francois et al., 2003; Fontagné et al., 2011, 2016; Nordås, 2018).

The estimation is carried out in two steps. Firstly, we estimate the gravity equation using cross-section data.

¹² Fontagné et al. (2016), in a preceding paper, provides AVEs using same methodology and updated GTAP data for year 2011, covering more countries.

The sector-specific gravity equations are estimated, with the following specifications:

$$x_{ij} = c + 0.8y_j + \alpha_{ij}dist_{ij} + \beta_{ij}D_{ij} + \gamma_i + \gamma_j + \varepsilon_{ij} \quad (1)$$

where x_{ij} represents exports from country i to country j , $dist_{ij}$ is the distance D_{ij} includes gravity variables commonly used in trade literature: contiguity, common colony, and regional trade agreement (all dummies). The exporter and importer fixed effects are given as γ_i and γ_j respectively, controlling for country-specific characteristics.

In equation 1, the impact of GDP is captured in fixed effects; hence the GDP of the exporting country (i) is dropped from the model. Since we are interested in the fixed products of the importing countries to calculate AVEs, the GDP of the importing country (j) is constrained to 0.8 for the sensitivity analysis. By doing so, the fixed effect of importing countries includes information on protection only.

We estimate equation (1) using the PPML method. PPML, as suggested by Santos Silva and Tenreyro (2006), is preferred to log-linearized estimation with ordinary least square, as it accommodates zero trade values and is robust to heteroscedasticity. Also, Fally (2015) shows that when gravity is estimated with Poisson, the estimated fixed effects are precisely equal to the multilateral resistances (MRs) that satisfy the gravity equation system. We obtain the fixed effect coefficients for both importers and exporters. However, our interest is in importers' fixed effects to calculate sectoral AVEs for each importer.

3.2 Derivation of AVEs

In the second step, we derive AVEs, using the regression results from the first step. We will briefly discuss the theory. It is important to consider aggregate trade costs with the rest of the world, to be consistent with the theory. The country-specific trade costs with the rest of the world are called multilateral resistance terms (MRT) and can be controlled using country-specific fixed effects. Anderson & van Wincoop; (2003), in a pioneering work, derive a new theoretical approach to gravity equation, grounded on the gravity theory of Anderson (1979). With MRT, the gravity equation states that after controlling for the size of the economies, the bilateral trade between countries i and j depends on the bilateral trade barriers between them divided by the product of their MRT, given as:

$$x_{ij} = \frac{y_i y_j}{y^W} \left(\frac{t_{ij}}{P_i P_j} \right)^{1-\sigma} \quad (2)$$

In our gravity equation (1), y_j is observed $P_i^{(\sigma-1)}$ is captured by exporter fixed effect (γ_i), $P_j^{(\sigma-1)} t_{ij}^{(1-\sigma)}$ is captured by importer fixed effect (γ_j), and y^W is fixed.

Since the regulations in the service sector cannot be directly observed, the actual trade is compared with the hypothetical situation of free trade, provided by the highest coefficient of fixed effects, defined as a benchmark country. Under the assumption of constant elasticity of substitution, the equation to calculate AVEs is the following:

$$\ln(1 + AVE)^{-\sigma} = Fe\gamma_j - Fe\gamma_{\overline{Benchmark}} \quad (3)$$

The fixed effects are obtained from the estimation of equation (1) and the consumer constant elasticity of substitution is equal to 5.6, following Park (2002) ; and Fontagné et al. (2011, 2016). The higher the elasticity (σ), the lower the AVE. However, the relative ranking of the countries, being restrictive or open, is not sensitive to the choice of elasticity parameter. Hence, the open countries will remain open and restrictive countries will remain restrictive, with different values of AVEs when the elasticity is different than 5.6. The benchmark countries (with the highest fixed effect at the sectoral level from gravity regression) include developed countries and emerging countries. Everything else is compared to the benchmark and the AVEs in each sector are calculated using equation (3) for all countries.

The benchmark countries are the countries that have the highest fixed effect coefficient, obtained from the estimation of the gravity model, equation (1). The AVEs of the benchmark countries calculate to zero, however, this is to be interpreted with caution. The zero AVEs do not reflect the absence of any regulation, which is unrealistic, rather the AVEs explain the extent to which the regulation is restricting the trade. Hence a country with zero AVEs is the one having the least costly regulations: not restricting the trade flows. This is a hypothetical situation of free trade; hence we call the countries “free traders” Note that all the regulations are not necessarily trade-restrictive: the regulations other than tariffs do not generally address trade issues, rather they address issues like consumer safety, environmental safety, and stability of the market. Such regulations can inhibit or facilitate trade.

4. Data

The main source of the data is the Global Trade Analysis Project (GTAP). The latest version GTAP10 provides data on bilateral trade for 20 services sectors for the year 2014: Accommodation and Food (AFS), Air transport (ATP), Communication (CMN), Construction (CNS) Education (EDU), Electricity (ELY), Gas manufacture and distribution (GDT), Human Health and Social Work (HHT), Insurance (INS), Business Services (OBS), Financial services (OFI) Public Administration and Defense (OSG), Transport (OTP) Recreational and other services (ROS), Real estate activities (RSA), Trade (TRD), Warehousing and support activities (WHS), Water transport (WTP), Water (WTR) and Dwellings (DWE).¹³ We estimate the gravity model on a sectoral level using GTAP10 data on 19 services sectors for 121 countries.¹⁴ The trade values in services sectors are in millions of USD. The bilateral data covers mode 1 (cross-border trade) and mode 2

¹³ Further details of each sector are provided in Annex-A

¹⁴ Dwellings is not included in the analysis due to significant number of missing data.

(consumption abroad).¹⁵ The gravity variables are taken from the gravity database of CEPII.¹⁶ The variable *Distance* is the log of distance (km) between the most populated cities of each country. *Comcol* represents a common colony, takes Dummy equal to 1 if countries share a common colonizer post-1945. *Contiguity* takes Dummy equal to 1 if countries are contiguous. The variable *RTA* represents regional trade agreement, taking the value 1 if the pair currently has a regional trade agreement. All the data used in the analysis is bilateral.

5. Results and Discussion

5.1 Gravity model

Table 1 provides the regression results from the estimation of equation (1) for each sector. Distance does not appear as a significant impeding factor for services trade in our analysis. Table 1 shows that distance is insignificant for half of the sectors and the other half, distance is positively linked with international trade in services.

The standard gravity literature states that distance is a proxy for transportation costs. However, researchers interpret the distance effect differently for the services sector. If the distance is a proxy for information cost, as identified by Fontagné et al. (2011), the services sector may likely have overcome the information asymmetry, given that most of the services are digitalized. The findings concur with the common perception of globalization wherein distance is becoming less important to international trade in general. Tharakan et al. (2005) find that distance is not significant for Indian software exports. In a recent study, Boulatoff (2021) find that the impact of distance is negative and not homogenous across the sectors, with much less impact on telecommunication and information technology.¹⁷

The results of the gravity model vary in different econometric exercises. For example, compared to the OLS estimates, the negative effect of distance decreases with PPML estimation, Santos & Tenreyro (2006), conclude that OLS estimation exaggerates the negative role of distance in both traditional and structural gravity models. Their simulation results show that the distance elasticity is relatively smaller when the gravity model is estimated with PPML. They also comment that the common colony is a significant determinant of bilateral trade in OLS and insignificant in PPML estimation.

¹⁵ The GTAP services trade data relies on IMF balance of payment statistics which covers only mode 1 and mode 2

¹⁶ The database can be freely accessed at <http://www.cepii.fr/CEPII/en/cep/cep.asp>

¹⁷ Note that distance may be an impediment for the presence of a natural person (service supply mode 3) and the commercial presence (service supply mode 4), the latter accounts for 59 percent of global trade in services as of 2017, is not part of the analysis.

Table 1: Estimation results of the GTAP sample of 121 countries, 2014

Sectors	distance	Comcol	contiguity	rta	Importer FE	Exporter FE
CMN	0.18**	0.04	0.52***	0.43***	Yes	Yes
CNS	0.15**	0.36*	0.41***	0.27**	Yes	Yes
TRD	0.08	-0.02	0.52***	0.36***	Yes	Yes
INS	0.30**	0.60***	0.91***	0.32***	Yes	Yes
OBS	0.16***	0.06	0.46***	0.39***	Yes	Yes
OFI	0.30***	0.67**	0.67***	0.60***	Yes	Yes
OSG	0.56**	0.15	1.34***	0.49***	Yes	Yes
AFS	-0.00	-0.08	0.62***	0.28***	Yes	Yes
ELY	-0.40	1.64***	2.69***	0.28**	Yes	Yes
WTP	0.14***	0.04	0.37***	0.31***	Yes	Yes
ATP	0.16*	0.05	0.57***	0.24***	Yes	Yes
OTP	0.12	0.04	0.80***	0.26***	Yes	Yes
GDT	0.27	-0.17	0.79***	0.27*	Yes	Yes
HHT	0.15	0.00	0.90***	0.36***	Yes	Yes
WHS	0.08	-0.11	0.75***	0.22***	Yes	Yes
WTR	0.14	-0.07	0.90***	0.30***	Yes	Yes
RSA	0.06	0.16	0.80***	0.30***	Yes	Yes
ROS	0.11*	-0.05	0.76***	0.33***	Yes	Yes
EDU	0.40**	0.15	1.04***	0.41***	Yes	Yes

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Constrained parameter on importers' GDP not reported

Source: Authors' calculations

The significant positive relation of distance in some of the sectors is an interesting result. As mentioned earlier, each sector included in the analysis is traded in four different modes: cross-border trade, consumption abroad, commercial presence, and natural presence. This analysis considers only cross-border trade (mode 1) and consumption abroad (mode 2) in each sector. We take the example of the education sector to explain the positive distance effect. In mode 1, the service provider in one country delivers online educational services through the internet to students from different parts of the world. In mode 2, consumers of the services (students) travel abroad to study in foreign universities. Ideally, the distance effect is negligible in distance learning facilitated by technology, for example, distance does not limit access to information. In other words, the

consumption of online services increases with greater distance, for example, for consumers in India, the probability of enrolment in an online course offered by the university in England is greater than online courses offered by Pakistani universities. Similarly, statistics show that half of the population of international students studying in the United States are from China, which explains the positive distance effect in the case of mode 2. With the advancement in technology and digital infrastructure, distance is becoming less relevant for trade advancement, especially in the service sector.

Another explanation for a distance not impeding trade in our analysis is the dominance of mode 1 over mode 2. For example, according to World Trade Organization (2019), global trade through mode 1 represents 27.7 percent compared to 10.4 percent in mode 2 as of 2015-2017.¹⁸ Mode 3 is the dominant mode of global service trade (58.9 percent) and is not part of the analysis. If we see the composition of a single sector, it is easy to understand. For example, in the construction sector, most of the trade is through mode 3: establishing affiliate abroad, followed by mode 1: an architect designing the construction project for online clients abroad, and mode 4: architect visiting the clients' country in implementation of the project. In this case, mode 2: consumer traveling to another country to find an architect, sounds very rare in this globalized world. Since our analysis only considers mode 1 and mode 2, and distance is no longer impeding mode 1, this justifies the non-negative role of distance in the gravity model of services trade.

RTA is positively linked with the bilateral trade in services because the proliferation of regional trade agreements facilitates trade both in goods and services. This is well established in trade literature and is consistent with a recent study by Benz & Jaax, (2021). This result makes economic sense, for example, lifting restrictions on the movement of individuals and facilitating the visa process will increase services trade in mode 2. Flexible arrangement like issuing temporary visas facilitate the movement of people. Similarly, easing the licensing requirements for online consultancy increases service supply through mode 1. A recent study by Nordås, (2018) shows that free trade agreements boost trade in services.

The coefficient of contiguity is also positive and significant. The countries sharing the same border trade more due to similar structural features, for example, both US and Canada specialize in high tech which leads to more services trade between them. Similarly, in the health sector, the number of patients from Pakistan going to India for medical surgeries outnumbers the number of patients going to England to avail of the same service. Adjacent countries share a common economic zone and common policies which facilitate trade in services under mode 1 and mode 2. Under mode 1, the countries share the common businesses and the neighboring countries specialized in services that the economy in the bordering country demands. Under mode 2, it is a low-cost option for consumers to avail of services in bordering countries. Other reasons for positive border effect include common language, common religion, and cultural similarities for example the legal services in countries comprising Gulf Cooperation Council.

¹⁸ Calculated as the average of world trade

The common colony is not a determinant of services trade, as for almost all the sectors the coefficient is not significant. From literature, colonial relationships facilitate trade in services due to the business network in place, which is not relevant in the case of mode 1 and mode 2 services. The nature of cooperation is now more aligned with regional cooperation. ASEAN is a perfect example where there are four colonial powers in the region: British, Dutch, French, and Spanish. Nonetheless, these countries came together to promote regional cooperation that brings mutual benefits to all member countries.

The gravity estimation shows that distance is not an impeding factor and for some of the sectors, it is positive. Even if the distance effect exists, the reason to trade more in services is regional trade agreements and the benefits stemming from the common border.

5.2 Tariff Equivalents

In this section, we discuss the sectoral AVEs for the entire sample calculated using the importers' fixed effect coefficients from the gravity model. The AVEs calculated for 121 countries in each sector are provided in annex C.

Fig1: Average AVEs (percent) by sector computed using GTAP10

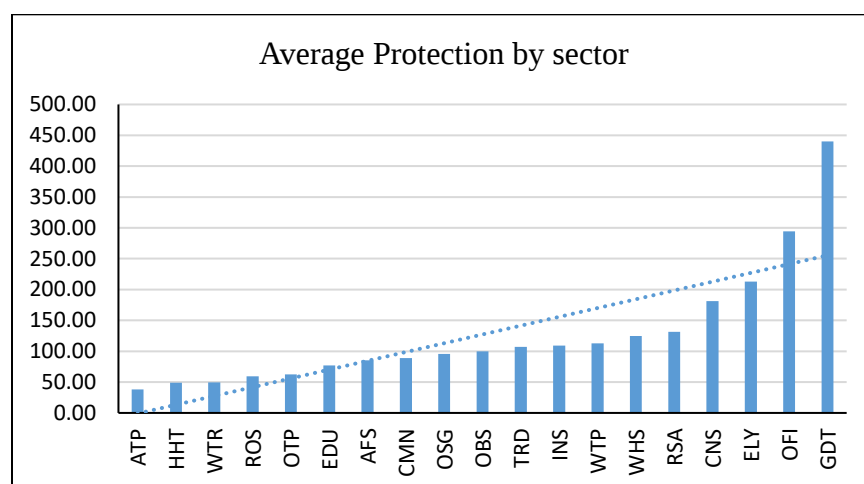


Fig 1 shows the average protection by sectors for the entire sample. Average AVEs are high for electricity, gas, financial sector, and construction while lower for air transport, human health and social work, water, and recreation services. Our estimates show that air transport is the least restrictive, and construction is more restrictive which is support the findings of Fontagné et al. (2011, 2016), comparing the sectors common in both analyses. Using the same methodology but a different sample, Peridy and Ghineim, (2013) also find that electricity and gas were the most restrictive ones while air transport is the least restrictive.

Table 2 reports the open economies in each sector. Luxembourg, Singapore, and Ireland serve as a benchmark for at least one sector. Some of the high-income oil-producing economies also appear among the top ten open economies, including Kuwait, Oman, and Saudi Arabia, which is very relevant given the high dependency of these economies on services trade. The majority of the open economies are high-income countries. From table 2, out of 68 countries appearing in the top ten

open economies, 61 countries are in the per capita income range between 119,173USD (LUX) and 1099USD (KHM).

Table 2: Top 10 open countries in each sector

Sect	1	2	3	4	5	6	7	8	9	10
CMN	LUX	BEL	DNK	NLD	SGP	IRL	SWE	MLT	DEU	HUN
	0.00	17.96	20.82	21.08	25.10	28.68	30.09	31.51	34.11	37.06
CNS	AZE	KAZ	LAO	LUX	TJK	RUS	DNK	ETH	MOZ	BGR
	0.00	20.56	29.52	32.37	32.37	40.37	42.53	44.71	45.03	54.46
TRD	IRL	SGP	LUX	NLD	BEL	CHN	OMN	DNK	HKG	ITA
	0.00	10.28	27.29	38.86	42.53	44.08	45.66	47.25	52.46	53.79
INS	IRL	LUX	SGP	DNK	MLT	OMN	BFA	USA	BOL	CAN
	0.00	11.72	37.35	43.15	53.13	56.49	56.49	58.55	61.33	65.23
OBS	IRL	LUX	SGP	MLT	BEL	SWE	NLD	FIN	HUN	DEU
	0.00	11.00	12.21	14.43	20.03	31.22	34.69	35.87	40.07	41.60
OFI	LUX	IRL	MLT	SGP	DNK	BEL	HKG	GBR	UKR	CYP
	0.00	80.24	91.14	124.99	129.93	132.44	136.52	137.55	150.82	161.40
OSG	KWT	CYP	NGA	TTO	BRN	GHA	MAR	GIN	GBR	LUX
	0.00	30.66	32.95	34.11	36.76	37.06	38.86	40.68	40.98	42.22
AFS	IRL	LUX	SGP	KWT	THA	CYP	HKG	KOR	BEL	ALB
	0.00	9.80	24.28	35.28	35.87	36.76	37.06	39.16	40.37	40.98
ELY	ALB	TGO	MOZ	BEN	NAM	HRV	MAR	THA	KHM	NPL
	0.00	1.75	4.22	7.44	10.76	11.97	12.46	13.93	14.43	19.77
WTP	GRC	NOR	SGP	CYP	ISR	CHL	GIN	LKA	BEL	MUS
	0.00	0.00	1.31	15.43	18.74	25.37	26.46	27.85	28.40	30.37
ATP	HKG	LUX	DNK	GBR	DEU	BEL	AUT	TTO	CYP	FRA
	0.00	2.42	3.76	4.22	6.97	8.14	9.32	10.28	10.76	12.95
OTP	SGP	BEL	LUX	KGZ	HKG	KWT	CYP	URY	DEU	LTU
	0.00	7.44	15.18	15.43	19.25	20.82	21.88	22.41	23.74	24.28
GDT	GEO	AUT	POL	TJK	FIN	LUX	GHA	HRV	TUR	IRL
	0.00	30.94	30.94	35.28	41.60	43.46	48.54	58.20	71.08	83.80
HHT	SGP	LUX	KWT	CYP	ALB	BEL	IRL	HKG	SAU	GBR
	0.00	3.31	3.54	6.74	8.38	9.08	9.80	10.04	10.28	15.43
WHS	SGP	KOR	HKG	NLD	LVA	CYP	CHL	BEL	LUX	CZE
	0.00	42.22	50.16	50.49	51.47	54.13	59.58	60.28	60.98	67.04
WTR	SGP	LUX	KWT	CYP	ALB	BEL	HKG	IRL	SAU	GBR
	0.00	4.22	4.90	6.51	9.08	9.32	10.04	10.52	11.48	16.18
RSA	OMN	TJK	LAO	AZE	MAR	SGP	CHE	BLR	LUX	MNG
	0.00	28.68	33.82	35.28	51.14	60.63	61.68	68.13	70.34	70.34
ROS	LUX	KGZ	SGP	CYP	MYS	ALB	KWT	BEL	HUN	HKG
	0.00	8.38	9.32	14.18	16.18	16.44	18.48	19.25	20.56	21.08
EDU	KWT	DNK	MAR	CYP	GHA	TTO	LUX	GBR	UKR	BRN
	0.00	19.00	23.48	27.01	28.96	30.09	30.94	30.94	31.80	32.08

Notes: AVEs are reported in percentages

Source: Authors' calculations

Table 3 shows that the most restrictive countries in more than one sector include Zimbabwe, Bangladesh, and Tajikistan. The countries with higher protection are mostly low per capita income countries with a few exceptions. From table 3, among the 46 countries appearing as restrictive, 35 countries are in the per capita range of 355 USD (MWI) and 8318 USD (BLR).

One of the important findings of the research is the indirect link between income per capita and protection in the services sector.

Table 3: Top 10 restrictive countries in each sector

Sect	1	2	3	4	5	6	7	8	9	10
CMN	ZMB	BGD	MEX	PRY	RWA	ECU	TZA	NIC	MDG	JOR
	237.84	217.89	175.40	167.14	163.68	163.11	154.67	153.01	151.37	148.65
CNS	ZMB	MDG	PRY	BGD	MWI	DOM	ECU	SLV	PAK	LKA
	351.10	340.44	334.73	325.39	323.54	322.62	321.70	321.70	316.24	312.63
TRD	TJK	ZMB	ETH	DOM	ECU	KAZ	PAK	GIN	BGD	KEN
	280.74	215.82	192.05	173.01	171.83	171.24	168.31	164.83	163.68	161.97
INS	BGD	PAK	BEN	TUN	RWA	MDG	GHA	TTO	EST	BLR
	280.74	242.27	227.71	215.13	190.78	188.89	169.47	156.89	155.78	153.01
OBS	ZMB	ECU	SEN	TZA	GHA	PRY	KHM	GTM	BHR	ZAF
	281.57	269.33	245.26	244.51	234.91	231.29	227.71	222.76	219.27	205.69
OFI	BGD	GIN	MWI	RWA	LKA	PAK	BEN	TUN	ECU	ETH
	527.74	497.13	489.39	489.39	486.83	479.23	463.09	460.64	453.38	441.48
OSG	ZMB	TJK	MDG	ETH	ECU	SLV	KEN	BEN	HND	PAN
	213.08	207.69	190.78	182.68	164.83	164.83	160.83	151.37	150.82	149.73
AFS	TJK	BGD	TGO	ZMB	LAO	ETH	GIN	MDG	KAZ	PAK
	243.02	171.83	167.14	163.11	150.82	144.36	144.36	137.55	130.93	130.93
ELY	ETH	BGD	LKA	PRY	DOM	PER	ISR	CMR	SEN	QAT
	812.36	760.35	716.62	706.03	700.79	658.44	640.51	637.30	612.10	592.25
WTP	TJK	ZMB	BGD	TGO	PRY	DOM	SLV	PRI	PAK	MWI
	268.53	243.76	235.64	228.42	219.27	214.45	209.03	208.36	205.02	201.07
ATP	ZMB	LKA	PAK	UGA	NAM	CRI	RWA	URY	TJK	BWA
	151.91	122.55	121.59	109.41	108.05	107.15	100.07	94.07	92.81	90.72
OTP	BGD	TJK	TGO	LAO	GIN	MDG	PAK	ECU	LKA	DOM
	144.36	139.63	139.11	119.19	119.19	113.09	107.15	105.35	104.02	104.02
GDT	BGD	CRI	TGO	ZMB	BEN	PRY	ETH	CMR	KHM	NGA
	1498.64	1484.80	1400.97	1391.21	1147.73	1136.93	1086.88	1048.80	985.67	969.27
HHT	TJK	BGD	TGO	ZMB	LAO	ETH	PRI	MDG	GIN	KAZ
	179.62	111.24	108.50	108.05	93.65	91.97	88.25	85.81	84.20	80.63
WHS	TJK	BGD	ZMB	LAO	PRY	DOM	PRI	LKA	PAK	KAZ
	297.66	240.79	231.29	200.42	197.82	192.05	189.52	189.52	188.89	185.14
WTR	TJK	BGD	TGO	ZMB	LAO	ETH	GIN	PRI	MDG	PRY
	171.24	113.55	109.87	108.05	94.07	91.97	91.14	87.03	85.41	81.42
RSA	ZMB	TGO	BGD	GIN	ETH	MDG	PRY	DOM	PAK	ECU
	240.79	238.57	237.10	209.03	207.02	196.52	195.88	195.88	194.60	192.68
ROS	TJK	BGD	TGO	ETH	MDG	PRI	GIN	DOM	LKA	PAK
	194.60	137.04	134.47	114.48	111.24	108.50	107.60	102.69	99.63	98.33
EDU	TJK	ZMB	MDG	ETH	ECU	SLV	TGO	KEN	BEN	HND
	192.05	185.14	162.54	158.57	144.36	141.72	141.19	138.59	131.94	128.93

Source: Authors' calculations

Our results show that the protection is lower with an increase in per capita income. For example, the most restrictive countries in table 3 include BGD, PAK, ZMB, LAO, AND PRY are the countries having a low per capita income while LUX, SGP, BEL, HKG, and MLT are the most open and high per capita income countries. We can see that LUX appears as the most open economy and had the highest per capita income in the world in 2014. Previous studies also support this trend.

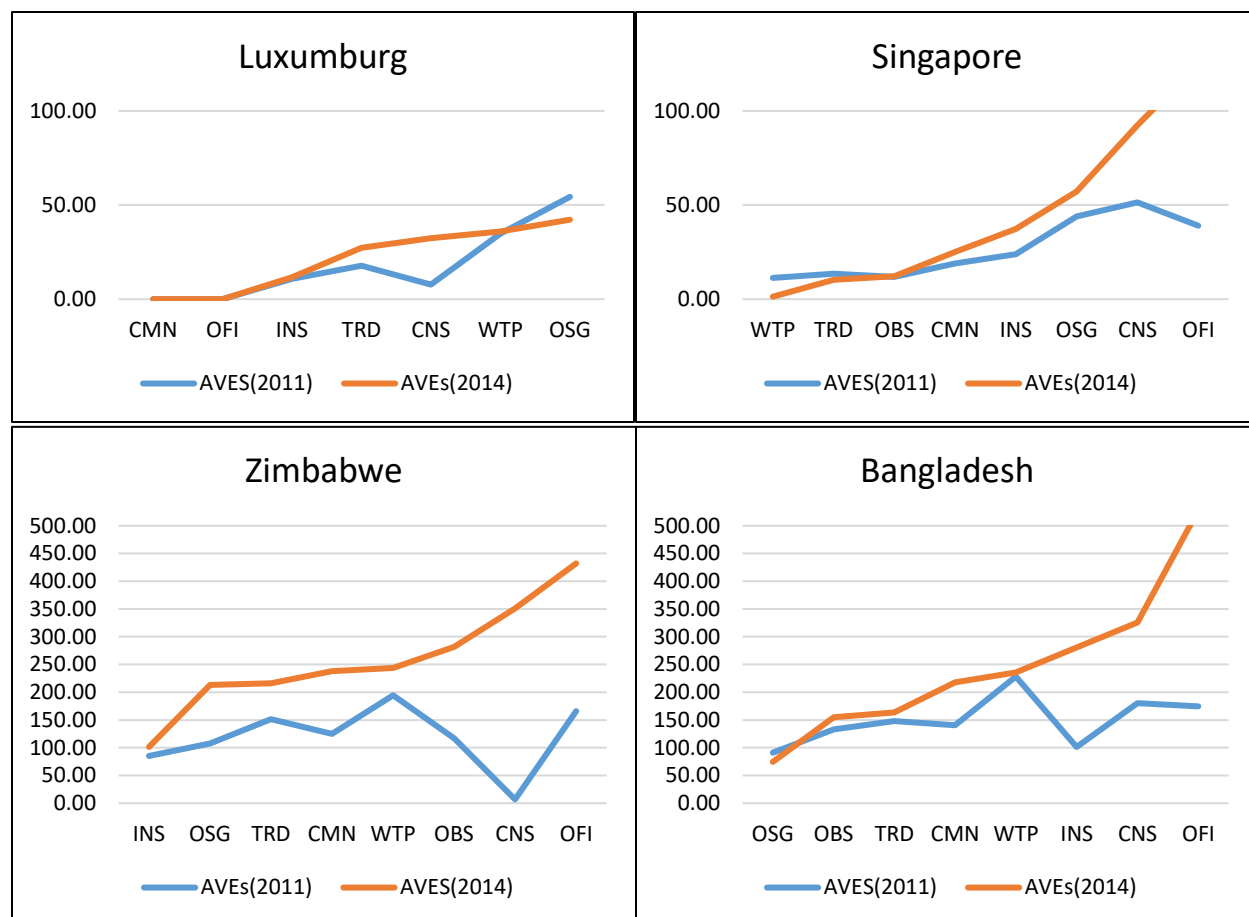
Table 4. Overall performance of countries in the entire sample of GTAP, 2014

Sectors	Open economies				Restrictive economies			
	LUX	SGP	BEL	IRL	BGD	ZMB	PAK	TJK
CMN	0.00	25.10	17.96	28.68	217.89	237.84	124.99	104.02
CNS	32.37	92.39	79.46	154.11	325.39	351.10	316.24	32.37
TRD	27.29	10.28	42.53	0.00	163.68	215.82	168.31	280.74
INS	11.72	37.35	71.45	0.00	280.74	101.38	242.27	144.89
OBS	11.00	12.21	20.03	0.00	154.67	281.57	78.29	140.15
OFI	0.00	124.99	132.44	80.24	527.74	432.14	479.23	315.33
OSG	42.22	57.17	51.80	52.46	74.46	213.08	95.76	207.69
AFS	9.80	24.28	40.37	0.00	171.83	163.11	130.93	243.02
ELY	71.45	330.03	89.07	73.70	760.35	336.63	163.11	162.54
WTP	35.87	1.31	28.40	68.50	235.64	243.76	205.02	268.53
ATP	2.42	16.44	8.14	27.85	23.48	151.91	121.59	92.81
OTP	15.18	0.00	7.44	27.57	144.36	71.45	107.15	139.63
GDT	43.46	137.04	101.38	83.80	1498.64	1391.21	407.29	35.28
HHT	3.31	0.00	9.08	9.80	111.24	108.05	80.24	179.62
WHS	60.98	0.00	60.28	73.33	240.79	231.29	188.89	297.66
WTR	4.22	0.00	9.32	10.52	113.55	108.05	77.91	171.24
RSA	70.34	60.63	79.07	71.82	237.10	240.79	194.60	28.68
ROS	0.00	9.32	19.25	26.19	137.04	63.44	98.33	194.60
EDU	30.94	36.46	38.55	43.46	74.08	185.14	86.22	192.05

Source: Authors' calculations

Note: The classification is based on the calculated AVEs and comparing the countries in all the sectors. The countries are categorized as open/restrictive economies because they appear more frequently in the top 10 open/restrictive economies, provided in Table 2 and Table 3.

Fig 1: Comparison of AVEs in 2011 and 2014 for the whole GTAP sample and seven sectors



Source: Based on calculated AVEs (%) and Fontagné et al., 2016

As mentioned earlier, Fontagné et al. (2016) calculated AVEs for nine services sectors using the GTAP data for the year 2011 and a sample of 118 countries. Although our sample and data are different, still we can compare our results with the AVEs computed for 2011, given the fact that the approach to computing AVEs is the same, i.e. using importers' fixed effect coefficient as a proxy for protection. Fontagné et al. (2016) witnessed that Luxembourg (LUX), Singapore (SGP), Belgium (BEL), and Ireland (IRL) were the most open economies while Zambia (ZMB), and Bangladesh (BGD) were the most restrictive. Our results, as explained earlier, support their findings. Compared to the AVEs calculated for 2011, our estimates are higher. The higher AVEs obtained using PPML is consistent with the literature, as previous studies show higher AVEs estimate with PPML compared to OLS. Note that to infer that protection has increased tremendously in short period: from 2011 to 2014 is severely misleading. We are confident that our estimates are true reflection of protection, given that the relative ranking of the countries are consistent with 2011 estimation provided by Fontagné et al. (2016) and we are using the most preferred methodology.

To compare the AVEs computed in 2011 for the topmost open and restrictive economies, we plot the AVEs in fig 1.¹⁹ Two important points can be seen in figure 1. Firstly, the deviation is smaller for open economies over the year. For example, for LUX, the AVEs in the communication, financial services, water transport, and insurance sector are almost the same in 2011 and 2014. Secondly, our calculated AVEs with PPML are very high than obtained from OLS estimation for 2011.

6. Conclusion

Services represent a significant percentage of global trade and are a crucial determinant of economic development and job creation. Non-tariff measures are more critical in services trade than the trade in goods as the protection in the services sector is entirely entitled to non-tariff standards. This paper uses GTAP 10 data and provides tariff equivalents of regulations for 19 services sectors and 121 countries for the year 2014. The report uses the quantity-based approach proposed by Park (2002) and adopted by Fontagné et al. (2011, 2016). The two-step process involves estimating the gravity model for each services sector and deriving the AVEs using the importers' fixed effect information obtained for each sector, assuming a constant elasticity of substitution. The "free traders" identified in each sector have zero AVEs, which is interpreted as the presence of regulation in that sector does not inhibit trade in services.

We conclude the following: protection reflected in AVEs is not homogenous across the sectors and declines with an increase in per capita income. Our tariff equivalent estimate range between 2 percent to 1498 percent. On average, the most liberalized sector is air transport with an AVE of 39 percent, while Gas manufacture and distribution is the most restrictive sector with middle AVE of 440 percent. These results are consistent with the findings of Peridy and Ghineim (2013). They also find that air transport is the most liberalized sector and the electricity and gas sector have high AVEs.

Trade barriers in services sectors are associated with countries' levels of development. In other words, the tendency to comply with regulations increases with an increase in per capita income, as it appears that the regulations are least trade-restrictive for countries with high per capita. For example, Luxemburg is the most open economy, the country with the highest per capita income in the world in 2014. Similarly, we conclude that LUX, SGP, BEL, and IRL are the most open economies, while BGD, ZMB, PAK, and TJK are more restrictive. The regulations are found to have the least effect in developed countries and emerging countries, while the AVEs of developing countries is very high.

Our estimates can be used as an input for welfare analysis for further economic analysis.

¹⁹ Note that Fontagné et al., 2016 do not calculate the AVEs for some of the sectors and countries due to insignificant fixed effect co-efficient. Hence, we plot the available sectors. However, they treat transport sector in aggregation (trn), while we keep each sector separate.

References

- Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American economic review*, 93(1), 170-192.
- Benz, S. (2018). Services trade costs: Tariff equivalents of services trade restrictions using gravity estimation.
- Benz, S., & Jaax, A. (2021). The costs of regulatory barriers to trade in services: New estimates of ad valorem tariff equivalents. *Economics Letters*, 110057.
- Berden, K. G., Francois, J., Tamminen, S., Thelle, M., & Wymenga, P. (2009). Non-Tariff Measures in EU-US Trade and Investment An Economic Analysis. *Rotterdam, ECORYS Nederland BV*.
- Boughzala, M., & Saidane, D. (2007). Liberalization of the Banking Sector in Tunisia. *Savings and Development*, 217-234.
- Boulatoff, C., İscan, T. B., & Kotlyarova, Y. (2021). Does Distance Matter for Trade in Services? The Case of Interprovincial Trade in Canada. *Open Economies Review*, 1-29.
- Deardorff, A. V., & Stern, R. M. (2005). Empirical analysis of barriers to international services transactions and the consequences of liberalization. In *Quantitative Methods For Assessing The Effects Of Non-Tariff Measures And Trade Facilitation* (pp. 549-609).
- Fally, T. (2015). Structural gravity and fixed effects. *Journal of International Economics*, 97(1), 76-85.
- Fontagné, L., & Mitaritonna, C. (2013). Assessing barriers to trade in the distribution and telecom sectors in emerging countries. *World Trade Review*, 12(1), 57-78.
- Fontagné, L., Mitaritonna, C., & Signoret, J. (2016). *Estimated Tariff Equivalents of Services NTMs*.
- Fontagné, L., Guillin, A., & Mitaritonna, C. (2011). Estimations of tariff equivalents for the services sectors.
- Fontagné, L., Mitaritonna, C., & Signoret, J. (2016). Estimated tariff equivalents of services NTMs.
- Francois, J. F., Van Meijl, H., & Van Tongeren, F. (2003). Trade liberalization and developing countries under the Doha round.
- Guillin, A. (2013). Assessment of tariff equivalents for services considering the zero flows. *World Trade Review*, 12(3), 549-575.
- Jafari, Y., & Tarr, D. G. (2017). Estimates of ad valorem equivalents of barriers against foreign suppliers of services in eleven services sectors and 103 countries. *The World Economy*, 40(3), 544-573.

Kimura, F., & Lee, H. H. (2006). The gravity equation in international trade in services. *Review of world economics*, 142(1), 92-121.

Movchan, V., & Shportyuk, V. (2010). Non-tariff measures and country welfare: Analysis with the cge model for Ukraine. *EERC grant competition, Research project R*, 7, 1581.

Nordås, H. K. (2018). What drives trade in services? Lessons from the Nordics. *Applied Economics*, 50(33), 3532-3545.

Nordås, H. and D. Rouzet (2015), "The Impact of Services Trade Restrictiveness on Trade Flows: First Estimates", *OECD Trade Policy Papers*, No. 178, OECD Publishing, Paris,

Ortiz Valverde, G., & Latorre, M. C. (2020). A computable general equilibrium analysis of Brexit: Barriers to trade and immigration restrictions. *The World Economy*, 43(3), 705-728.

Péridy, N., & Ghoneim, A. (2013). Middle East and North African integration: Through the lens of non-tariff measures. *Journal of Economic Integration*, 580-609.

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics*, 88(4), 641-658.

Sun-ch'an, P. (2002). *Measuring tariff equivalents in cross-border trade in services*. Korea Institute for International Economic Policy.

Tharakan, P. K. M., Beveren, I. V., & Ourti, T. V. (2005). Determinants of India's software exports and goods exports. *Review of Economics and Statistics*, 87(4), 776-780.

Walmsley, T., & Strutt, A. (2021). A Comparison of Approaches to Modelling Non-Tariff Measures. *Journal of Global Economic Analysis*, 6(1), 1-33.

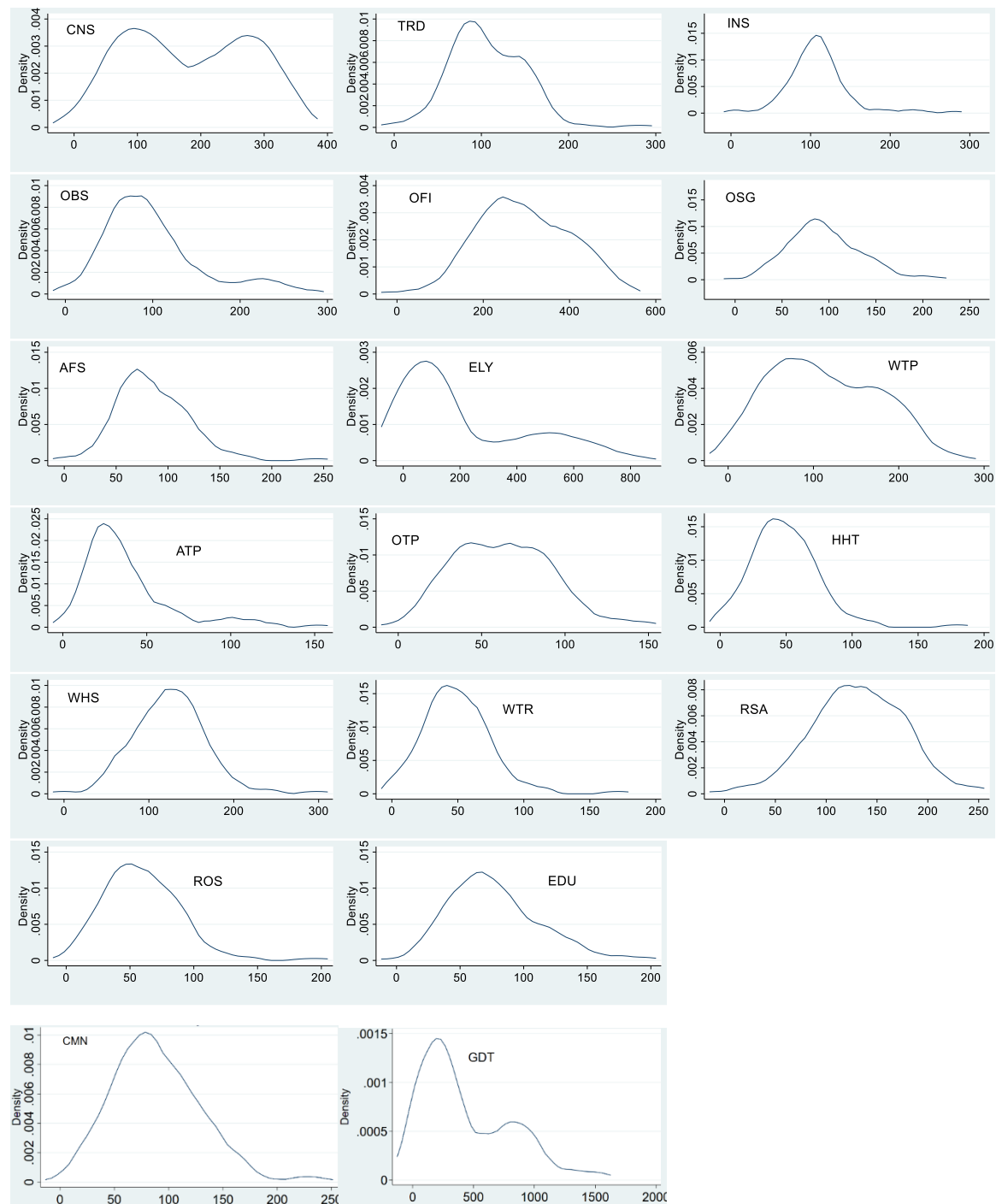
Walsh, K. (2008). Trade in services: Does gravity hold. *J. World Trade*, 42, 315.

World Trade Organization. (2019). World Trade Report 2019. The Future of Services Trade.

Annex-A Description of Services sectors in GTAP10

	Code	Description
1	AFS	Accommodation, Food and service activities
2	ATP	Air transport
3	CMN	Information and communication
4	CNS	Construction: building houses factories offices and roads
5	EDU	Education
6	ELY	Electricity; steam and air conditioning supply
7	GDT	Gas Distribution: distribution of gaseous fuels through mains; steam and hot water supply
8	HHT	Human health and social work
9	INS	Insurance: includes pension funding, except compulsory social security
10	OBS	Other Business Services: real estate, renting and business activities
11	OFI	Other Financial Intermediation: includes auxiliary activities but not insurance and pension funding
12	OSG	Other Services (Government): public administration and defense; compulsory social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations , extra-territorial organizations and bodies
13	OTP	Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies
14	ROS	Recreation & Other Services: recreational, cultural and sporting activities, other service activities; private households with employed persons (servants)
15	RSA	Real estate activities
16	TRD	Trade: all retail sales; wholesale trade and commission trade; hotels and restaurants; repairs of motor vehicles and personal and household goods; retail sale of automotive fuel
17	WHS	Warehousing and support activities
18	WTP	Water transport
19	WTR	Water supply; sewerage, waste management and remediation activities
20	DWE	Dwellings: ownership of dwellings (imputed rents of houses occupied by owners)

Annex B: Kernel density estimate of AVEs for 121 countries and 19 services sectors, 2014



Source: Authors' estimates

Appendix C: AVEs by country from cross-section estimates using GTAP 10 data

Code	ALB	ARE	ARG	ARM	AUS	AUT	AZE	BEL
Countries	Albania	United Arab Emirates	Argentina	Armenia	Australia	Austria	Azerbaijan	Belgium
CMN	82.61	66.67	88.25	79.07	82.61	37.95	118.72	17.96
CNS	109.87	108.05	268.53	168.31	249.03	71.82	0.00	79.46
TRD	71.08	75.60	110.78	103.58	101.81	72.95	139.11	42.53
INS	81.82	91.14	130.43	79.46	132.44	69.60	100.50	71.45
OBS	91.97	68.50	116.82	127.45	99.63	50.81	50.16	20.03
OFI	239.31	217.20	344.29	290.81	308.17	211.05	182.06	132.44
OSG	46.61	76.37	127.94	64.16	112.62	78.29	77.91	51.80
AFS	40.98	68.50	87.84	67.04	70.34	60.28	101.81	40.37
ELY	0.00	226.29	62.03	105.35	450.98	72.57	219.27	89.07
WTP	71.45	71.45	138.59	134.47	85.01	106.70	87.84	28.40
ATP	28.68	29.24	27.57	18.48	16.18	9.32	24.82	8.14
OTP	25.91	50.81	71.08	46.29	56.49	37.06	73.33	7.44
GDT	650.24	101.81	186.39	287.42	126.95	30.94	345.26	101.38
HHT	8.38	34.11	47.25	27.85	37.65	25.91	58.20	9.08
WHS	81.42	101.81	141.72	110.78	118.24	76.75	151.37	60.28
WTR	9.08	36.76	48.54	29.81	38.25	24.55	61.33	9.32
RSA	82.61	113.55	142.25	106.70	123.04	105.80	35.28	79.07
ROS	16.44	47.89	55.81	36.46	38.86	27.01	79.07	19.25
EDU	39.76	59.24	108.05	54.80	79.46	61.33	70.34	38.55

Code	BEN	BFA	BGD	BGR	BHR	BLR	BOL	BRA
Countries	Benin	Burkina Faso	Bangladesh	Bulgaria	Bahrain	Belarus	Bolivia	Brazil
CMN	124.50	126.46	217.89	74.08	118.72	67.40	79.46	77.13
CNS	309.06	65.59	325.39	54.46	223.46	106.70	253.62	255.16
TRD	150.82	157.45	163.68	90.72	87.03	119.67	113.09	109.41
INS	227.71	56.49	280.74	99.63	147.03	153.01	61.33	117.77
OBS	107.15	164.83	154.67	75.60	219.27	101.81	100.94	66.31
OFI	463.09	337.58	527.74	232.01	355.04	229.14	352.08	264.54
OSG	151.37	78.68	74.46	92.39	88.66	88.25	95.76	70.34
AFS	117.77	113.09	171.83	57.86	53.79	81.82	71.82	70.71
ELY	7.44	68.86	760.35	34.99	79.07	51.14	586.26	47.57
WTP	195.24	189.52	235.64	107.15	121.11	85.41	123.04	46.61
ATP	32.08	23.48	23.48	28.68	60.28	42.22	16.44	30.37
OTP	95.34	77.91	144.36	45.97	37.95	47.57	53.46	75.22
GDT	1147.73	371.15	1498.64	232.73	190.78	117.30	932.72	190.15
HHT	68.86	64.16	111.24	35.57	21.88	37.95	34.99	50.49
WHS	145.96	165.98	240.79	82.21	97.47	123.52	119.19	148.65
WTR	70.34	65.95	113.55	32.66	21.35	40.07	37.35	52.79
RSA	176.00	171.83	237.10	91.97	97.47	68.13	123.04	143.30
ROS	91.55	86.62	137.04	42.22	36.46	37.06	51.80	58.55
EDU	131.94	77.52	74.08	79.07	70.71	70.34	68.13	52.13

Code	BRN	BWA	CAN	CHE	CHL	CHN	CIV	CMR
Countries	Brunei Darussalam	Botswana	Canada	Switzerland	Chile	China	Côte d'Ivoire	Cameroon
CMN	77.52	77.91	56.15	75.22	122.07	84.20	89.90	148.11
CNS	254.39	165.41	179.62	215.82	295.94	97.47	289.11	183.29
TRD	91.14	131.94	91.97	100.50	93.23	44.08	146.50	74.08
INS	145.43	118.72	65.23	90.31	114.01	66.31	117.30	100.94
OBS	76.75	76.75	67.40	45.34	131.94	92.39	100.07	82.21
OFI	336.63	397.46	184.53	168.31	277.45	311.74	199.11	375.26
OSG	36.76	127.94	76.75	79.85	118.72	94.91	140.67	136.01
AFS	52.46	88.66	65.59	69.23	107.15	51.14	104.02	75.22
ELY	498.42	37.35	84.60	88.25	408.39	153.56	548.55	637.30
WTP	63.09	168.89	80.63	93.23	25.37	141.72	111.70	140.67
ATP	25.91	90.72	14.18	18.48	52.13	36.76	19.77	34.69
OTP	49.18	71.08	57.51	32.37	78.29	51.14	87.43	75.98
GDT	921.56	880.22	217.89	90.31	197.17	410.61	406.19	1048.80
HHT	35.57	48.21	30.66	31.51	69.23	36.16	62.03	54.80
WHS	118.24	144.89	116.82	115.88	59.58	123.52	145.43	151.37
WTR	38.25	48.54	30.37	30.37	68.13	36.76	63.44	55.14
RSA	124.99	122.55	120.63	61.68	175.40	88.25	165.41	150.82
ROS	50.16	66.67	33.53	41.29	79.46	53.46	83.40	77.52
EDU	32.08	107.60	57.17	65.23	100.50	79.07	122.55	116.35

Code	COL	CRI	CYP	CZE	DEU	DNK	DOM	ECU
Countries	Colombia	Costa Rica	Cyprus	Czech Republic	Germany	Denmark	Dominican Republic	Ecuador
CMN	97.90	100.07	37.35	43.15	34.11	20.82	126.95	163.11
CNS	285.74	302.88	110.32	114.95	60.98	42.53	322.62	321.70
TRD	103.58	116.82	65.59	77.52	54.46	47.25	173.01	171.83
INS	111.70	121.11	74.46	94.07	88.66	43.15	118.24	123.52
OBS	112.62	143.83	63.80	49.18	41.60	42.22	203.04	269.33
OFI	311.74	405.09	161.40	171.83	173.61	129.93	368.08	453.38
OSG	147.57	144.36	30.66	89.07	64.16	47.57	109.41	164.83
AFS	106.25	80.63	36.76	72.95	51.14	67.76	128.44	126.95
ELY	285.74	55.14	427.53	65.59	135.50	78.68	700.79	40.37
WTP	154.11	189.52	15.43	109.87	35.28	34.69	214.45	124.99
ATP	29.52	107.15	10.76	45.34	6.97	3.76	32.08	38.86
OTP	86.62	81.03	21.88	42.53	23.74	36.16	104.02	105.35
GDT	962.32	1484.80	609.01	205.02	88.66	179.01	207.02	596.78
HHT	64.51	59.24	6.74	35.57	17.96	33.53	77.52	76.75
WHS	98.33	160.83	54.13	67.04	81.82	72.95	192.05	145.43
WTR	64.51	58.55	6.51	35.28	17.20	34.69	77.91	78.29
RSA	165.41	162.54	74.08	121.11	96.62	117.77	195.88	192.68
ROS	76.37	80.63	14.18	42.84	26.74	22.14	102.69	65.95
EDU	126.95	123.04	27.01	67.40	44.71	19.00	82.21	144.36

Code	EGY	ESP	EST	ETH	FIN	FRA	GBR	GEO
Countries	Egypt	Spain	Estonia	Ethiopia	Finland	France	United Kingdom	Georgia
CMN	90.72	56.83	46.29	126.46	40.07	57.51	39.16	117.30
CNS	129.43	105.80	75.60	44.71	105.35	103.13	121.11	281.57
TRD	145.43	87.84	100.07	192.05	81.03	60.63	77.13	144.89
INS	78.68	98.77	155.78	105.80	111.24	96.62	101.81	68.13
OBS	87.43	47.25	48.21	108.96	35.87	51.47	46.61	148.11
OFI	357.02	182.06	201.07	441.48	266.13	232.01	137.55	305.52
OSG	89.07	100.07	85.41	182.68	100.94	72.95	40.98	65.95
AFS	106.25	84.60	68.50	144.36	67.04	64.87	50.81	102.25
ELY	208.36	108.05	27.57	812.36	45.66	195.24	66.31	56.83
WTP	175.40	99.63	31.22	36.46	51.14	47.25	61.68	140.67
ATP	42.84	21.35	24.01	19.77	36.46	12.95	4.22	25.10
OTP	70.34	61.68	27.57	96.62	56.49	37.65	34.99	69.97
GDT	407.29	144.89	237.84	1086.88	41.60	110.78	102.25	0.00
HHT	57.51	42.84	35.57	91.97	40.98	25.91	15.43	53.13
WHS	158.01	97.47	107.60	156.33	118.24	67.40	75.98	131.44
WTR	58.55	42.53	30.94	91.97	39.46	26.19	16.18	56.15
RSA	164.25	134.98	112.16	207.02	126.46	112.62	85.41	131.94
ROS	78.29	45.03	45.03	114.48	56.15	29.81	27.57	45.97
EDU	35.87	76.75	49.18	158.57	87.84	54.80	30.94	48.21

Code	GHA	GIN	GRC	GTM	HKG	HND	HRV	HUN
Countries	Ghana	Guinea	Greece	Guatemala	Hong Kong	Honduras	Croatia	Hungary
CMN	138.07	71.82	73.70	135.50	46.93	86.22	61.68	37.06
CNS	253.62	57.51	164.25	299.40	115.88	302.88	213.77	85.81
TRD	107.15	164.83	121.11	145.96	52.46	147.57	87.03	73.70
INS	169.47	99.20	83.80	97.04	87.84	114.95	132.95	105.35
OBS	234.91	108.96	101.38	222.76	54.46	168.89	72.20	40.07
OFI	376.30	497.13	251.32	428.68	136.52	389.95	273.37	220.66
OSG	37.06	40.68	94.91	145.43	66.31	150.82	102.69	87.43
AFS	69.23	144.36	92.81	103.58	37.06	108.96	84.60	78.68
ELY	142.25	69.97	45.03	71.45	29.81	31.80	11.97	26.19
WTP	143.83	26.46	0.00	188.89	31.51	194.60	87.03	104.46
ATP	76.37	45.97	62.74	42.22	0.00	28.96	61.33	17.45
OTP	52.13	119.19	28.12	82.21	19.25	87.43	66.67	33.24
GDT	48.54	816.34	246.01	547.14	84.20	788.87	58.20	208.36
HHT	29.52	84.20	50.16	59.93	10.04	63.80	56.15	41.91
WHS	119.19	171.83	121.59	162.54	50.16	168.89	141.72	122.07
WTR	31.80	91.14	50.81	59.58	10.04	63.80	55.81	40.68
RSA	117.30	209.03	161.40	164.25	79.85	171.24	154.11	127.45
ROS	48.86	107.60	57.17	81.03	21.08	85.41	54.80	20.56
EDU	28.96	43.15	62.03	123.52	50.81	128.93	77.91	53.79

Code	IDN	IND	IRL	IRN	ISR	ITA	JAM	JOR
Countries	Indonesia	India	Ireland	Iran	Israel	Italy	Jamaica	Jordan
CMN	82.21	71.82	28.68	64.51	99.63	63.80	72.95	148.65
CNS	115.88	154.67	154.11	104.91	256.71	94.91	209.70	248.28
TRD	104.02	153.56	0.00	79.85	70.71	53.79	140.15	84.60
INS	138.07	103.13	0.00	85.41	115.88	101.38	71.45	71.08
OBS	89.07	71.08	0.00	65.23	56.83	54.80	59.58	101.38
OFI	304.64	429.83	80.24	202.38	430.99	274.99	253.62	411.72
OSG	129.43	128.44	52.46	73.70	97.90	94.49	74.84	77.13
AFS	69.97	122.07	0.00	68.13	49.51	81.03	98.33	71.45
ELY	432.14	112.62	73.70	71.08	640.51	72.20	481.75	86.62
WTP	109.87	69.23	68.50	68.50	18.74	62.74	67.76	43.46
ATP	39.46	41.60	27.85	28.40	23.48	25.10	44.40	26.19
OTP	79.85	79.85	27.57	50.49	69.60	54.13	58.89	41.29
GDT	917.13	240.79	83.80	137.55	188.89	191.41	758.49	469.24
HHT	60.63	68.13	9.80	32.08	50.49	43.46	51.80	38.55
WHS	124.99	140.67	73.33	102.69	86.62	134.47	101.81	103.13
WTR	61.68	65.23	10.52	35.87	49.51	42.84	52.79	38.25
RSA	161.40	83.40	71.82	111.24	124.99	138.07	152.46	91.14
ROS	69.60	80.63	26.19	47.25	70.34	50.16	71.08	53.46
EDU	103.58	108.05	43.46	57.17	83.01	51.47	68.86	45.97

Code	JPN	KAZ	KEN	KGZ	KHM	KOR	KWT	LAO
Countries	Japan	Kazakhstan	Kenya	Kyrgyzstan	Cambodia	Korea	Kuwait	Lao
CMN	86.22	115.88	65.95	79.46	71.82	91.97	89.48	89.48
CNS	73.33	20.56	307.29	105.80	65.95	93.23	183.29	29.52
TRD	77.52	171.24	161.97	126.46	65.23	61.33	66.31	94.49
INS	111.70	129.93	127.45	106.70	97.90	124.01	114.48	90.72
OBS	73.70	62.38	111.24	95.34	227.71	63.44	174.80	103.58
OFI	246.01	279.09	316.24	252.08	435.62	296.80	285.74	197.82
OSG	117.77	130.43	160.83	91.14	70.34	91.14	0.00	74.46
AFS	59.24	130.93	119.67	87.43	69.97	39.16	35.28	150.82
ELY	571.50	100.94	153.01	60.28	14.43	465.54	401.81	45.97
WTP	50.16	180.23	188.89	154.67	147.57	35.87	94.91	157.45
ATP	21.88	55.14	75.98	14.43	19.00	27.29	40.37	67.76
OTP	76.75	94.49	97.90	15.43	83.40	32.95	20.82	119.19
GDT	197.82	342.36	788.87	160.26	985.67	180.23	97.47	397.46
HHT	45.03	80.63	71.82	44.71	58.89	25.37	3.54	93.65
WHS	94.91	185.14	118.72	129.93	132.44	42.22	74.46	200.42
WTR	47.25	79.85	72.95	44.40	60.98	25.91	4.90	94.07
RSA	149.73	188.26	182.06	85.81	161.40	124.99	73.33	33.82
ROS	59.93	89.07	93.65	8.38	72.57	39.16	18.48	67.76
EDU	75.98	78.29	138.59	81.82	59.24	63.44	0.00	74.08

Code	LKA	LTU	LUX	LVA	MAR	MDG	MEX	MLT
Countries	Sri Lanka	Lithuania	Luxembourg	Latvia	Morocco	Madagascar	Mexico	Malta
CMN	125.48	70.71	0.00	67.76	104.91	151.37	175.40	31.51
CNS	312.63	94.91	32.37	81.03	270.94	340.44	297.66	211.05
TRD	132.95	95.76	27.29	101.38	144.89	138.07	143.30	80.24
INS	113.55	104.46	11.72	128.93	123.04	188.89	106.25	53.13
OBS	108.96	103.58	11.00	87.03	79.46	95.76	192.68	14.43
OFI	486.83	293.36	0.00	267.73	440.30	412.83	389.95	91.14
OSG	148.65	72.20	42.22	104.46	38.86	190.78	121.59	73.33
AFS	127.45	64.51	9.80	76.75	103.13	137.55	107.60	67.40
ELY	716.62	34.69	71.45	45.03	12.46	64.16	141.19	583.28
WTP	27.85	101.38	35.87	78.29	132.95	183.91	187.01	127.45
ATP	122.55	55.47	2.42	41.29	16.69	67.40	49.83	15.68
OTP	104.02	24.28	15.18	48.86	79.85	113.09	94.49	52.46
GDT	554.21	230.57	43.46	236.37	167.72	808.41	209.03	826.35
HHT	77.91	32.66	3.31	45.66	55.14	85.81	65.59	30.94
WHS	189.52	98.77	60.98	51.47	157.45	169.47	170.65	77.52
WTR	77.52	30.66	4.22	41.60	57.86	85.41	63.44	32.08
RSA	177.20	112.16	70.34	132.44	51.14	196.52	173.01	116.35
ROS	99.63	47.25	0.00	57.17	78.29	111.24	75.98	38.55
EDU	110.78	43.46	30.94	78.68	23.48	162.54	104.02	45.97

Code	MNG	MOZ	MUS	MWI	MYS	NAM	NGA	NIC
Countries	Mongolia	Mozambique	Mauritius	Malawi	Malaysia	Namibia	Nigeria	Nicaragua
CMN	63.44	64.51	124.99	107.15	38.86	109.87	99.20	153.01
CNS	68.50	45.03	244.51	323.54	231.29	149.73	201.07	300.26
TRD	87.43	101.38	68.50	129.43	89.90	150.28	121.59	145.43
INS	89.90	138.07	89.48	148.65	90.72	121.59	142.77	98.77
OBS	85.81	43.15	58.89	144.89	52.13	104.46	72.57	130.93
OFI	275.81	206.35	270.13	489.39	268.53	352.08	384.65	382.55
OSG	50.49	98.77	112.62	97.90	85.41	112.16	32.95	143.30
AFS	55.81	63.80	54.13	104.46	66.31	103.58	82.61	101.81
ELY	21.35	4.22	508.92	102.25	316.24	10.76	580.32	164.25
WTP	118.72	87.84	30.37	201.07	54.46	186.39	118.24	187.63
ATP	21.35	21.61	27.29	35.28	67.76	108.05	37.06	18.74
OTP	24.28	46.29	32.95	81.82	48.86	83.80	63.44	81.42
GDT	800.54	869.62	666.72	800.54	170.65	888.78	969.27	412.83
HHT	19.77	28.12	33.24	65.59	28.68	59.24	40.07	58.20
WHS	98.77	108.50	121.11	145.43	113.09	164.25	135.50	160.26
WTR	20.30	29.24	33.53	67.04	29.81	60.28	42.22	57.86
RSA	70.34	109.41	91.55	166.56	111.70	161.40	130.93	160.26
ROS	34.99	45.03	51.14	61.68	16.18	80.63	56.15	80.24
EDU	45.03	80.63	91.55	77.91	68.50	100.94	33.53	121.59

Code	NLD	NOR	NPL	NZL	OMN	PAK	PAN	PER
Countries	Netherlands	Norway	Nepal	New Zealand	Oman	Pakistan	Panama	Peru
CMN	21.08	46.93	143.30	72.57	107.15	124.99	103.13	95.76
CNS	86.62	176.00	277.45	147.57	245.26	316.24	299.40	134.98
TRD	38.86	85.01	93.23	104.91	45.66	168.31	82.21	160.83
INS	87.84	113.55	119.19	125.48	56.49	242.27	106.25	110.32
OBS	34.69	51.14	110.78	92.39	85.01	78.29	130.93	116.35
OFI	188.26	187.63	413.95	298.53	405.09	479.23	182.06	396.38
OSG	65.95	62.74	113.55	99.63	128.93	95.76	149.73	114.48
AFS	56.15	51.14	93.23	68.86	87.03	130.93	93.23	114.48
ELY	69.23	105.80	19.77	458.21	572.96	163.11	102.25	658.44
WTP	62.38	0.00	64.16	64.51	154.11	205.02	191.41	177.20
ATP	40.37	33.24	19.00	26.74	27.01	121.59	19.25	42.53
OTP	34.40	37.06	62.03	53.13	67.76	107.15	85.81	94.49
GDT	157.45	446.21	888.78	926.01	128.93	407.29	345.26	802.50
HHT	22.94	21.35	50.16	35.28	49.18	80.24	62.74	71.45
WHS	50.49	73.33	130.43	125.48	139.63	188.89	129.93	129.93
WTR	23.21	22.41	49.51	35.87	49.18	77.91	62.38	70.71
RSA	100.94	95.34	145.96	121.11	0.00	194.60	166.56	157.45
ROS	32.08	27.85	57.51	48.21	66.31	98.33	85.41	86.22
EDU	45.66	37.65	96.19	83.01	106.70	86.22	127.45	97.47

Code	PHL	POL	PRI	PRT	PRY	QAT	ROU	RUS
Countries	Philippines	Poland	Puerto Rico	Portugal	Paraguay	Qatar	Romania	Russian Federation
CMN	93.65	56.83	106.25	54.80	167.14	70.34	54.46	58.20
CNS	193.96	85.81	246.01	133.96	334.73	112.62	78.68	40.37
TRD	98.77	90.72	149.19	73.70	140.67	85.81	139.63	94.07
INS	102.69	109.41	97.90	114.01	109.87	95.34	127.94	104.02
OBS	88.25	67.04	122.07	87.03	231.29	72.57	78.29	56.15
OFI	231.29	237.84	266.13	253.62	356.03	224.17	249.03	201.73
OSG	93.65	87.43	80.63	86.22	106.25	79.85	113.09	56.15
AFS	84.20	71.08	129.43	50.81	123.52	72.57	94.91	61.33
ELY	519.61	91.14	139.63	58.55	706.03	592.25	101.38	135.50
WTP	118.24	100.50	208.36	102.25	219.27	75.60	130.43	79.46
ATP	23.74	37.06	50.81	15.68	36.76	32.08	54.80	25.10
OTP	65.23	41.91	81.82	57.51	88.66	54.13	75.22	40.68
GDT	355.04	30.94	215.82	147.03	1136.93	884.49	331.91	95.34
HHT	42.84	35.28	88.25	40.37	79.07	37.06	63.44	25.37
WHS	111.24	98.77	189.52	108.96	197.82	106.25	152.46	103.13
WTR	43.77	34.69	87.03	40.07	81.42	39.76	62.74	25.37
RSA	132.44	120.15	192.05	127.45	195.88	118.72	161.40	96.62
ROS	59.24	44.40	108.50	38.86	83.40	51.14	66.67	31.51
EDU	75.98	59.93	72.95	59.24	101.81	62.38	83.40	49.51

Code	RWA	SAU	SEN	SGP	SLV	SVK	SVN	SWE
Countries	Rwanda	Saudi Arabia	Senegal	Singapore	El Salvador	Slovakia	Slovenia	Sweden
CMN	163.68	99.63	77.13	25.10	125.97	69.97	49.83	30.09
CNS	205.02	196.52	284.90	92.39	321.70	83.80	72.95	83.01
TRD	120.15	74.46	134.47	10.28	151.37	79.85	88.25	71.45
INS	190.78	123.52	81.42	37.35	98.33	116.35	140.15	118.24
OBS	96.19	188.26	245.26	12.21	125.48	77.13	60.63	31.22
OFI	489.39	297.66	329.10	124.99	416.19	180.84	247.52	228.42
OSG	106.70	65.59	79.46	57.17	164.83	106.25	99.20	71.82
AFS	106.25	42.53	97.47	24.28	120.63	89.07	78.68	56.83
ELY	63.80	418.44	612.10	330.03	46.29	49.51	27.29	78.68
WTP	190.78	104.91	176.60	1.31	209.03	167.72	100.07	55.14
ATP	100.07	47.57	21.88	16.44	37.35	36.16	40.37	14.68
OTP	93.23	27.57	77.13	0.00	97.47	32.95	30.66	32.66
GDT	808.41	700.79	410.61	137.04	445.02	256.71	263.75	164.25
HHT	73.33	10.28	51.80	0.00	73.33	56.49	44.40	20.03
WHS	137.55	85.01	154.11	0.00	175.40	138.07	110.32	97.04
WTR	75.22	11.48	53.79	0.00	72.57	53.79	43.77	20.30
RSA	154.67	81.82	152.46	60.63	184.53	134.47	134.47	100.07
ROS	95.76	24.82	73.33	9.32	94.91	53.13	44.71	35.28
EDU	86.62	52.46	73.70	36.46	141.72	77.91	68.86	60.63

Code	TGO	THA	TJK	TTO	TUN	TUR	TWN	TZA
Countries	Togo	Thailand	Tajikistan	Trinidad and Tobago	Tunisia	Turkey	Taiwan	Tanzania
CMN	98.33	112.16	104.02	146.50	116.82	128.44	66.31	154.67
CNS	249.79	237.10	32.37	270.13	300.26	206.35	105.80	271.75
TRD	122.07	71.08	280.74	130.43	99.63	160.83	64.51	122.07
INS	79.46	75.22	144.89	156.89	215.13	94.49	89.90	117.30
OBS	134.98	50.49	140.15	100.07	148.65	146.50	66.31	244.51
OFI	343.32	299.40	315.33	434.46	460.64	269.33	209.03	353.07
OSG	147.03	105.35	207.69	34.11	137.55	68.13	79.46	117.77
AFS	167.14	35.87	243.02	86.62	112.62	120.63	65.95	81.03
ELY	1.75	13.93	162.54	568.59	82.61	108.05	433.30	201.73
WTP	228.42	68.13	268.53	57.86	50.16	197.82	69.23	159.70
ATP	18.22	20.30	92.81	10.28	36.46	43.46	28.12	65.59
OTP	139.11	51.47	139.63	54.80	76.75	95.34	48.54	62.03
GDT	1400.97	274.99	35.28	274.18	137.04	71.08	185.77	944.01
HHT	108.50	41.91	179.62	40.98	64.51	68.13	31.80	41.29
WHS	151.91	81.82	297.66	140.15	99.63	127.45	99.63	134.98
WTR	109.87	43.46	171.24	43.77	65.23	68.50	34.69	42.22
RSA	238.57	113.55	28.68	138.59	176.60	190.78	110.32	133.46
ROS	134.47	52.79	194.60	52.13	83.40	85.81	46.61	60.28
EDU	141.19	77.13	192.05	30.09	122.07	67.76	59.93	98.77

Code	UGA	UKR	URY	USA	VEN	VNM	ZAF	ZMB	ZWE
Countries	Uganda	Ukraine	Uruguay	United States of America	Venezuela	Viet Nam	South Africa	Zambia	Zimbabwe
CMN	90.31	75.98	104.91	65.95	95.76	53.79	125.48	237.84	109.87
CNS	292.51	134.47	269.33	179.01	293.36	262.17	267.73	351.10	155.22
TRD	153.01	91.14	126.95	101.38	159.70	93.23	79.46	215.82	120.63
INS	83.01	109.41	118.24	58.55	125.97	81.42	121.11	101.38	137.55
OBS	108.50	79.46	79.46	79.07	114.48	76.37	205.69	281.57	108.96
OFI	368.08	150.82	253.62	192.68	277.45	184.53	341.40	432.14	302.88
OSG	145.96	46.93	77.13	42.84	96.62	71.08	113.55	213.08	122.55
AFS	108.05	60.98	89.07	86.62	120.15	66.31	49.83	163.11	103.13
ELY	58.20	307.29	412.83	113.55	510.25	45.34	27.57	336.63	36.16
WTP	187.01	76.75	167.14	149.73	131.44	68.86	103.58	243.76	109.41
ATP	109.41	29.24	94.07	21.08	38.86	30.37	22.94	151.91	57.17
OTP	87.03	36.76	22.41	46.93	98.77	62.74	75.98	71.45	82.21
GDT	634.10	143.30	195.88	158.01	410.61	785.02	186.39	1391.21	786.94
HHT	62.74	27.29	48.21	52.13	71.08	52.46	53.46	108.05	61.68
WHS	168.31	107.15	143.83	134.98	156.33	139.63	148.65	231.29	143.30
WTR	63.44	29.52	49.83	51.14	72.57	51.14	53.46	108.05	64.16
RSA	167.14	112.16	138.07	137.55	183.29	109.87	157.45	240.79	161.97
ROS	77.13	30.66	21.88	69.60	49.51	45.34	63.09	63.44	81.03
EDU	125.48	31.80	59.58	37.35	92.81	55.81	85.81	185.14	98.33

Source: Authors' estimates