Estimation of Tariffs Equivalents in Transportation Services Sector

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I. Introduction

The services sector is a crucial element of the global economy. Still, even though it constitutes a large share of the world's GDP, only a small share of all international trade flows originate from services trade. However, the importance of services in the global trade has been increasing throughout the last decades, which drew more attention of economists to this field.

Among the key challenges associated with the service sector faced by the developing countries is to find a solution that would enhance the supply side of services on the internal markets and would therefore contribute to the economic growth. The liberalization of trade in services—the removal of barriers to entry and any legislation discriminating against foreign service suppliers—is one of such likely solutions. Figure 1 presents a simple relation between the GDP per capita level, indicating the development level of a country, and the restrictiveness index. The relation suggests that progress in the liberalisation of services sectors is positively correlated with economic development of a country. Nevertheless, in many countries the need for protection of the internal market is still a strong opposing force.

There are also some concerns with regard to the possible negative effects of the liberalization of services trade. Especially in the case of some services subsectors, such as energy distribution, transportation or the telecommunications sector, which have been subject to state monopolies and led to the implementation of specific social policies, the risk of negative impact of liberalization can be most significant.

There is, therefore, a need for further research focusing on the possible impacts of progress of services trade liberalization. Despite such demand for studies in the field, rather few empirical studies on services trade policy have been done. This is due to both conceptual and empirical difficulties. Restrictions to services trade are much more difficult to assess than it is in the case of trade in goods. The intangible nature of the services makes them an object hard to analyze since it is difficult to accurately measure the services trade flows. Moreover, services trade often requires proximity between pro-

ducer and consumer of the service. Additionally, the typical trade restrictions in the services sectors do not take the form of import tariffs. The most common boundaries to services trade activity are barriers to entry—licensing, ownership requirements, legal form of the entrepreneurship (mode 3) and quotas (mode 4). Also any restrictions on operations and regulatory environment in a given country have a significant impact on business activity. Therefore, since the typical barriers to services trade are qualitative, they are difficult to quantify. Consequently, the very concept of services trade liberalization may be difficult to apprehend and present in a quantified form, enabling a comparison of countries or regions.

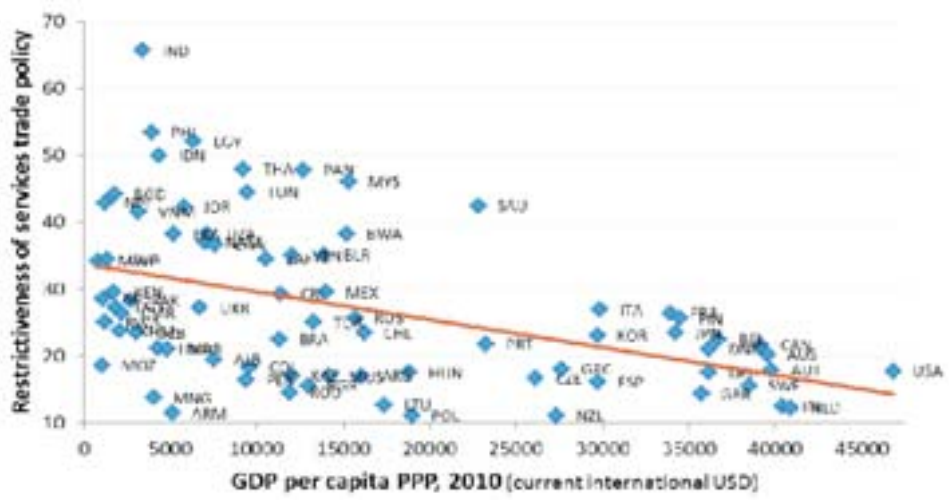

Figure 1.

Relation between the services restrictiveness level and economic development

Source: own calculations using the World Economic Outlook database and the Services Trade Restrictions database.

Yet, in order to assess the possible impacts of services liberalization, an empirical study needs to employ quantitative data on trade restrictions. The objective of this paper is therefore to measure the barriers to cross-border trade in services.

There have already been several attempts to quantify and measure the barriers to services trade. A number of different approaches were applied. Some of the studies dealing with the subject rely on questionnaires assessing the situation on the market in a particular country. Such technique has many advantages. It allows for distinction between various factors influencing the final trade restrictiveness level. One notable example of such an approach is the Services Trade Restrictiveness Index (STRI), created by the World Bank. In this case the final index is computed on the basis of information on ser-

vices trade policy supplied by 103 countries[1]. The information gathered in the project enables a comparison of qualitative and quantitative data regarding applied policies, together with annotated descriptions of the policies and a detailed documentation of policy. The main drawback of STRI is that it does not allow for observation of changes in the restrictiveness levels over time. The index is aimed at showing the most recent state of the market. Still, cross-sectional information can be biased since not all countries filled the questionnaires at the same time. Consequently, although STRI allows for comparison of applied policies and regulatory environment between countries, it does not provide information on changes in restrictions experienced by the market.

Other researchers, such as Arnold, Javorcik and Mattoo [2006], use questionnaires to assemble information on restrictiveness levels and barriers to services trade which are perceived by entrepreneurs in the market. An opportunity to learn subjective opinions about the situation in the market from the very companies that operate in it is of great value. It allows not only to explore the state of legislation but also its practical application in the market. The main drawback is the current nature of the information received. The data obtained usually refers to one year or a specific time period. No comparable data has been collected for the subsequent years. Therefore, just as STRI, such indices do not supply information on changes in the barriers to trade over time.

An alternative to obtaining restrictiveness indices on the basis of questionnaires is to compute such indices based on observable, empirical data, such as cross-country trade flows. Such approach was taken by Francois [1999] who estimated tariff equivalents of protection in two services subsectors by fitting a gravity model to bilateral trade flows in these subsectors between the United States and its trading partners. A similar approach was presented by Park [2002] who used the gravity equation to determine the tariff equivalents in seven service subsectors for a group of 51 countries. This enabled comparison of restrictiveness levels among the countries subject to the study. However, neither of the studies enables comparison of the changes to services trade barriers over time.

Kimura and Lee [2004] confirmed that the gravity model can be applied to studies on services trade flows and the outcomes are similarly reliable to those for trade flows of goods. Therefore in this paper I am also attempting to measure tariff equivalents in services sector using gravity equation. Unlike Francois [1999] and Park [2002] I introduce a time series of bilateral services trade flows. The study presented in this papers focuses on developing countries from Central and Eastern Europe. Some West European countries are also included in the analysis as a reference point. I include bilateral trade flows for 20 countries in Europe and their trading partners. This paper pro-

[1] Borchert, Gootiiz, Mattoo [2012].

vides estimates for the transportation services sector, which is solely responsible for almost a quarter of all international services flows.

This paper has been organised as follows: an overview of the transportation services sector is presented in section II. Section III introduces the theoretical gravity model to be used in the regression. The empirical issues concerning the model and the results of the study are presented in section IV. The methodology used for measuring the tariff equivalents is described in section V. And finally, section VI presents the conclusions.

II. Transportation services

The transportation services sector is an important part of the economy. The value of transportation services is a significant part of most countries' GDP. For example in Poland in the years 2004–2008 it accounted for 7.5–7.8% of GDP. A similar share of GDP is generated by this sector in many other European countries. Nevertheless, its greatest value for the economy is that it is closely correlated with other sectors of the economy. The trade of goods requires transportation of merchandises. This increases their total value and therefore affects the GDP level.

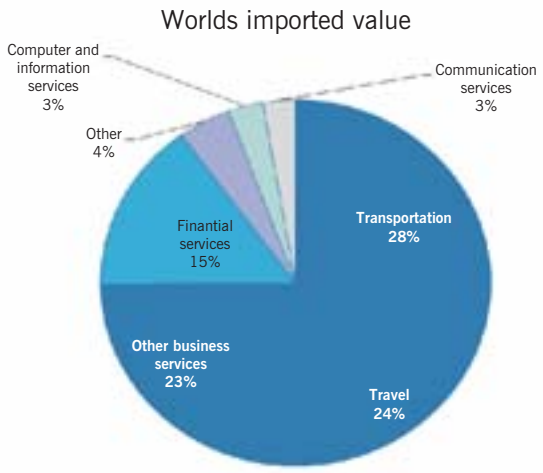

Figure 2.

The structure of international trade in services in 2010
Source: own calculations using the International Trade Map database.

Hence, transportation services facilitate other types of economic activity and stimulate economic growth. On the other hand, an acceleration of economic development intensifies demand for transport services. The strength of such a relationship depends on the structure of the economy and the na-

ture of the main drivers of its development. Additionally, in most cases there is no substitute to transportation services. In consequence transportation services are complimentary to the whole national economy, facilitating its growth and the general prosperity. The quality of the economy and its competitiveness in the international market depend on the effectiveness of the national transportation system.

Moreover, as shown in figure 2, transportation services account for over a quarter of the global value of services trade. For the reasons listed above the state of transportation services sector can be regarded as one of crucial factors influencing economic growth. Thus the liberalization of this sector can add to its competitiveness and therefore to the efficiency of the main players on the market. Therefore the knowledge of the restrictiveness level in the sector can be of high value in many economic studies, helping to design optimal policy scenarios.

Though transportation services play a crucial role in facilitating the international trade of goods, both flows—international trade of goods and transportation services—are not identical. In order to observe the value of transport service in the national trade balance the service should be provided to a foreign customer. With regard to international trade of goods, the transportation cost is often covered by the selling party. In many cases this charge either increases the final value of products sold or is a separate payment, though the consumer of the service is of the same nationality as the provider. Hence in such scenarios the value of international transportation services is omitted from the national trade balance. In order to ascribe transportation service as subject of international trade it requires the service provider to supply its services to a foreign consumer. Therefore, though both flows—trade of goods and transportation services—are naturally correlated, in terms of their values observable in the national trade balances this relation is much less direct.

III. Gravity equation

The gravity model is one of the most successful empirical trade devices. It has long been recognized that the model well describes the empirical bilateral trade patterns. The gravity equation has been applied in multiple studies on a wide range of goods and factors moving over regional or national borders. In recent decades the model has also been used to describe the bilateral trade flows. Although there are some important characteristics distinguishing the trade of goods and of services, the gravity model proved to be successful in (bilaterally) describing both. As mentioned before, Kimura and Lee [2004] focused on the issue of using the gravity model while studying services trade flows. They argue that the gravity equation for services trade is as robust as for goods trade.

Following the suppositions of the model applied by Anderson and Wincoop [2001], it is assumed that (a) products are differentiated by country of or-

igin and (b) that there are trade costs to international trade. Consequently, the gravity equation takes the following form:

$$x_{ij} = \frac{Y_i Y_j}{Y^W} \frac{\tau_{ij}^{-\sigma}}{P_j^{1-\sigma} \varphi} \tag{1}$$

The nominal bilateral services trade flow from country i to country j (x_{ij}) is related to the exporting and importing countries' GDP (Y_i and Y_j respectively). P_j is the price index in country j while, following Park [2002], φ is the exporter's price index. σ is the constant elasticity of substitution between services. The bilateral trade costs influencing the trade flow between a pair of countries is denominated as τ_{ij}. If $\sigma > 1$, then a higher trade barrier will negatively influence the volume of trade.

Anderson and Wincoop [2001] assumed the existence of symmetrical trade costs between pairs of countries. In this paper, following Park [2002], it is assumed that a country has single trade barrier imposed on all trade partners, i.e. $\tau_{ik} = \tau_k$. These trade costs, following the assumptions introduced by Bergstrand [1985] and Anderson Wincoop [2001], consist of two components, which are the bilateral distance between the two partners (d_{ij}^{ρ}) and the trade barriers ($t_j^{k_{ij}}$). Therefore the trade cost takes the form of:

$$\tau_{ij} = t_j^{k_{ij}} d_{ij}^{\rho} \tag{2}$$

where k_{ij} equals 0 if i equals j, which indicates that they are the same country in which case no additional tariff to trade is present. The trade barrier t equals 1 plus the country j's tariff equivalent.

IV. Empirical model

The empirical problem is associated with measuring the barriers to trade in services (t_{ij}), which cannot be directly observed. Following Park [2002], an indirect method of computing this term will be applied. In order to specify the significance of this term I will compare the observable, empirical trade flows with the theoretical volume that should take place under the assumption of frictionless conditions. The difference between the two values should indicate the level of existing trade barriers that causes distortion of empirical trade flows as compared to theoretical predictions.

In order to capture the trade effects specific for transportation services sector, additional variables describing this subsector are included in the econometric model. Additional binary variables describing the impact of common language and other regional characteristics influencing the propensity to trade between a pair of countries are not included in the analysis. Their impact will be assessed by the assumption of existence of fixed effects among pairs of countries. Consequently the final equation might be written as:

$$\ln x_{ij} = c + \beta_1 \ln y_i + \beta_2 \ln y_j + \beta_3 \ln d_{ij} + \beta_5 \ln Y^W + \beta_6 \ln P_j^{1-\sigma} + \\ + \beta_7 \ln \varphi + \sum_i z_i + \varepsilon_{ij} \quad (3)$$

The study uses the data on bilateral trade flows of transportation services supplied by the International Trade Centre. GDP levels and price indices are obtained from the World Bank database. From the same source come variables describing the development of the transportation services sector as a part of the national economy: the yearly rail transport tonnage and the total length of roads in the country.

Also, in order to apprehend the possible impact of volume of goods trade as a source of demand on transportation services flows between a pair of countries I added the variables describing these flows both in form of value of bilateral export flows and as an absolute value of export to all trading partners reported by each country. The time period for which the analysis was conducted is limited due to limited data availability. It is both due to constricted data on bilateral trade flows of services and due to a lack of continuous data on transport infrastructure. Consequently the sample covers only the years 2002–2008.

Table 1 presents the coefficient estimates and their significance estimated in the model. The conducted analyses assume the existence of fixed effects and additionally control for clustering of standard errors within observations for the same country (column 2).

Table 1.

Results of the regression

	(1)	(2)
GDP (exporting country)	0.481**	0.481
	(0.189)	(0.482)
GDP (importing country)	0.426***	0.426**
	(0.109)	(0.179)
CPI (importing country)	–0.0000083***	–0.0000083***
	(0.0000026)	(0.0000011)
CPI (exporting country)	–0.00807***	–0.00807***
	(0.00309)	(0.00618)
Roads, total network (exporting country)	0.434*	0.434
	(0.222)	(0.374)
Railways, goods transported (exporting country)	0.275***	0.275
	(0.0795)	(0.230)
Value of goods export (bilateral flow)	0.0843***	0.0843
	(0.0252)	(0.0598)

	(1)	(2)
Total value of exported goods (exporting country)	0.364***	0.364
	(0.140)	(0.290)
Total value of exported goods (importing country)	0.325***	0.325**
	(0.101)	(0.147)
FDI to GDP (exporting country)	0.00500***	0.00500*
	(0.00150)	(0.00255)
Constant	–34.34***	–34.34***
	(3.963)	(8.904)
Time dummies	YES	YES
Observations	4,466	4,466
Adj. R-squared	0.252	0.435

The coefficients for exporter and importer GDP levels are positive and statistically significant which means that trade volume is positively correlated with the economic size of trade partners. Additionally, the coefficients for variables describing the value of trade flows of goods are also positive and statistically significant, which confirms the hypothesis, that greater goods trade volume influences probability of transportation services to occur in countries trade balance. Also the size of road network and capacity of rail network have positive impact on international trade of transportation services. This indicates that a better infrastructure of home market can assist national service providers to expand their business activity.

V. Estimates for tariff equivalents

In order to obtain the estimates for tariff equivalents some constraints have to be imposed on equation (3). First, the sum of residuals ε_{ij} for a given importing country in a given year has to be equal to 0. Second, the sum of all residuals for a given year also has to equal 0.

Following Anderson and Wincoop [2001] and Park [2002], it can be assumed that the residual ε_{ij} is defined as the difference in log values of actual and predicted export value from country i to country j. The difference between the total predicted value of country imports and the total observed import flows are assumed to indicate the level of distortion in trade caused by the existence of trade barriers. The absolute differences should then be normalized relative to a benchmark free-trade country case, where the trade volume is least distorted. Then the relative trade barrier in the transportation services sector for a given country in a given year can be measured on the basis of the following relation:

$$-\sigma \ln t_j = \ln \frac{X_j^a}{X_j^p} - \ln \frac{X_b^a}{X_b^p} \tag{4}$$

The indices a, p and b represent the actual predicted and benchmark trade volumes. X_j^a is then the country's j observable value of imports. Countries for which the total difference between the actual and predicted value of imports is negative and has greatest absolute value are assumed to be the most restrictive. The most liberalised countries in the sample, that is countries with the greatest actual trade volumes relative to the predicted values, are Ireland and Denmark. Therefore Ireland in the year 2003 will be regarded as the benchmark country in further analysis.

In order to compute the final trade restrictiveness indices an additional assumption regarding the constant elasticity of substitution is required. Following the assumption made by Park [2002] we apply the value of 5.6 as representing the most likely consumer preferences, characteristic for most services sectors.

Table 2 presents the measured relative restrictiveness indices for the transportation services sector for a group of European countries over the years 2002–2008. One has to remember that the outcomes presented refer to relative differences in restrictiveness levels, not to the absolute values. Therefore, the fact that in this data sample Ireland in year 2003 is defined as the country with 0% restrictions to trade in the sector, indicates, that this country had the most liberalized market compared to other countries in the sample, not that there were literally no restrictions in this country.

Table 2.

Estimated tariff equivalents in transportation services sector

	2002	2003	2004	2005	2006	2007	2008
Austria	10.48%	8.83%		9.55%	9.32%	6.19%	6.92%
Belarus		9.44%	6.43%	6.32%			
Belgium	10.82%	7.23%	7.70%	7.16%	6.57%		
Croatia	23.75%	13.34%	12.79%	11.77%	7.55%	12.02%	14.25%
Czech Republic	15.42%	14.62%	10.50%	11.74%	6.16%	6.92%	7.18%
Denmark	8.58%	7.06%	6.02%				
Estonia	20.04%	10.09%	9.79%	6.42%	7.25%	6.30%	9.38%
Finland	16.26%	14.73%	9.56%	7.88%	6.24%	4.96%	5.52%
France	11.26%	8.60%	7.74%	7.72%	7.67%	6.89%	5.84%
Germany					7.71%	6.58%	7.39%
Hungary	9.39%	14.22%		12.72%	11.29%	8.16%	9.18%
Ireland		0.00%				8.99%	13.93%
Italy		8.05%		8.75%			
Latvia	18.32%	13.44%	7.58%	7.52%	10.27%	7.23%	9.45%
Lithuania	8.90%	14.24%	11.99%	11.25%	7.80%	7.57%	5.39%

	2002	2003	2004	2005	2006	2007	2008
Moldova				10.09%	7.48%	5.54%	7.00%
Poland			7.17%	7.86%	8.47%	8.16%	7.80%
Russian Federation				1.58%	8.46%	6.32%	
Slovak Republic	24.55%	75.90%	12.57%	7.96%	6.64%	7.20%	6.74%
Slovenia	9.40%	8.70%	7.35%	8.16%	7.57%	7.64%	8.58%

Analysis of the outcomes reveals that in general the Western European countries are more liberalized in terms of the transportation sector than countries from Central and Eastern Europe.

Table 3 lists the outcomes obtained in the presented analysis for year 2003 together with the corresponding restrictiveness indices computed by Park [2002] and by OECD (the STRI). Unfortunately, there is no precise information regarding the year for which the STRI was computed. The comparison of the indices shown in the table may indicate that the approach to the issue of measuring the restrictiveness indices which was presented in this paper is reliable. The relative differences in restrictiveness levels obtained in this paper correspond with the STRI levels. As mentioned before, STRI is based on analysis of the legal environment in a country and therefore is regarded to be the most objective. Its main disadvantage is lack of time dimension. The development of a method enabling to compute indices comparable not only among countries but also over time for which the outcome (such as the relative differences in restrictiveness levels in a given year) would be consistent with the relations identified by STRI, could be most beneficial for further studies on the subject of services trade liberalisation.

Table 3.

Comparison of transportation services sector restrictiveness indices measured in different studies

	Park [1997]	STRI	Indices computed for year 2003
Ireland	12.34%	17.6	0.00%
Denmark	4.32%	17.6	7.06%
Belgium	9.13%	31.8	7.23%
Italy	13.02%	32.8	8.05%
France	15.04%	43.9	8.60%
Slovenia	.	.	8.70%
Austria	7.28%	31.6	8.83%
Belarus	.	36.8	9.44%
Estonia	.	.	10.09%
Croatia	.	.	13.34%

	Park [1997]	STRI	Indices computed for year 2003
Latvia	.	.	13.44%
Hungary	13.88%	45.2	14.22%
Lithuania	.	22.1	14.24%
Czech Republic	.	26.8	14.62%
Finland	15.14%	23.5	14.73%
Singapore	0.00%	.	.

The indices levels obtained by Park [2002] differ from the ones presented in this paper. The reason for such a situation may be the different choice of country group in the sample. Both studies, the one presented in this paper and the one presented by Park [2002], include similar assumptions in terms of applying the gravity model to measuring the restrictiveness level. Also, the estimates presented by Park [2002] were computed with regard to year 1997, that is five years before the first observation included in the data sample used in the analysis presented in this paper.

VI. Conclusions

The subject of trade barriers in the services sectors is one of a complex nature. The restrictions in services are of qualitative nature, which makes it hard to conduct empirical research on the matter of possible impacts of progressing liberalisation. Therefore, it is crucial to develop methods enabling the creation of indices describing the likely level of restrictions in a given services sector. Additionally, since many studies assume panel data analysis, there is a need for such restrictiveness indices presented in the form of a time series.

In order to fulfil the aforesaid need, the study presented in this paper aims at creating restrictiveness indices comparable both among countries and over time. The approach presented in this paper allows for the conduction of the same or similar analysis for different groups of countries, which makes it a more flexible tool than most of the currently available approaches by enabling econometric apprehension of changes in relative trade barriers.

It has to be noted that the outcomes obtained in this paper rely heavily on the model and data sample used. Due to imperfect data on transport infrastructure and other factors affecting possible trade flows, the final results presented in this paper do not compile a complete time series. Nevertheless, the outcomes tend to be consistent with the restrictiveness levels defined by other studies, mainly by the STRI levels. This may indicate that an approach aiming at measuring such indices on the basis of observable bilateral trade flows can be successfully employed in further studies.

The model presented above is a preliminary attempt to construct such indices. Much is to be done in this aspect in order to improve the results. Still, it is hoped, that despite the obvious limitations, the results presented in this

paper will contribute to further studies on international services trade liberalisation.

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Abstract **Estimation of Tariffs Equivalents in Transportation Services Sector**

In this study I am focusing on the definition of tariff equivalents in the services sector. The contemporary solutions to the problem of quantifying the qualitative attributes of services trade are often limited to a single country or are difficult to reproduce. Basing my work on the solution introduced by Park [2002] I will present an empirical study aiming at quantifying the restrictions to international trade of services in a way that enables comparison of outcomes between countries and observation of changes in the restrictiveness level over time. The analysis assumes that restrictiveness level is responsible for the distortions of the empirical trade flows from theoretical expectations. The outcome is a time series of indices describing the restrictiveness level which can be used in further studies using panel data analysis. In this study I will present the indices obtained for the transport services sector.

Key words: tariff equivalents in services, gravity equation

JEL Classification: F13