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Abstract: This paper has two objectives: (i) to introduce border policy-induced barriers (PIBs) to services trade and (ii) analyze the impact of border PIBs in services sectors on goods trade. The World Input-Output Database covering 43 countries is used over the period 2000-2014. A three-stage analysis is employed. The measures of bilateral services trade barriers calculated in each services sector in the first stage are decomposed into its cultural/geographical and policy-induced parts in the second stage. Border PIBs to services trade are used in the structural gravity estimations of bilateral goods trade in the final stage. The results demonstrate significant and robust adverse effects of barriers to services trade on goods trade. When the level of development is taken into consideration, there are marked differences in the impact of these barriers on goods trade.

Keywords: border services trade barriers, goods exporting, gravity.
JEL Codes: *F10, F14*

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1. Introduction

The rising international fragmentation of production, also known as global value chains (GVCs), has played an important role in the evolution of services trade in the recent decades. We witnessed a boom in the trade of services both as intermediate and final products due to increasingly fragmented production lines across countries as well as technological advances that made once untradeable services tradeable.

Even though two-thirds of global economic activity stems from services sector and there was a sizeable increase in the services trade due to expanding GVCs, trade in services makes up only one-fifth of the world trade. The reasons for this mismatch should be sought in the reporting traditions in the balance of payments statistics which do not take value-added of services into account (when included, services trade makes up 50 percent of world trade) and the recent servicification of manufacturing sector. The term 'servicification of manufacturing' is used to signify the increasing reliance of manufacturing processes on services, either as inputs, as activities within firms or as output sold together with goods (Miroudot and Cadestin, 2017). Core elements in this structure are finance, knowledge intensive producer services (KIPS), telecom, transport and wholesale and retail (W&R), which constitute the key services sectors in this paper, as they are important inputs in production and a significant part of final consumption[1].

This paper has two objectives: (i) to introduce border policy-induced barriers (PIBs) to services trade and (ii) to analyze the impact of PIBs in services sectors on goods trade.

The first objective has its roots in the fact that aside from major tariff and non-tariff barriers that affect GVCs, there are also other barriers coming from the services side such as sector-specific regulations, the lack of enforcement of competition, rules related to data localization, commercial presence requirements or restrictions on movement of people. In this paper, border PIBs represent these multi-faceted barriers to services trading that affect goods trade through global value chains.

The second objective is directly related to increasing global competition, which has reduced the margins of error in production and made it necessary to have sophisticated process design, supply chain management, software, high-speed telecommunications, effective transportation, and universal and safe financial services (Nordås and Rouzet, 2015). Therefore, barriers to trade in services are expected to be associated with lower trade volumes not only in services but also in goods.

This paper employs a three-stage approach to achieve its objectives using data from the World Input Output Database (WIOD) for 43 countries spanning the period 2000-2014.

The first stage of the analysis involves calculating the tariff equivalents of services trade

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[1] *Finance* is composed of financial service activities; insurance, reinsurance and pension funding; activities auxiliary to financial services and insurance activities. *KIPS* include computer programming, consultancy and related activities, information service activities; legal and accounting activities, activities of head offices, management consultancy activities; architectural and engineering activities, technical testing and analysis; scientific research and development; advertising and market research. *Telecom* is composed of postal and courier activities; telecommunications. *Transport* includes land transport and transport via pipelines; water transport; air transport; warehousing and support activities for transportation. *W&R* is composed of wholesale and retail trade and repair all goods including motor vehicles and motorcycles.

barriers (STBs) in five services sectors, mentioned above, using Novy (2013) method. These barriers stem from cultural and geographic barriers between two countries, unilateral barriers applied by one country to its all foreign suppliers and bilateral barriers between countries.

Calculating services trade barriers using Novy (2013) has several advantages: (i) As services trading is more prone to behind the border regulations than goods trade, the most beneficial feature of this method is its inclusion of frictions in domestic trade as well; (ii) We can avoid suffering from econometric estimation errors and capture services trade barriers by inferring them from observable services trade flows[2]; and (iii) Since trade flows vary over time, we can compute tariff equivalents in services sectors not only for cross-sectional data but also for time series and panel data.

The second stage of the analysis is to estimate border PIBs in services trade. As argued by Nordås and Rouzet (2015) as well, measures of STBs designed and calculated so far are unable to distinguish between natural barriers, such as cultural and geographical barriers (CGBs) and policy-induced barriers in services trade. The important issue here is to identify the impact of border PIBs on goods trade in time, i.e. the impact of bilateral liberalization efforts or protection measures, which leads us to make a novel contribution by decomposing STBs into CGBs and border PIBs and analyze the impact of the latter separately.

Our descriptive analysis on border PIBs indicate that advanced countries face lower border PIBs compared to emerging countries throughout the sample period. Furthermore, when we shine light on the change of barriers from 2000 to 2014, we observe that the new members of the EU (Poland, Hungary, Romania, Bulgaria, Estonia and Croatia) witnessed declining PIBs probably due to the convergence of these countries' legal systems to the older members of the EU. Emerging countries (Russia, Turkey, Mexico, India and Indonesia), on the other hand, exhibited the opposite trend and experienced higher barriers over time as a possible outcome of the anti-globalization movement which resulted in more restrictive behind the border regulations between advanced and emerging countries, in particular.

The third stage of our analysis is to estimate a structural gravity equation of goods trade[3] by including border PIBs to trade in five services sectors (*Finance*, *KIPS*, *Telecom*, *Transport* and *W&R*) as explanatory variables.

Our baseline results indicate that border PIBs in the services sector as a whole adversely affect goods trading. However, when key services sectors considered individually or all together, the negative impact of the border PIBs shows up only in *Transport* and *W&R*.

We then extend our analysis to the effect of border PIBs in services trade by level of economic development (trade between advanced-advanced, advanced-emerging and

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[2] One drawback of using observable trade flows is the missing trade problem. Some trade is unobserved. In services, this might be more so due to the restrictiveness of domestic or policy barriers. We recognize that there is a selection problem when services trade restrictiveness is derived from observed data.
[3] See Anderson and van Wincoop (2004), Bergstrand (1985, 1989) and Yotov et al. (2016).

emerging-advanced country groups). The results show that (i) border PIBs in the services sector as a whole have a negative and significant impact on goods trade for all country groups; (ii) border PIBs in *Transport* and *W&R* negatively affect goods trade independent of the development level of the exporter and the importer; (iii) border PIBs in *Finance* and *Telecom* have a negative and significant effect only on exports of goods from advanced countries to emerging countries.

The paper proceeds as follows. Section 2 presents the nature of services trade barriers. Section 3 lays out the methodology and data followed by a discussion of calculation of services trade barriers in the first stage in Section 4. Next, Section 5 presents the results of second stage complemented with a descriptive analysis of policy-induced barriers. Section 6 outlines the baseline results and the extensions of our analysis. Finally, Section 7 concludes.

2. The Nature of Services Trade Barriers

Barriers to trade can be defined as natural or man-made obstacles that reduce domestic and international transactions between economic entities. They can be of cultural and geographic in nature or policy-induced.

Cultural and geographic barriers to trade involve a wide range of factors ranging from physical distance between trading countries to colonial ties, sharing a border or being landlocked. The work-horse of international trade analysis, the gravity model of trade, which dates back to Tinbergen (1962) and Anderson (1979), employs a plethora of these cultural and geographic barriers to explain trade between nations.[4]

There are also policy-induced trade barriers that are put in place by governments through laws and regulations. In services trading, these barriers can take three forms: (i) Domestic regulations; (ii) Discriminatory barriers against all foreign suppliers; (iii) Country-specific barriers.

Domestic regulations are behind-the-border and non-discriminatory in purpose. Essentially, these barriers increase the cost of doing business for both domestic and foreign suppliers. The objective of these regulations is to protect intermediate and final users of services.[5] Licensing requirements (e.g., to practice medicine many countries have specific requirements), limits on total number of providers (e.g., preset number of banks that can operate in a country) or administrative red tape (e.g., each ship in the coastal waters of a country has to submit certain number of documents to the port authority) are some examples to domestic regulations. Even though these measures are designed to be non-discriminatory, they may affect domestic and foreign suppliers differently. Crozet, Milet and Mirza (2013) argue that foreign suppliers may be more sensitive to domestic regulations due to inadequate access to information on local legislation and practices.

Discriminatory barriers against all foreign suppliers can be defined as measures that are designed to prevent or reduce the volume of operations of foreign services suppliers.

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[4] See Yotov et al. (2016).

[5] However, it is possible that the regulations can be misused for cronyism, electoral support and other purposes, which are beyond the scope of this paper.

Some of the examples discussed above for domestic regulation, such as licensing requirements and red tape can be discriminatory against foreign suppliers (e.g., to work as a professor in a foreign country there might be additional and time-consuming accreditation procedures or foreign ships in the coastal waters of a country may be subject to more scrutiny and documentation than their domestic counterparts). These barriers are uniform across all foreign service providers and are not country-specific.

Country-specific barriers are discriminatory barriers put in place against a particular country. The reasons vary across three main axes: safety/security, political tension or competitive advantage. For the purposes of concreteness, the examples for these three reasons are as follows: (i) Many countries have much more stringent regulations for the movement of natural persons from Middle Eastern countries due to the fear of terrorism that was on rise since September 11 attacks. (ii) The historical dispute between Turkey and Cyprus is reflected on many services trade restrictions –some prohibitive- between these countries. (iii) Allocation of new licenses or rejections of license applications may be very opaque and discretionary to provide or sustain market competitiveness of domestic companies.

Table 1 demonstrates the presence of these three types of services trade barriers in the World Bank STRI[6], the OECD STRI[7] and PIBs calculated in this paper. While the former two account for domestic regulations and discriminatory barriers against all foreign suppliers, PIBs are comprised of only discriminatory barriers (to all foreign suppliers and country-specific ones). All these measures harbor advantages and disadvantages.

The WB and OECD STRIs have been commonly used in empirical studies on services trade barriers. The former is available only for a short-period of time between 2008-2010 while the latter has recently had an update in 2018. Border PIBs calculated in this paper offer the longest time range extending between 2000-2014.

The WB STRI is a survey-based measure and may suffer from survey-bias. The OECD STRI, on the other hand, compounds information from laws and regulations. One drawback of this approach is that it reflects de jure measures rather the de facto situation.

PIBs calculated in this paper are based on observable trade data on services. The current quality of services trade data is somewhat lower than that of goods trade data due to data collection and processing methods that are mainly tailored for goods trading. Therefore, border PIBs harbor the problems related to services trade data. However, note that this paper applies a novel method to measure policy-induced services trade barriers which may be an efficient tool for academics and policy-makers interested in calculating services trade barriers. As the data collection and processing improve in the services trade area, the measure proposed in this paper will improve as well.

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[6] See Van der Marel and Shepherd (2013).
[7] See Nordås and Rouzet (2015).

3. Methodology and Data

This section presents the details of the methodology for the purpose of analyzing the impact of border policy-induced services trade barriers on goods trade.

3.1. First Stage: Services Trade Barriers

The first stage of our analysis involves the calculation of a micro-founded measure of bilateral services trade costs exactly as in Novy (2013) where he derives a trade cost measure from a wide range of leading trade models based on the idea that all those models yield gravity equations in general equilibrium. We start with a short review of this method based on the gravity model of Anderson and van Wincoop (2003, 2004) that can apply to trade in goods or services:

$$x_{ij}^s = \frac{y_i^s y_j^s}{y^s} \left(\frac{t_{ij}^s}{\Pi_i^s P_j^s}\right)^{1-\sigma^s} \qquad \forall i,j; \tag{1}$$

$$(\Pi_i^s)^{1-\sigma^s} = \sum_j \left(\frac{t_{ij}^s}{P_j^s}\right)^{1-\sigma^s} \frac{y_j^s}{y^s} \qquad \forall i; \tag{2}$$

$$(P_j^s)^{1-\sigma^s} = \sum_i \left(\frac{t_{ij}^s}{\Pi_i^s}\right)^{1-\sigma^s} \frac{y_i^s}{y^s} \qquad \forall j. \tag{3}$$

Let x_{ij}^s denote the value of exports of services sector s at destination prices from country i to country j. y_j^s signifies the expenditure on services sector s in country j originated from all countries. y_i^s and y^s denote the sales of services sector s at destination prices from i to all countries and total output of services sector s at those prices, respectively. Next, t_{ij}^s denotes the bilateral trade costs between countries i and j. The trade elasticity of substitution across services sectors is represented by σ^s. Π_i^s and P_j^s are price indices of exporting and importing countries in services sector s, respectively. These price indices, which are called as outward and inward multilateral resistance by Anderson and van Wincoop (2003), include trade costs with all other partners and can be interpreted as average trade costs.

Due to the difficulty of finding expressions for the multilateral resistance variables, Novy (2013) proposes a method that makes use of the insight that a change in bilateral trade barriers does not only affect international trade but also intranational trade. More precisely, a decline in international trade barriers in country i reduces the domestic consumption (intranational trade) of the services sector s because of an increase in shipments of that service to foreign countries after the policy change.

Using equation (1), we can write the gravity equation for intranational trade of country i in services sector s as follows:

$$\Pi_i^s P_i^s = \left(\frac{x_{ii}^s / y_i^s}{y_i^s / y^s} \right)^{1/\sigma^s - 1} t_{ii}^s \tag{4}$$

Suppose that countries i and j are of the same size $y_i^s = y_j^s$ and same level of openness $x_{ii}^s = x_{jj}^s$ in services sector s. However, country i has more stringent domestic regulations in services sector s compared to country j, $t_{ii}^s > t_{jj}^s$. Then, equation (4) shows that multilateral resistance in services sector s is higher for country i.

To solve for the bilateral trade costs in services sector s, we use equation (4) in conjunction with equation (1). Equation (1) includes the product of outward multilateral resistance of the exporting country and inward multilateral resistance of the importing country, $\Pi_i^s P_j^s$ in service sector s. Equation (4) provides a solution for $\Pi_i^s P_i^s$. By multiplying gravity equation (1) by the corresponding gravity equation for trade flows in service sector s in the opposite direction, x_{ij}^s, we can obtain a bidirectional gravity equation with outward and inward multilateral resistance variables of exporting and importing countries in services sector s:

$$x_{ij}^s x_{ji}^s = \left(\frac{y_i^s y_j^s}{y^s} \right)^2 \left(\frac{t_{ij}^s t_{ji}^s}{\Pi_i^s P_i^s \Pi_j^s P_j^s} \right)^{1-\sigma^s} \tag{5}$$

Substituting the solution from equation (4), assuming asymmetry in domestic and bilateral services trade costs, $t_{ij}^s \neq t_{ji}^s$ and $t_{ii}^s \neq t_{jj}^s$, and taking the geometric mean of the barriers in both directions, we arrive at the following tariff equivalent in services sector s:

$$\tau_{ij}^s \equiv \left(\frac{t_{ij}^s t_{ji}^s}{t_{ii}^s t_{jj}^s} \right)^{\frac{1}{2}} - 1 = \left(\frac{x_{ii}^s x_{jj}^s}{x_{ij}^s x_{ji}^s} \right)^{\frac{1}{2(\sigma^s - 1)}} - 1 \tag{6}$$

where τ_{ij}^s measures bilateral trade costs $t_{ij}^s t_{ji}^s$ relative to domestic trade costs $t_{ii}^s t_{jj}^s$ in services sector s.

The most beneficial feature of Novy (2013) method for our purposes is its inclusion of frictions in domestic trade as well. This is particularly relevant for services trading because it is more prone to behind the border regulations than goods trade as explained in Section 2.

The tariff equivalent in equation (6) has a simple yet elegant logic. Recall that t_{ij} is the bilateral trade costs between countries i and j. Furthermore, t_{jj} represents domestic services regulations in county j applied to all suppliers. Then, $t_{ij}^* = t_{ij}/t_{jj}$ denote trade costs incurred by country i services suppliers when exporting to country j. These costs stem from (i) cultural and geographic barriers between two countries; (ii) unilateral barriers applied by country j to all foreign suppliers exporting to country j) and bilateral

barriers (applied to foreign suppliers from country i only). Consequently, $\tau_{ij}^s = \sqrt{t_{ij}^* t_{ji}^*} - 1$.

It might be helpful to consider two extreme cases[8] for the interpretation of τ_{ij}^s: A frictionless world and a completely closed economy. (i) In a frictionless world, all trade costs would be equal to one ($t_{ij}^s = t_{ji}^s = t_{ii}^s = t_{jj}^s = 1$) and that would make $\tau_{ij}^s = 0$. (ii) In a completely closed economy, bilateral trade $x_{ij}^s x_{ji}^s$ between countries i and j would be zero which would make trade costs approach infinity.[9]

By calculating bilateral services trade barriers using Novy (2013), we can avoid suffering from econometric estimation errors and capture bilateral services trade barriers by inferring them from observable services trade flows. If there is an increase in bilateral trade flows $x_{ij}^s x_{ji}^s$ relative to domestic trade flows $x_{ii}^s x_{jj}^s$ in services sector s, it means that trading products of services sector s between the two countries must have become easier relative to trading domestically, which is signified by a decline in τ_{ij}^s.

Due to the time-varying nature of trade flows, this method gives us an opportunity to calculate bilateral barriers to services trade over a long time period as opposed to STRI measures developed by the World Bank and the OECD.

In equation (6), $\sigma^s > 1$ is the elasticity of substitution in services sector s and it is assumed to be 4.67 in all services sectors used in this paper following Francois et al. (2005). It would be ideal to estimate different σ^s for each services sector, however, this would require highly disaggregated product level data standardized across countries in these services sectors, which are not available to the best of our knowledge. Trying to construct such a data set is beyond the scope of this paper.

We calculate the tariff equivalent in equation (6) for five leading services sector categories: *Finance*, KIPS, *Telecom*, *Transport* and *W&R* as a measure of services trade barriers (STBs) for years 2000-2014.

3.2. Second Stage: Policy-Induced Barriers in Services Trade

The second stage of our analysis is to estimate border policy-induced barriers (PIBs) in services trade. Our objective is to decompose STBs into its two main components: cultural and geographical barriers (CGBs) and policy-induced barriers in services trade (PIBs). The motivation behind this decomposition is the idea that services trade policy is a lever that can be controlled by policymakers for economic and political reasons whereas culture and geography are not. Furthermore, another purpose of focusing on policy barriers to services trade is the fact that these barriers are subject of negotiations in the WTO or regional trade agreements.

As a next step, in obtaining the unobservable, residual trade costs (border PIBs) in services trade in each services sector s, we regress STBs obtained in the first stage of our analysis on CGBs proxied by geographical barriers (common border, distance) and cultural

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[8] As in Chen and Novy (2011).

[9] In this paper, zero trade flows do not occur due to the level of aggregation. The exports of services sector s in country i are destined towards the total use in country j (intermediate use in all sectors + final use by consumers).

barriers (same country, colonial ties, common language, member of the same currency union) as follows:

$$ln\tau_{ijt}^{s} = \alpha_0 + \alpha_1 ln(Distance_{ij}) + \alpha_2 Border_{ij} + \alpha_3 Language_{ij} + \alpha_4 Colony_{ij}$$
$$+ \alpha_5 Same\ Country_{ij} + \alpha_6 Landlocked_i + \alpha_7 Landlocked_j \qquad (7)$$
$$+ \alpha_8 Currency\ Union_{ijt} + \varepsilon_{ijt}^{s}$$

where $ln\tau_{ijt}^{s}$ is the logarithm of bilateral trade barriers in services sector s between exporting country i and importing country j in year t. Here

$$ln(Distance_{ij}) = ln\left(\frac{d_{ij}d_{ji}}{d_{ii}d_{jj}}\right)^{\frac{1}{2}} - 1 \qquad (8)$$

for the purpose of using the same functional form as in the tariff equivalent term, where $d_{ij} = d_{ji}$ is the distance between trading partners and d_{ii} and d_{jj} are internal distances[10]. $Border_{ij}$ takes the value of 1 if there is a common border between i and j and 0 otherwise while $Language_{ij}$ is a dummy to capture the presence of a common language between these countries. $Colony_{ij}$ shows if there are colonial ties between the two countries. $Same\ Country_{ij}$ takes the value of 1 if countries were or are the same state or the same administrative entity for a long period (25-50 years in the twentieth century, 75 years in the ninetieth century and 100 years before) and 0 otherwise. $Landlocked_i$ and $Landlocked_j$ are indicator variables equal to 1 if exporting and importing country are landlocked, respectively. Finally, $Currency\ Union_{ij}$ accounts for a currency union among countries i and j. Note that there is no need to conduct the same transformation that is done for distance variable for the other gravity variables since they are all dummy variables.

First, we estimate five equations with time varying dummy variables for five services sectors under consideration as well as for the entire services sector. Next, we use the residual vector, $\varepsilon_{ijt}^{s} = v_{ij}^{s} + e_{ijt}^{s}$, as a proxy for border PIBs, which reflect bilateral regulations in services trade, as suggested by Francois et al. (2007). The first term is the panel specific error which is constant over time. The second one is the regular error term. We need both of them. The first one gives us the exporter-importer specific trade barriers which we did not control with our observed variables. The second one gives us the exporter-importer-year specific error. An example that can be given to make the time-invariant part of the residual, v_{ij}^{s}, clear is the political conflict between Turkey and Cyprus that has not changed during the sample period. This conflict totally hinders trade between these two countries as will be apparent in Section 5. The time-variant part of the residual, e_{ijt}^{s}, represent all regulatory changes that have an impact on services trade during the sample period.

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[10] Internal distance of the exporting country i is calculated as, $d_{ii} = .67\sqrt{Area_i/\pi}$ and for the importing country j, $d_{jj} = .67\sqrt{Area_j/\pi}$ (as a measure of average distance between producers and consumers in a country).

The residual vector in each estimating equation approximates the sector specific policy-induced barriers to services trade in that particular sector.

Finally, border PIBs are calculated by indexing the residual vector as follows:

$$\phi_{ijt}^{s} = \frac{\varepsilon_{ijt}^{s} - \min(\varepsilon_{ijt}^{s})}{\max[\varepsilon_{ijt}^{s} - \min(\varepsilon_{ijt}^{s})]} \in [0,1] \qquad (9)$$

There might be a couple of identification issues: The first one stems from the complementarity of goods and services trade. It might be argued that the residual vector described above includes goods trade barriers in it as well. According to this argument, in case of complementarity, policy-induced measures that are used to change goods trade flows will also affect services trade flows. This will show up as part of the residual. In other words, policy-induced barriers to goods trade is embedded in the policy-induced barriers to services trade that we calculate in this paper. However, we believe that this is not an identification problem as these goods trade barriers naturally become services trade barriers owing to the interconnectedness of goods and services trade flows. For example, suppose that there are new tariff barriers to oranges in the destination country. Naturally, both exports of oranges and exports of transportation services to ship oranges to the destination country will be reduced. Even though the origin of the barriers is in the goods side, it becomes an indirect policy-induced services trade barrier. If there is no complementarity, on the other hand, barriers to goods and services trade will be unrelated and is not of concern in this paper. Pharmaceutical tariffs in a country, for example, will not have any noteworthy impact on construction services trade of this country.

The second one is related to the home market effect. It may be argued that this method works well for countries which have a similar domestic market for a product as its trading partners. In other words, there may have been lower domestic demand for some of these services in emerging countries, which results in lower intra-country trade of such services. This would cause our measure to misrepresent the trade costs. However, some of these services are quite traditional services such as transportation and wholesale/retail and there is always demand for them even in emerging economies. Furthermore, the emerging economies sample in the WIOD is not composed of the least developed countries where there is almost no demand for finance, telecom or KIPS. If we also add to this the period that is under consideration in our paper (2000-2014), very low home market demand should not be a concern for these countries.

3.3. Third Stage: Structural Gravity Estimation of Goods Trade

In the final stage, we estimate a structural gravity model of goods trade, which involves the policy-induced services trade barriers in the five sectors as explanatory variables, in the form

$$x_{ijt}^{g} = \exp\left(\beta + \beta_{it} + \beta_{jt} + \beta_{ij} + RTA_{ijt} + \sum_{s} \gamma_{s}\,\phi_{ijt}^{s}\right) + \zeta_{ijt} \qquad (10)$$

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where $\sum_s \gamma_s \phi_{ijt}^S = \gamma_{FIN}\phi_{ijt}^{FIN} + \gamma_{KIPS}\phi_{ijt}^{KIPS} + \gamma_{TEL}\phi_{ijt}^{TEL} + \gamma_{TRAN}\phi_{ijt}^{TRAN} + \gamma_{W\&R}\phi_{ijt}^{W\&R}$.

In equation (10), lnx_{ijt}^g is the logarithm of the nominal value of goods exports from country i to country j in year t, without any sectoral detail. In order to account for unobserved heterogeneity across time and countries, exporter-year β_{it}, importer-year β_{jt} and exporter-importer β_{ij} fixed effects are included in the estimations. Accounting for regional trade agreements across countries and time, we include RTA_{ijt}, which is an indicator that takes the value 1 if there is a regional trade agreement between countries i and j at time t[11]. Border PIBs approximated by ϕ_{ijt}^S in services sectors are included in this regression to measure the impact of bilateral barriers in services trade on goods trade.

Our choice of estimation method is Poisson pseudo-maximum-likelihood (PPML) estimator for its success in overcoming heteroskedasticity and zeroes in bilateral trade flows (Santos Silva and Tenreyro, (2006, 2011)).

3.4. Data

The analyses in this paper are based on bilateral international trade data from the World Input-Output Database (WIOD)[12] and the gravity data. In the first stage of the analysis, we use services trade data[13], while in the third stage we utilize aggregate bilateral goods trade data.

The WIOD November 2016 Release is composed of World Input Output Tables (WIOT) and Socio-Economic Accounts (SEA). The three improvements that have been incorporated in this new release are (i) addition of data that have become available in recent years, (ii) improvement of the bilateral shares estimation in especially services trade, and (iii) enhancement of the estimation of basic price tables by using information on margins and taxes on exports.[14]

The new release of WIOD covers 43 countries in total -28 EU countries and 15 other major countries in the world- for the period from 2000 to 2014.[15] Moreover, NACE Rev. 2 industry and CPA 2008 product classifications are used. The supply and use tables (SUTs) in the database cover 56 industries which are listed in Appendix Table A1.

In the framework of the WIOT, when a service is produced, it can be used by (A) domestic agriculture sectors, (B) domestic goods sectors, (C) domestic services sectors, (D)

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[11] Ideally, tariffs levied on goods trade have a place in equation (10). However, due to exporter-year and importer-year fixed effects, this variable becomes redundant.

[12] In this paper, the WIOD is preferred to the OECD ICIO database due to availability of more recent data.

[13] The WIOD covers services trade in GATS mode 1 (cross-border: services trade supplied from one territory to another) and mode 2 (consumption abroad: such as tourism expenditures).

[14] See Timmer et al. (2016) for a detailed discussion on the construction of WIOD and improvements of the database.

[15] The list of the 43 countries (plus estimated rest of world) included is: EU-28 Member States (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Germany, Denmark, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Poland, Portugal, Romania, Sweden, Slovakia, Slovenia and United Kingdom), Australia, Brazil, Canada, China, Norway, India, Indonesia, Japan, Korea, Mexico, Russia, Switzerland, Taiwan, Turkey, USA and Rest-of-World (estimated).

foreign agriculture sectors, (E) foreign goods sectors, (F) foreign services sectors, (G) domestic consumers and (H) foreign consumers.

Table 2 presents the structure of international input-output tables provided in the WIOD. For the purposes of this paper, on the supply side (inputs) the services sectors are categorized as follows[16]: Services Sector (as a whole), *Finance*, *Knowledge Intensive Producer Services*, *Telecom*, *Transport* (inc. logistics) and *Wholesale and Retail*. The use side (output) is categorized as follows: Intermediate Use (Agriculture, Manufacturing and Services) and Final Use by consumers. The total use by country j is the sum of intermediate and final use. Supply and use of services are distinguished as domestic and foreign as well in Table 2.

In the second stage of the analysis, we use standard controls for the gravity model, namely natural trade barriers. The variables that we use are distance between countries, *Distance*; common border between countries, *Border*; common language, *Language*; same historical origins, *Colony* and *Same Country*; being landlocked, *Landlocked*; being under the same currency union, *Currency Union*. *Area* is used for internal distance calculations. All the data are taken from CEPII, except data on currency union which come from De Sousa (2012).

In the third stage, we use a dummy for regional trade agreements, *RTA*, that takes the value 1 if there is a customs union, free trade agreement, economic integration agreement or a partial scope agreement between countries in place, and 0 otherwise. The regional trade agreement data come from Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008).

Summary statistics are given in Table 3.

4. Services Trade Barriers

As a first step in our analysis, we explore if there is a distinction between intermediate and final use in terms of services trade barriers. It is well-known that there are marked-differences between tariff and non-tariff barriers applied to intermediate and final goods trade (Baldwin and Lopez-Gonzalez, 2015). Therefore, it is natural to investigate if it is the case in service trade barriers.

For the intermediate use, we employ (A) and (D) to find τ_{ijt}^{int-a}, (B) and (E) to find τ_{ijt}^{int-m}, (C) and (F) to find τ_{ijt}^{int-s} and for the final use we employ (G) and (H) to find τ_{ijt}^{fin} using the method in equation (6).

Our calculations of STBs in intermediate services trade –services traded to be used in agriculture, manufacturing and services production- and final services trade –services traded for final consumption- exhibit a slight difference as displayed in Figure 1. The kernel density diagram shows that the distributions of the STBs in intermediate services

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[16] Row and column numbers in WIOT are also presented in Table A.1.

trade are almost the same. However, the distribution of STBs in final services trade is slightly higher than the intermediate ones.[17]

However, the correlation coefficients are all above 95 percent showing that these measures are virtually equal when used in regressions,

$$\tau_{ijt}^{int-a} = \tau_{ijt}^{int-m} = \tau_{ijt}^{int-s} = \tau_{ijt}^{final}.$$

Therefore, in the rest of the paper, we calculate the STBs in all services sectors without distinguishing between intermediate or final use[18].

5. Policy-Induced Barriers to Trade

Policy-induced barriers to services trade, which reflect border regulations in services trade, are calculated in the second stage for the five services sectors for the period 2000-2014. This section, firstly presents, the regression results for equation (7) which constitute the basis for calculations shown in equation (9). Secondly, the section discusses the differences of border PIBs among countries for the services sector as a whole first and then for each five services subsectors.

As shown in Table 4, when services trade barriers (STBs) obtained in Section 4 is regressed on the cultural and geographic barriers, most of the expected signs are observed. While longer distances between the trading countries increase the services trade barriers; sharing a border, a language and colonial ties as well as being involved in the same currency union reduces these barriers. One curious result in Table 4 is the negative signs in front of the *Landlocked* dummies. When scrutinized more closely, it is seen that there are only six landlocked countries (Austria, Czechia, Hungary, Luxemburg, Slovakia and Switzerland) all of which belong to the EU and heavily trade with other EU countries in terms of services.

The residual vector obtained in each estimating equation is then used to calculate the sector specific policy-induced barriers to services trade in that particular sector by using the index in equation (9).

PIBs are barriers coming from the services side such as sector-specific regulations, the lack of enforcement of competition, rules related to data localization, commercial presence requirements or restrictions on movement of people. In this paper, border PIBs represent these multi-faceted barriers to services trading that affect goods trade through global value chains.

The correlation coefficients of the sectoral PIBs are presented in Table 5 and range from 0.40 to 0.67. The border PIBs calculated in this paper are positively correlated with the WB STRI. Overall, the correlation between border PIBs in services trade and the survey based WB STRI is 0.21 for the year 2008. On the other hand, the sectoral

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[17] This slight difference is also proved by the Kolmogorov-Smirnov test for the equality of intermediate and final STBs, which is rejected. The results are available upon request.

[18] Mukherjee (2018) analyzes the impact of services trade restrictiveness index on intermediate and final consumption and suggests that there are no marked differences.

correlations between these two indices are 0.38 for Finance, 0.16 for Telecom, 0.26 for W&R, 0.16 for Transport and 0.12 for KIPS. To sum up, these two indices have a positive relationship for each sector. However, the degree of correlation is low for three reasons: (i) the sector definitions of these two indices are not exactly the same; (ii) the WB STRI covers different modes of supply compared to border PIBs; (iii) as indicated in Table 1, the WB STRI and the border PIBs calculated in this paper differ in types of barriers to services.

Figure 2 presents a comparison of border PIBs in services sector across countries in our sample for 2014. The measure of border PIBs for a country is calculated as the simple average of that country's border PIBs. Note that as border PIBs are indexed to change between 0 and 1, country-level PIBs will fall into the same range as well. A change in a country's level of border PIBs may be caused by; (i) that country altering its barriers towards a set of other countries (discriminatory barriers against all foreign suppliers), (ii) other countries changing barriers towards that country (country-specific barriers) or (iii) both (border PIBs).

The countries experiencing the lowest border PIBs (around 0.35) are small, open economies of the EU; namely, the Netherlands, Belgium and Malta. In contrast, India and Indonesia are the countries with the highest border PIBs, almost two-folds of the lowest border PIBs countries. Figure 2 shows that advanced countries face lower border PIBs compared to emerging countries. The exceptions are border PIBs of Taiwan with around 0.4 and Canada with around 0.5.

Figure 3 provides a comparison of average border PIBs between 2000 and 2014 for services sector as a whole and for each of the five subsectors. Panel (i) suggests that while some countries experienced a decrease in their border PIBs over time, there are countries that encountered an increase in their barriers between 2000 and 2014. Specifically, the countries that became a member of the EU after 2000 enjoyed lower border PIBs during 2000-2014 period. Some of those countries with significant decreases are Poland, Hungary, Romania, Bulgaria, Estonia and Croatia. This would be due to the convergence of these countries' legal systems to the older members of the EU. Moreover, some other members of the EU enjoyed further decreases in their barriers such as Malta, Belgium, Ireland and Luxemburg, which may be an indication of an added benefit of joining the European Monetary Union.

Emerging countries, however, followed an opposite trend and experienced higher barriers over time. Russia, Turkey, Mexico, India and Indonesia are amongst those countries. This may be the outcome of the anti-globalization movement which resulted in more restrictive behind the border regulations. Evenett and Fritz (2015) present a detailed picture of discriminatory measures (on both goods and services trade) implemented and experienced by G20 countries for years 2009-2015. Among these six countries, while Mexico was harmed relatively more by other countries' protectionist measures, India and Indonesia adopted protectionist measures that harm the interests of other countries relatively more intensely. Russia and Turkey, on the other hand, implemented and experienced a plethora of protectionist measures. To be precise, Russia has increased the

number of protectionist measures from 71 to 478 while Turkey from 27 to 157 during 2009-2015 period.

As a financial center, the UK is one of the countries with the lowest border PIBs in *Finance* both in 2000 and 2014 as shown in panel (ii) of Figure 3. Ireland and Malta are the other countries with the lowest barriers. In contrast, the highest trade barriers in the financial and insurance services are observed in Russia, India and Indonesia. These results are in line with the OECD STRI index (2018 release). Indeed, for financial and insurance services, border PIBs calculated in this paper and the OECD STRI values, both in 2014, are positively correlated at 65 percent level.

Border PIBs in *Knowledge Intensive Producer Services* is lower almost for all the countries in our sample compared to the services sectors as a whole (Panel iii). Most of the countries demonstrate border PIBs around 0.15-0.3 band. The two outlier countries experiencing higher barriers are Mexico and Turkey.

Compared to border PIBs in the overall services sector, most of the countries did not experience any change in their PIBs in *Telecom* during our sample period as evident in Panel (iv) of Figure 3. The countries facing significantly lower barriers in the *Telecom and Postal* services are among the EU members as it is the case in the overall services sectors. Belgium, Luxemburg, the UK and Italy were the countries with the lowest barriers in 2014, whereas Turkey, Mexico, Greece and Brazil had the highest barriers.

The highest border PIBs in the *Transport* were observed in India and Indonesia in 2014. The countries that started to experience significantly higher barriers in *Transport* over time are Turkey, Spain, Japan, India and Indonesia. Similar to the reduction of their border PIBs in services sector as a whole, the latest members of the EU also enjoyed decreasing PIBs in *Transport* as presented in Panel (v) of Figure 3. In addition to these new members of the EU, China also experienced a noticeable fall in its border PIBs in the transport sector following the liberalization efforts in transport sector in that country during the sample period.

Except Indonesia[19], the countries in our sample impose very low border PIBs in *W&R* as expected (Panel vi). Indeed, the OECD STRI index (2017 release) shows that Indonesia is an outlier in imposing high barriers in distribution sectors. Furthermore, in 2014, barriers to trade in wholesale and retail services calculated in this paper as border PIBs and the OECD STRI values reported by OECD are positively correlated at 80 percent level.

6. Structural Gravity
6.1. Baseline Results

Table 6 presents the results of the PPML estimation of bilateral goods trade (equation 10) for the period 2000-2014 for 43 countries composed of advanced and emerging countries in the WIOD database. The estimations include exporter-year, importer year, exporter-importer fixed effects, a regional trade agreement dummy as well as policy induced barriers to services trade in five services sectors.

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[19] Indonesia is removed from Figure 3 for demonstration purposes.

Column 1 of Table 6 reports the impact of border PIBs in services sector as a whole (in total) on goods trade. The coefficient is negative and significant as expected. Columns 2 to 6 present results related to 5 services sectors, namely *Finance, KIPS, Telecom, Transport* and *W&R*. Trade barriers in *Transport* and *W&R* sectors negatively and significantly affect goods trade. Barriers to trade in *Finance, KIPS* and *Telecom* services have no impact on goods trade.

Finally, the joint effect of all five policy induced services trade barriers are reported in Column 7 and only for *Transport* and *W&R* are negative and significant. These results are in line with Nordås and Rouzet (2015) and Ariu et al. (2016) who found similar results by using OECD STRI index and OECD PMR index, respectively.

Manufacturing sector relies on services in three ways: (i) as inputs, (ii) as activities within firms or (iii) as output sold bundled with goods. There is an extensive literature on this topic going back to Levitt (1972) questioning the complementarity of goods and services production. There exist past studies that analyze the share of services inputs in goods exports (Francois and Woerz, 2008; Nordås, 2008). There are also recent studies that look at the interconnection between goods and services exports for end-users such as Dincer and Tekin-Koru (2016) and Miroudot and Cadestin (2017).

Indeed, Miroudot and Cadestin (2017) explain the predominant role of services in GVCs as follows: "While the manufacturing process can be adequately described as a "value chain" where through successive transformations inputs are combined into a final product, services create value through "networks" (by facilitating exchanges among users) and through "shops" (by solving problems and bringing tailored solutions)."

Going back to Table 6, the outcome of the baseline analysis highlights that PIBs of *Transport* and *W&R* are all that matter when we talk about services trade barriers affecting goods trade. There seems to be no impact of barriers in other services sectors on goods trade. At this juncture, note that *Transport* and *W&R* are inseparably connected to the goods trading and thus it is no surprise to see a robust, significant, negative impact on goods trade of barriers to these types of services trading. However, the relationship between goods that are traded and services such as *Telecom, Finance* and *KIPS* are more indirect and elusive particularly when pooled data are used. This indeed is the thrust that pushes us to the analysis in the next section.

6.2. Country Group Results

In this section, we investigate whether our results in the benchmark regressions change when we consider trade between countries in different levels of development. Notice that the results of the previous section are valid for a number of different countries trading very different goods bunched together. However, even the most traditional trade theories that inform our thinking in terms of patterns of trade make a distinction between North-North and North-South trade. While, North-North trade is intra-industry in nature and largely driven by love of variety or scale economies, North-South trade is characterized by technology or endowment differences across countries and involves a very different set of traded goods. What this implies is that even if we have the same level of services trade

barriers, these barriers may have different impacts on the manufactured goods trade of advanced and emerging economies.

Advanced and emerging country classifications that are necessary for the regressions are made using the World Bank income taxonomy. Advanced countries are high income countries in the World Bank classification while emerging ones are all the rest in our database.

Before going into the country group regressions, a descriptive analysis of the PIBs across different country groups is in order. These country groups are Advanced ex(im)porter-Advanced im(ex)porter and Emerging ex(im)porter-Advanced im(ex)porter. Figure 4 presents the comparison of average PIBs (over these country groups) to trade in services sectors by country groups. Two observations can be made: (i) For both country groups the ranking of PIBs from highest to the lowest is as follows: *Telecom*, *Finance*, *Transport*, *KIPS* and *W&R*. (ii) Even though PIBs of the Emerging-Advanced group are higher than that of the Advanced-Advanced group, the differences are not that pronounced. Figure 5 shows the details of Figure 4 for the interested reader.

The results of the estimations are presented in Table 7. Columns 1-3 of Table 7 present goods trade between advanced countries, advanced countries' goods exports to emerging countries and emerging countries' goods exports to advanced countries, respectively. Emerging-Emerging goods trade flows are not reported due to insufficient degrees of freedom in the estimations. Each reported coefficient comes from an individual estimation using the related border PIBs for that sector only.

Recall that PIBs that are calculated in this paper are bilateral in nature; therefore PIBs used in Columns 2 and 3 are the same.

The main result of Table 7 is that border PIBs in the services sector as a whole have a negative and significant impact on goods trade for all country groups as observed from the first row of the Table. Furthermore, PIBs in *Transport* and *W&R* negatively affect goods trade independent of the development level of the exporter and the importer. Therefore, any country imposing high barriers in *Transport* and *W&R* has the possibility of reducing goods trade in a significant way as these are vital services sectors that act usually as inputs in goods production or complementary in consumption.

PIBs in *Finance* and *Telecom* have a negative and significant effect only on exports of goods from advanced countries to emerging countries. As explained in the beginning of this section, different types of goods are traded across different country groups. In particular, advanced countries produce and export capital intensive / knowledge intensive / skilled-labor intensive products to emerging countries. Most of the time, these types of goods require more finance, insurance and telecom services compared to traditional unskilled labor intensive products. Considering that barriers to the imports of these types of services are higher in emerging economies (Figures 4 and 5), there is a pronounced effect of *Finance* and *Telecom* barriers on goods exported by advanced countries to emerging ones.

7. Conclusion

In this paper, we investigated the impact of border policy-induced trade barriers in *Finance*, *Telecom*, *Transport*, *Wholesale and Retail (W&R)* and *Knowledge Intensive Producer Services (KIPS)* on goods trade using the World Input-Output Database covering 43 countries over the period 2000-2014.

We employed a three-stage approach: (i) In the first stage, we calculated barriers to trade in services using Novy (2013) methodology. The advantage of obtaining these tariff equivalents or services trade barriers (STBs) in an indirect way by inferring them from observable trade flows is to overcome the difficulties related to data limitations on the time dimension and heterogeneity of domestic and international regulations in services. Another benefit is to be able to compute tariff equivalents in services sectors not only for cross-sectional data but also for time series and panel data. (ii) In the second stage, we decomposed services trade barriers into their cultural/geographic and policy-induced components by regressing STBs on well-known gravity variables. We calculated border policy-induced barriers (PIBs) from the residual vector of this regression. In essence, we obtained a services trade cost measure that account for border barriers only. This measure includes both the discriminatory barriers against all foreign suppliers and country-specific barriers in services trading as opposed to the WB and OECD STRI measures. (iii) In the third stage, we estimated a structural gravity equation of goods trade by including border PIBs to trade in five services sectors as explanatory variables, namely finance, telecom, transport, W&R and KIPS.

Firstly, our results show that STBs calculated in the first stage using Novy (2013) are not different for intermediate and final use. Therefore, in the decomposition of STBs into cultural and geographic barriers (CGBs) and border PIBs in the second stage, we employed no such distinction. Next, in the second stage analysis, for the services sector as a whole, we found that advanced countries have lower border PIBs on average compared to emerging countries throughout the sample period. While the new members of the EU (Poland, Hungary, Romania, Bulgaria, Estonia and Croatia) witnessed declining PIBs over time, emerging countries (Russia, Turkey, Mexico, India and Indonesia) experienced higher barriers over time. Finally, in the structural gravity estimations in the third stage, the results show that border PIBs in transport and W&R adversely affect goods trading.

When we extended our analysis to goods trade between countries of different development levels, the results exhibited meaningful variations that can be of use to the policymakers. Services activities bundled with manufacturing are typically related to wholesale and retail trade, construction, maintenance and repair and engineering and related technical services. Part of these services are the ones needed by manufacturing firms in their international operations but some of these services are also complementary activities that add value for the customers and, in some cases, may be indispensable to exports (e.g. installation services). In other words, considering the services penetration in manufacturing sector and the intertwined nature of goods and services trading, our analysis may reveal potentially important policy implications.

First, independent of the level of development of the exporter or the importer, the impediments to trade in the most traditional services sectors such as *Transport* and *W&R*, had a significant role in adversely affecting the goods trade. Therefore, policy measures that reduce the services trade barriers in these sectors will have an important role in boosting goods trading in all countries.

Second, PIBs in *Finance* and *Telecom* have a negative and significant effect only on exports of goods from advanced countries to emerging countries. Considering the fact that advanced countries produce and export high-tech products to emerging countries, the demand for accompanying finance, insurance and telecom services becomes higher in emerging countries. As the advanced economy exporting firms prefer these services to be supplied by internationally recognized companies, importers of the high-tech products in emerging countries increase their import demand for finance, insurance and telecom as well. Due to high PIBs in these types of services in emerging economies, high-tech goods exports of advanced countries to emerging ones are affected adversely.

The policy implication that benefits advanced economies regarding the PIBs in *Finance* and *Telecom* is a reduction in barriers. However, even a carefully planned reduction in barriers in these sectors will increase both goods and services imports of emerging countries in the short run and may even hurt their current account balances. However, in the long run, competition brought by exposure to foreign markets in *Finance* and *Telecom* may play an important role in improving the efficiency and international reputation of these sectors in the emerging economies. As the efficient working of these network sectors has utmost importance not only for foreign dealings but also for the domestic markets, this type of a move may serve as a step towards faster development of these countries.

In summary, this paper has attempted to introduce a new measure of services trade barriers by inferring them from observable trade flows and to analyze the impact of these newly calculated barriers on goods trade. The method that we employed to calculate services trade barriers in this paper can be used as a complement to the available STRI measures particularly in the cases of country-specific barriers to services trading. Furthermore, both the method and the results of the analysis in regards to the effects of these barriers on goods trade can serve as a toolkit by policymakers in the multilateral, regional and bilateral services trade negotiations. That is to say, as servicification of GVCs become more common, international services trade regimes around the world need to be updated to cope up with the changing nature of production processes and to be harmonized at the multilateral level. In other words, reducing tariffs or removing of non-tariff barriers on imports of goods only is not sufficient in the GVC era. The results of this paper show that border PIBs significantly reduce goods trade flows. Therefore, understanding the nature of and then removing/reducing services trade barriers should be in the foundation of new services trade regimes that are compatible with GVCs.

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Figure 1. Kernel Density Diagram of Intermediate and Final STBs
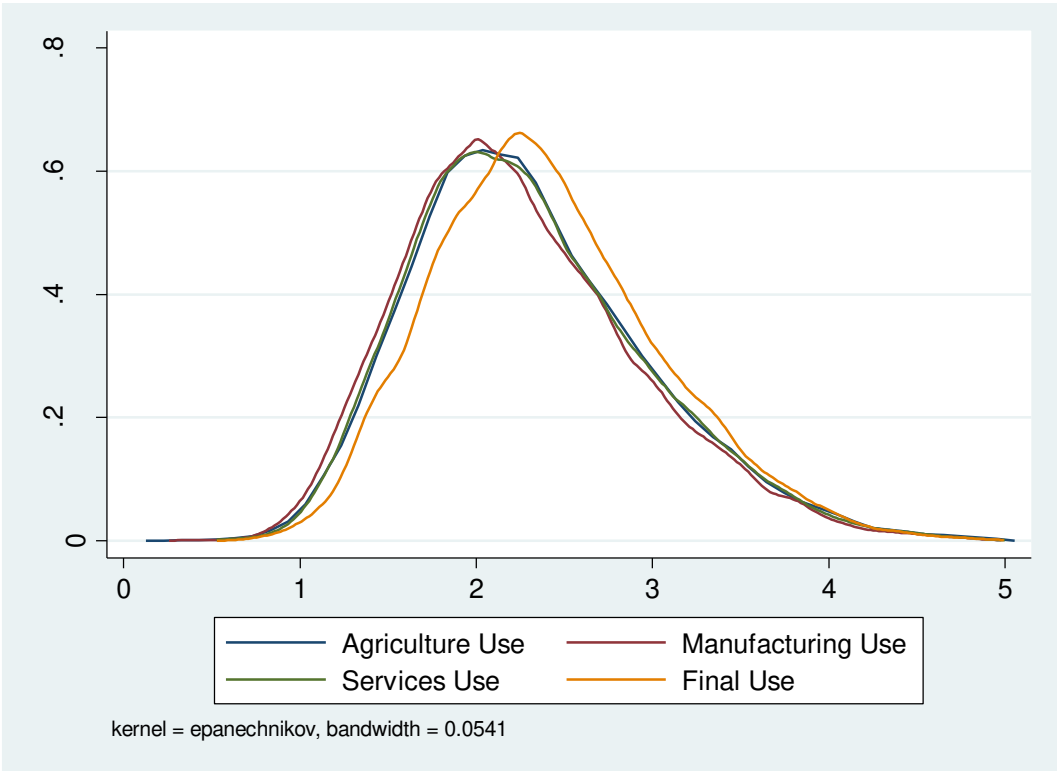

kernel = epanechnikov, bandwidth = 0.0541

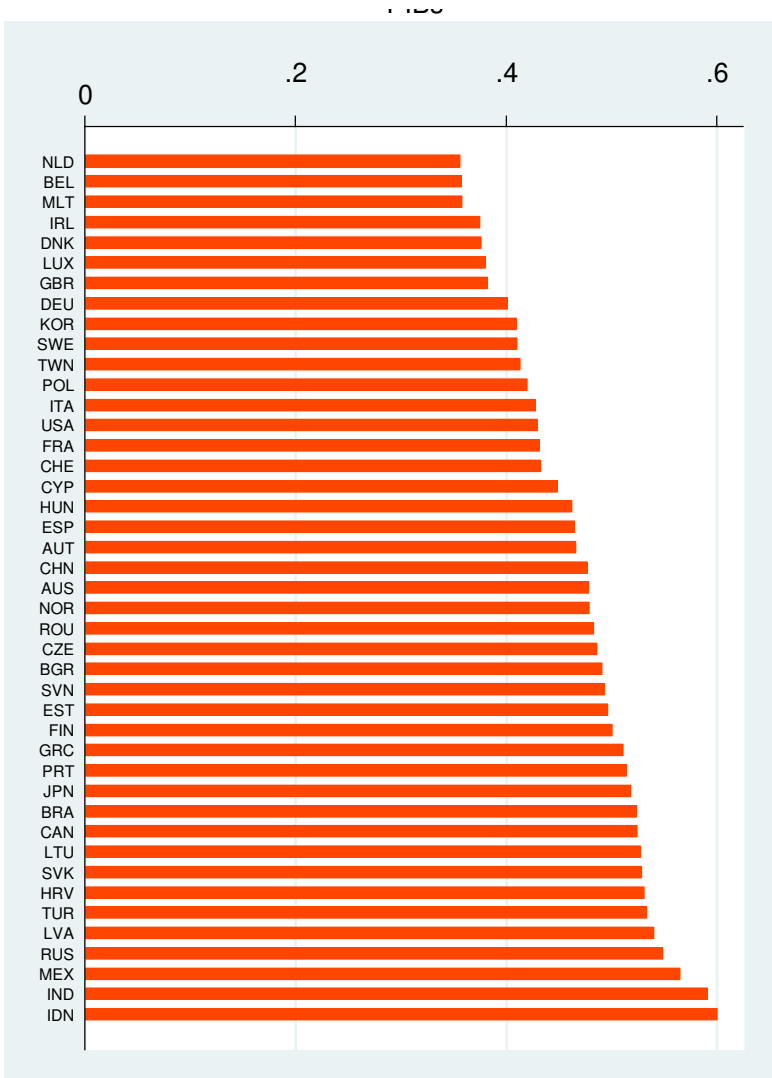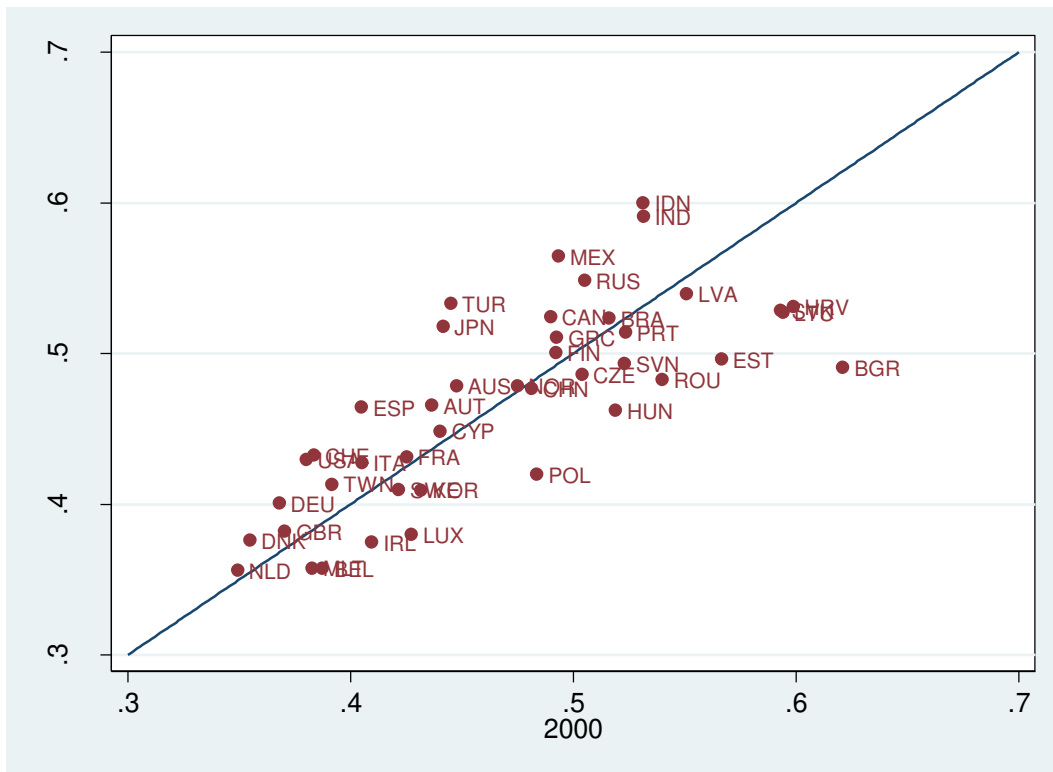**Figure 2. Comparison of Average PIBs in Total Services Trade across Countries 2014**
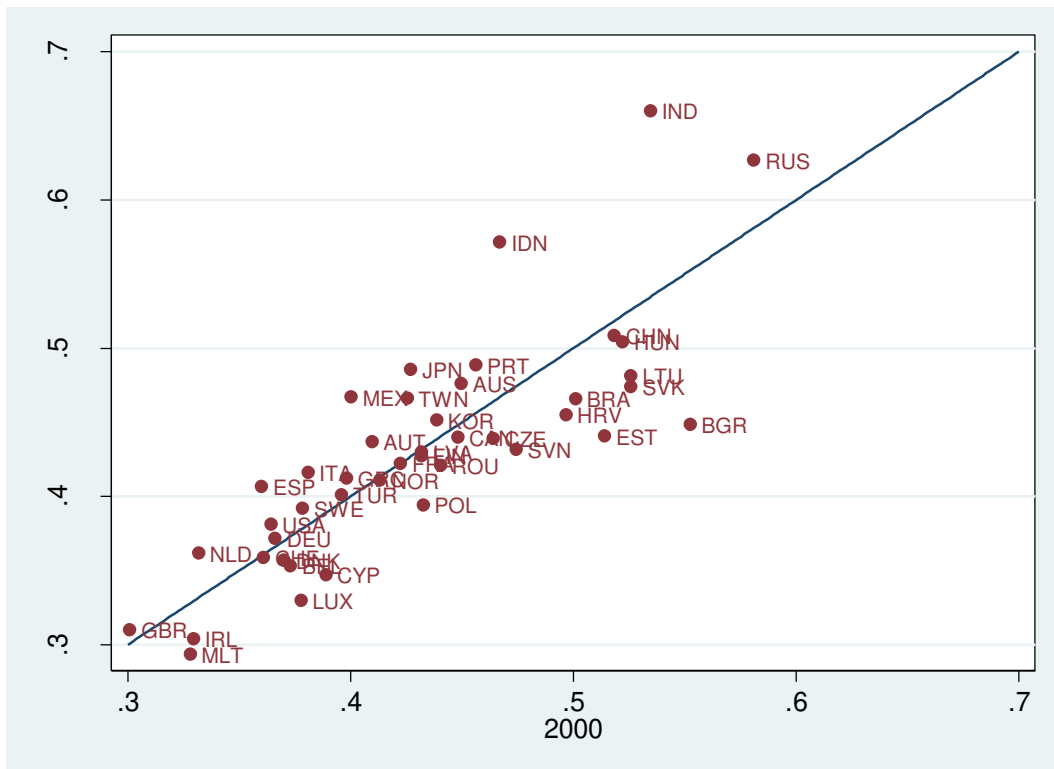
Figure 3. Comparison of Average PIBs across Countries between 2000 and 2014

i. PIBs in Services

ii. PIBs in Finance

iii. PIBs in Knowledge Intensive Producer

iv. PIBs in Telecom

24
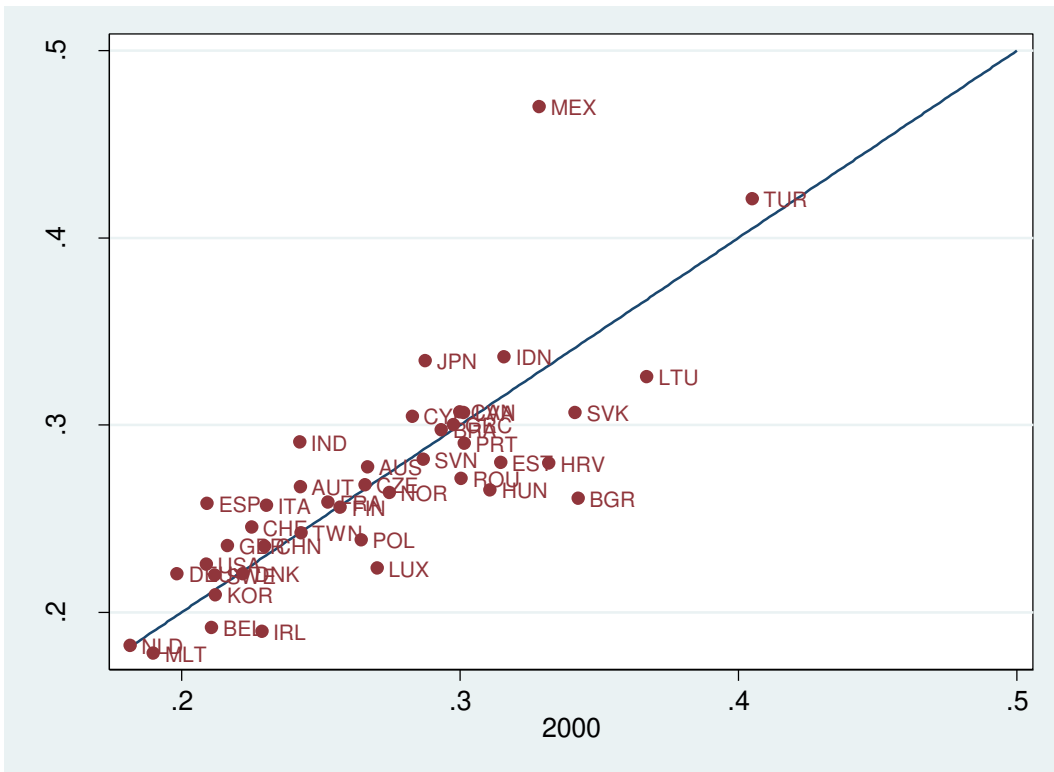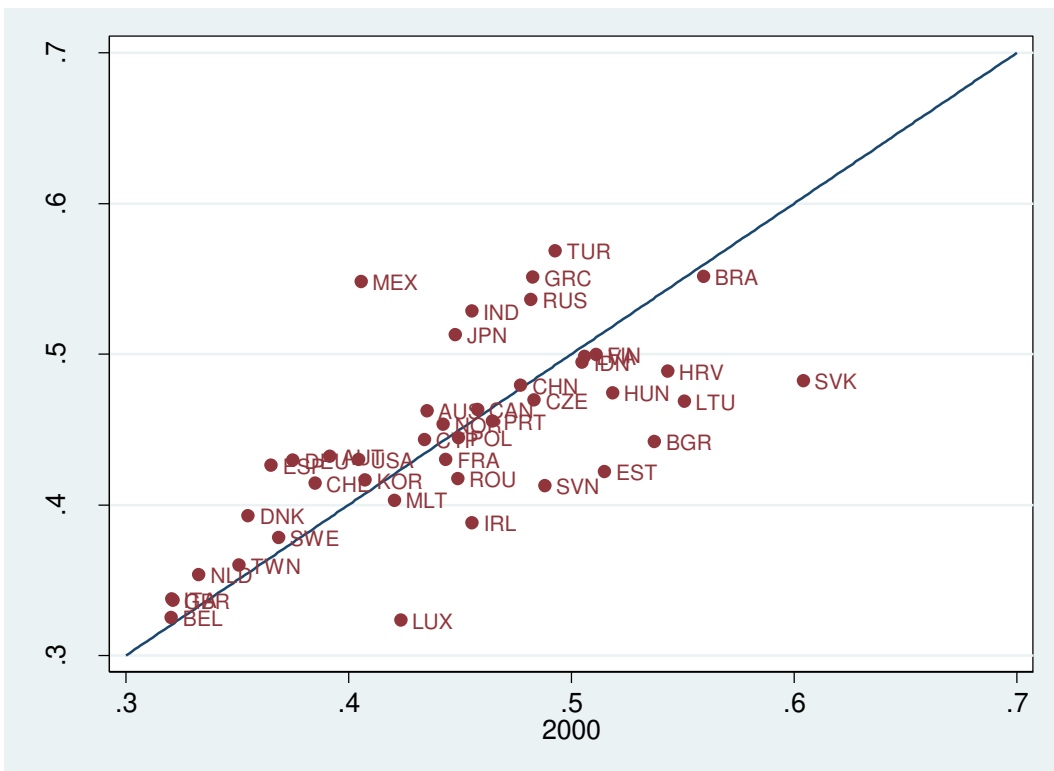
v. PIBs in Transport
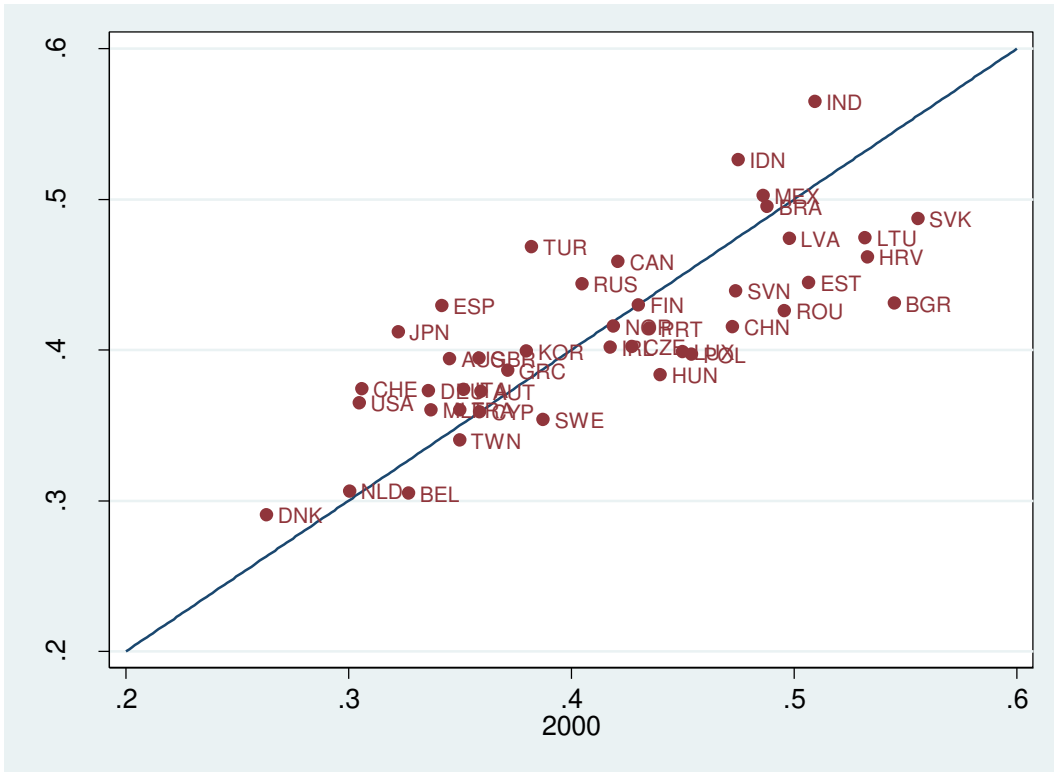
vi. PIBs in Wholesale and Retail
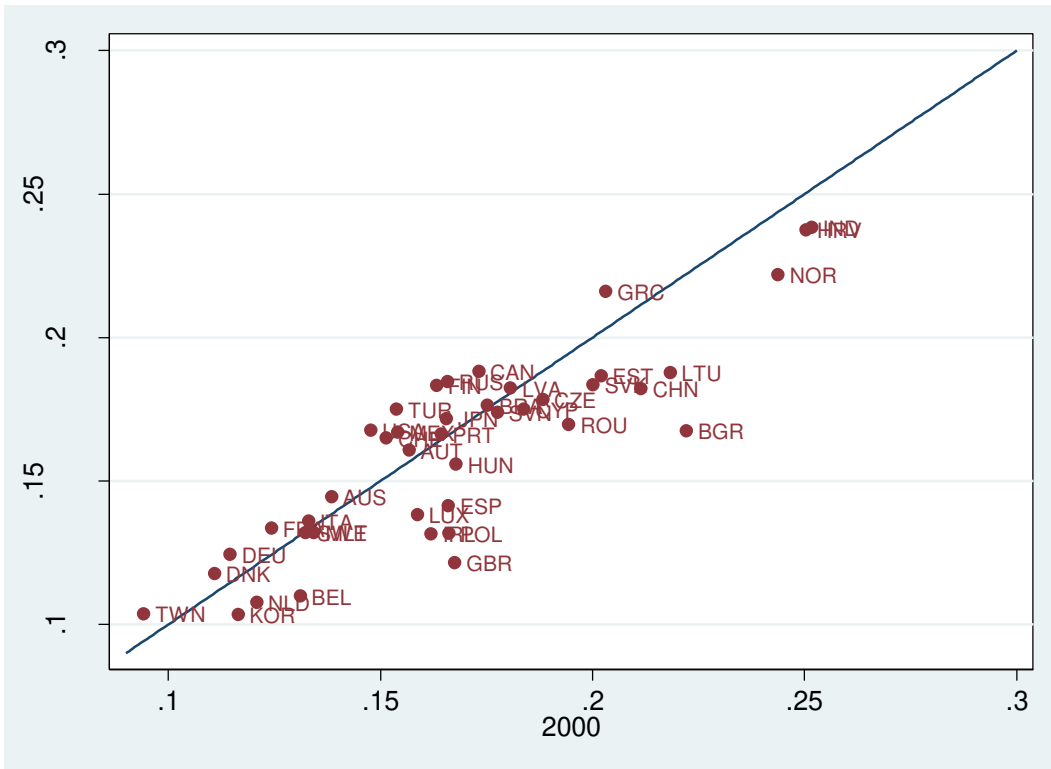
Figure 4. Comparison of Average PIBs to Trade in Services Trade by Country Groups
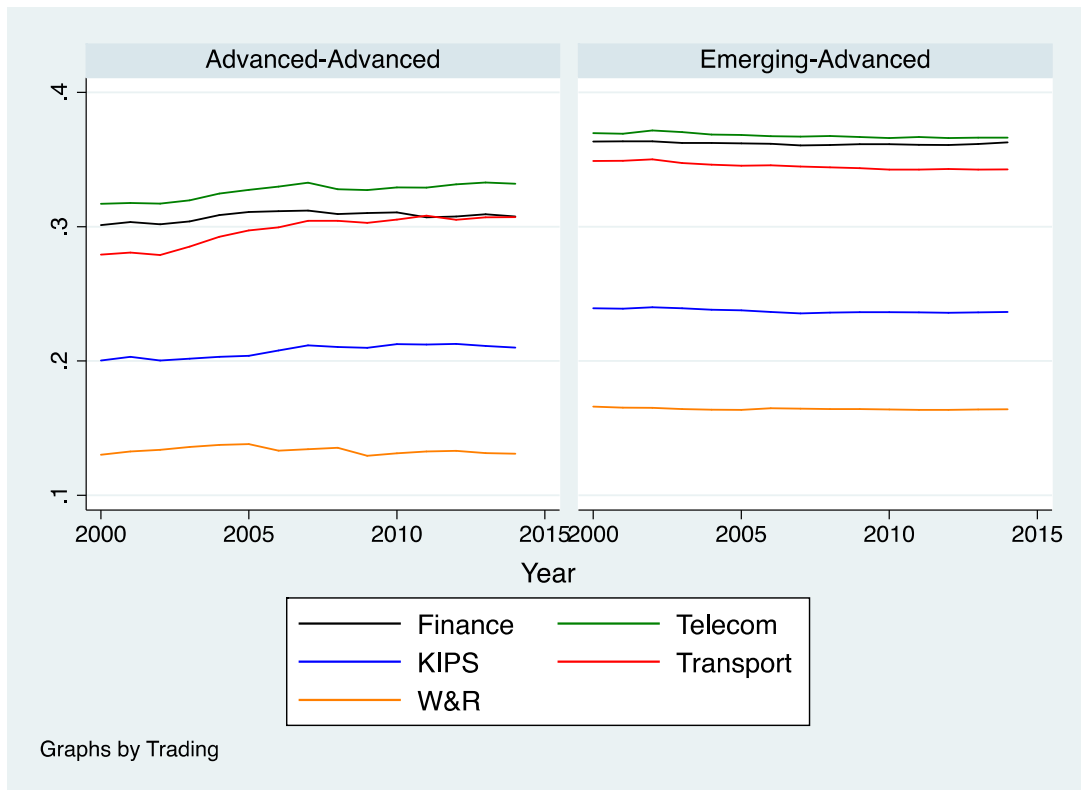
Note: PIBs in Emerging-Advanced country group is the same as Advanced-Emerging one due to the symmetry of the bilateral PIBs.

Figure 5. Average PIBs to Trade in Key Services Sectors by Country Groups
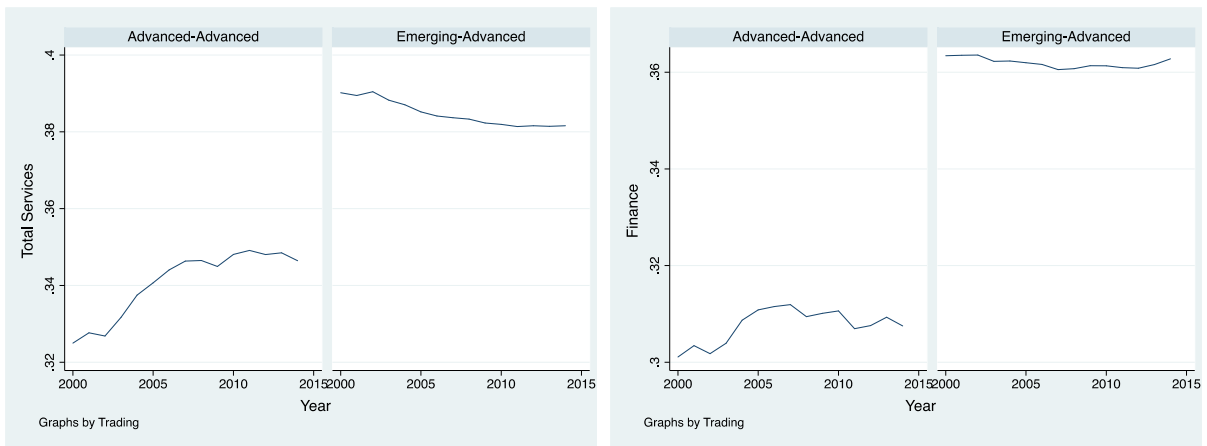
Total Services

Finance
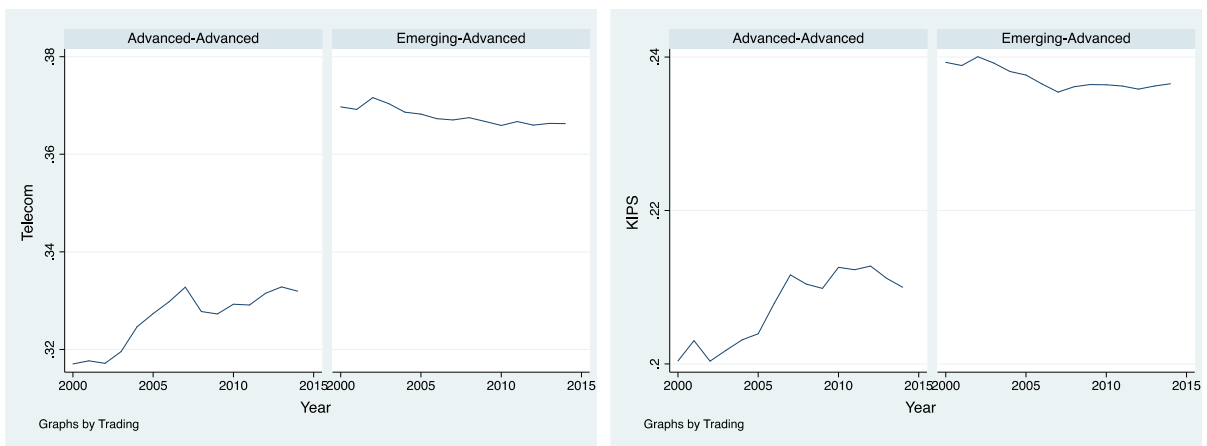
Telecom

KIPS
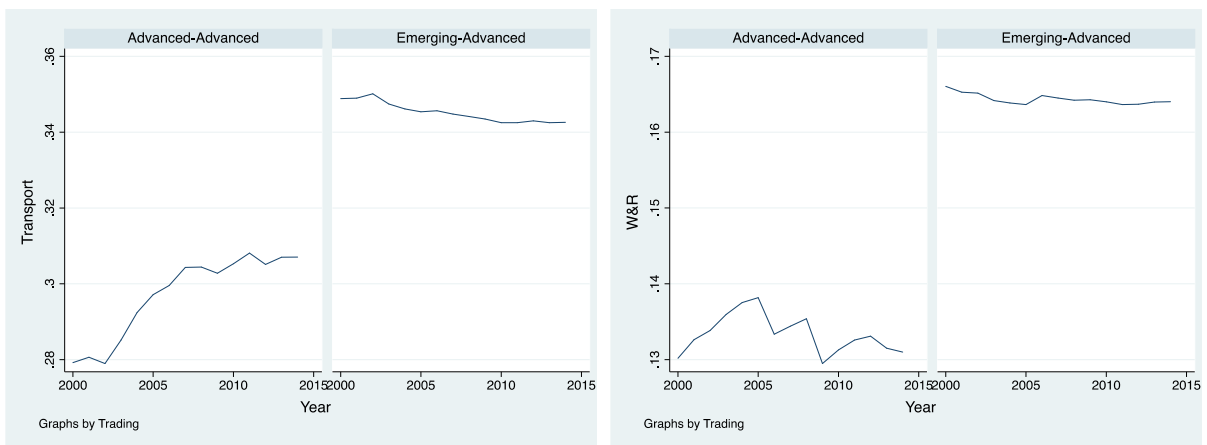
Transport

W&R

Table 1. Comparison of Coverage of Services Trade Barriers Indices

	WB STRI	OECD STRI	PIBS
Domestic regulations	✓	✓	
Discriminatory barriers against all foreign suppliers	✓	✓	✓
Country-specific barriers			✓

Table 2. Aggregation of Supply and Use at Sectoral Level

			Use									
			Intermediate						*Final*		**Total Use**	
			Agriculture		Manufacturing		Services		Final Use			
			i	j	i	j	i	j	i	j	**i**	**j**
Supply	**Services (Total)**	**i**										
		j										
	Finance	i										
		j										
	KIPS	i										
		j										
	Telecom	i										
		j										
	Transport (inc. Logis.)	i										
		j										
	Wholesale and Retail	i										
		j										

Note: On the supply side, the services sectors in this study are the aggregation of the following rows in WIOT: Services Sector in Total, 23-56; Finance, 41-43; KIPS, 40 & 45-48; Telecom, 35 & 39; Transport (incl. Logistics), 31-34; Wholesale and Retail, 28-30. The aggregation of the columns of the use side in WIOT are as follows: Intermediate Use, 1-56; Agriculture, 1-4; Manufacturing, 4-22; Services, 23-56; Final Use, 57-61; Total Use, 1-61.

Table 3. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Trade Variables				
lnx_{ijt}^{int-g}	5.144	2.433	0.000*	11.85
$lnx_{ijt}^{final-g}$	4.839	2.422	0.000*	12.29
lnx_{ijt}^{g}	5.734	2.447	0.000*	12.72
lnx_{ijt}^{s}	4.700	2.319	0.002	11.012
Gravity Variables				
Distance	4913.7	4430.8	59.62	18821
Border	0.059	0.237	0	1
Language	0.051	0.220	0	1
Colony	0.034	0.182	0	1
Same Country	0.022	0.147	0	1
Land-Locked	0.140	0.347	0	1
Currency Union	0.106	0.308	0	1
Area	1757782	3713285	316	17100000
RTA	0.519	0.500	0	1

* Minimum trade in these cases is rounded to 0 due to very small numbers as trade is denoted in millions of nominal dollars in WIOD.

Table 4. Estimation of STBs Using Cultural and Geographic Barriers

	Total	Finance	Transport	KIPS	Telecom	W&R
ln(Distance)	0.246***	0.178***	0.335***	0.320***	0.293***	0.376***
	(0.010)	(0.016)	(0.015)	(0.011)	(0.013)	(0.021)
Border	-0.090**	-0.072	0.019	-0.088*	-0.119**	-0.122
	(0.045)	(0.074)	(0.067)	(0.051)	(0.057)	(0.097)
Language	-0.285***	-0.505***	-0.374***	-0.241***	-0.155***	-0.274***
	(0.043)	(0.070)	(0.061)	(0.049)	(0.054)	(0.092)
Colony	-0.157***	-0.152*	0.027	-0.056	-0.238***	-0.032
	(0.052)	(0.087)	(0.079)	(0.060)	(0.067)	(0.112)
Same Country	0.082	0.019	0.067	0.030	0.043	0.208
	(0.066)	(0.109)	(0.095)	(0.076)	(0.084)	(0.142)
Exp Land-Locked	-0.113***	-0.299***	-0.148***	-0.090***	-0.000	-0.226***
	(0.026)	(0.043)	(0.037)	(0.030)	(0.033)	(0.056)
Imp Land-Locked	-0.113***	-0.299***	-0.147***	-0.089***	0.000	-0.225***
	(0.026)	(0.043)	(0.037)	(0.030)	(0.033)	(0.056)
Currency Union	-0.084***	-0.209***	-0.048***	-0.128***	-0.052***	-0.102***
	(0.006)	(0.009)	(0.008)	(0.008)	(0.008)	(0.013)
Observations	27,090	27,010	25,748	27,060	27,090	26,490
R$_2$	0.365	0.200	0.293	0.386	0.308	0.208

Note: Standard errors are reported in brackets. *** ** and * denotes significance at 1%, 5% and 10%, respectively. All regressions include year fixed effects. The dependent variable, $ln\tau_{ijt}^s$ is the logarithm of bilateral trade barriers in services sector s between exporting country i and importing country j in year t. The residuals obtained from these regressions are used to calculate PIBS.

Table 5. Correlations among Sectoral PIBs

	Finance	Transport	KIPS	Telecom	W&R
Finance	1				
Transport	0.62	1			
KIPS	0.52	0.63	1		
Telecom	0.60	0.65	0.67	1	
W&R	0.46	0.51	0.43	0.40	1

Table 6. Baseline PPML Estimation of Bilateral Goods Trade, 2000-2014

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PIBS (total)	-1.611***						
	(0.319)						
PIBS (finance)		-0.161					-0.087
		(0.242)					(0.221)
PIBS (KIPS)			-0.694				-0.162
			(0.468)				(0.459)
PIBS (telecom)				-0.191			0.122
				(0.124)			(0.113)
PIBS (transport)					-1.244***		-0.859***
					(0.277)		(0.291)
PIBS (W&R)						-3.386***	-3.086***
						(0.854)	(0.926)
RTA	0.028	0.025	0.024	0.026	0.031	0.034	0.039
	(0.021)	(0.025)	(0.023)	(0.025)	(0.023)	(0.029)	(0.024)
Observations	26,040	25,972	24,893	26,011	26,040	25,478	24,318
Log Likelihood	-582587	-589746	-522299	-591305	-586479	-556777	-488556

Note: Standard errors are reported in brackets. *** ** and * denotes significance at 1%, 5% and 10%, respectively. All regressions include exporter-year importer-year and exporter-importer fixed effects.

Table 7. PPML Estimation of Bilateral Goods Trade between Country Groups 2000-2014

Exporter	Advanced	Advanced	Emerging
Importer	Advanced	Emerging	Advanced
PIBS (total)	-1.050*	-1.510*	-1.790***
	(0.572)	(0.811)	(0.482)
PIBS (finance)	0.195	-1.184**	-0.430
	(0.199)	(0.471)	(0.422)
PIBS (KIPS)	-1.103*	-0.698	0.253
	(0.591)	(0.572)	(0.636)
PIBS (telecom)	-0.145	-0.552**	-0.117
	(0.186)	(0.251)	(0.287)
PIBS (transport)	-0.882*	-1.516***	-1.230**
	(0.498)	(0.557)	(0.489)
PIBS (W&R)	-4.762***	-2.448***	-2.210**
	(1.223)	(0.858)	(1.001)

Note: Standard errors are reported in brackets. *** ** and * denotes significance at 1%, 5% and 10%, respectively. All coefficients come from individual regressions. All regressions include exporter-year importer-year and exporter-importer fixed effects. Emerging-emerging country group is not reported due to degrees of freedom issues in estimation.

Table A1. Sectors in WIOD Release 2016 (NACE.Rev2)

Nr	Sector	
1	A01	Crop and animal production, hunting and related service activities
2	A02	Forestry and logging
3	A03	Fishing and aquaculture
4	B	Mining and quarrying
5	C10-C12	Manufacture of food products, beverages and tobacco products
6	C13-C15	Manufacture of textiles, wearing apparel and leather products
7	C16	Manufacture of wood and of products of wood and cork, except furniture; etc.
8	C17	Manufacture of paper and paper products
9	C18	Printing and reproduction of recorded media
10	C19	Manufacture of coke and refined petroleum products
11	C20	Manufacture of chemicals and chemical products
12	C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
13	C22	Manufacture of rubber and plastic products
14	C23	Manufacture of other non-metallic mineral products
15	C24	Manufacture of basic metals
16	C25	Manufacture of fabricated metal products, except machinery and equipment
17	C26	Manufacture of computer, electronic and optical products
18	C27	Manufacture of electrical equipment
19	C28	Manufacture of machinery and equipment n.e.c.
20	C29	Manufacture of motor vehicles, trailers and semi-trailers
21	C30	Manufacture of other transport equipment
22	C31_C32	Manufacture of furniture; other manufacturing
23	C33	Repair and installation of machinery and equipment
24	D	Electricity, gas, steam and air conditioning supply
25	E36	Water collection, treatment and supply
26	E37-E39	Sewerage; waste collection, treatment and disposal activities; materials recovery; etc.
27	F	Construction
28	G45	Wholesale and retail trade and repair of motor vehicles and motorcycles
29	G46	Wholesale trade, except of motor vehicles and motorcycles
30	G47	Retail trade, except of motor vehicles and motorcycles
31	H49	Land transport and transport via pipelines
32	H50	Water transport
33	H51	Air transport
34	H52	Warehousing and support activities for transportation
35	H53	Postal and courier activities
36	I	Accommodation and food service activities
37	J58	Publishing activities
38	J59_J60	Motion picture, video and television program production, sound recording and music publishing activities; etc.
39	J61	Telecommunications
40	J62_J63	Computer programming, consultancy and related activities; information service activities
41	K64	Financial service activities, except insurance and pension funding
42	K65	Insurance, reinsurance and pension funding, except compulsory social security
43	K66	Activities auxiliary to financial services and insurance activities
44	L	Real estate activities
45	M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities
46	M71	Architectural and engineering activities; technical testing and analysis
47	M72	Scientific research and development
48	M73	Advertising and market research
49	M74_M75	Other professional, scientific and technical activities; veterinary activities
50	N	Rental and leasing activities, Employment activities, Travel services, security and services to buildings
51	O	Public administration and defense; compulsory social security
52	P	Education
53	Q	Human health and social work activities
54	R-S	Creative, Arts, Sports, Recreation and entertainment activities and all other personal service activities
55	T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
56	U	Activities of extra-territorial organizations and bodies