Direction of Serbian Trade: Gravity Model Based on Pool Data

Vladimir Ristanovic[1], Dusan Cogoljevic[2], Sinisa Barjaktarevic[3]

Abstract: The objective of this paper is to evaluate the effects of bilateral trade between Serbia and EU countries in the period 2001-2015 on the basis of a gravity model. So far in research papers the gravity model has been used for the evaluation of effects of trade among different countries. The gravity model, which combines the cross-section data and the time-series data, has been estimated to the panel data. Estimated results based on a sample of 28 countries reveal that the economic size of foreign countries, the market size of trading partners (the number of inhabitants), and the geographical distance produce altogether huge effects on Serbia's total trade and exports. Border and language factors have also been taken into account. The research leaves room for further scientific analyses and provides guidance for trade policy creators in analyses for directions of the Serbian trade. This research is based on complex econometric analyses and a recognised model, and shows that there is considerable room for the growth of bilateral trade between Serbia and EU.

Keywords: international trade; panel model; Serbia; EU

JEL Classification: F14; F15

1 Introduction

From the outset of the new millennium Serbia began to alter its trade policy by gradually liberalising prices and exchange rates, as well as by reforming the tax and finance systems. It was a common path that all other transition economies in the Central and Eastern Europe also took, namely the path of transformation from a centrally planned to a market economy. Rapid liberalisation of prices, the fixed exchange rate (the overvalued national currency), and increased domestic salaries led to a high trade deficit. Therefore, the most important objective was to push up international trade activities. Domestic companies had a chance to promote their cooperation with foreign partners and improve their export performance. By encouraging growth of the private economic sector, Serbian economy managed to grow over the last decade. Undertaken reforms contributed to the growth of the total trade of Serbia but, unexpectedly, to a rapid increase in imports[4] and a high level of trade deficit as well.

European countries have always been Serbia's major trading partners. Every year Serbia realises more than 80% of its total trade with European countries. This does not come as a surprise given the geographical position and available resources of Serbia, as well as its trading needs. This paper applies the gravity model to the analysis of bilateral trade between Serbia and EU countries over a fifteen-year

[1] Associate Professor, Faculty of Business Economics and Entrepreneurship, Belgrade, Serbia.
[2] Assistant Professor, Faculty of Business Economics and Entrepreneurship, Belgrade, Serbia.
[3] MA, Public Policy Secretariat, Republic of Serbia.
[4] The biggest problem for the Serbian tradable goods sector stems from the Serbian imported products being more expensive than Serbian exported products. In other words, Serbian imports are much higher than Serbian exports.

period, from 2001 to 2015. The idea underlying the paper is to investigate major factors that affect the level of trade between Serbia and the EU, and to detect room for more trade.

Such a cooperation between countries is accounted for by comparative advantages of each country and the potential for the growth of trade. As a general rule, countries have the highest volume of trade with neighbouring countries. Under such circumstances, advantages of each country sometimes render less relevant while the countries whose neighbour is strong and rich are in the most favourable position. What is the reason behind redirecting trade to richer and larger countries? The answer is that these countries have a wider market, a stronger economic activity, and more robust trade. There is a strong empirical relationship between the size of a country's economy and its total trade and exports.

In the reference books the gravity model is used to explain the bilateral trade between countries. The gravity model estimated in this paper is based on the pool data, with random and fixed effects. There is a myriad of research papers explaining the effects of the gross domestic product (GDP), population, and the distance on the trading between countries, such as the work of Montanari (2005) and Braha et al. (2015) on the Balkans. These two papers explain in general how the trade of the EU with Western Balkans countries shows considerable room for growth of trade itself and for the general economic activity as well. The first one investigates imports, exports, and the trade policy. The last one suggests that exports are positively affected by GDP but that they go down as the distance between trading partners increases.

In this paper we use the gravity model based on the panel data to evaluate the impact of specific factors on Serbia's international trade activities. Panel data take into account both the country and the time effects simultaneously. The panel estimation reveals several advantages over cross-section data (N) and time series data (T) as it offers more variability and a higher degree of freedom, and reduces collinearity among explanatory variables. The combination of the cross section data (N) and the time series data (T) increases the size of the sample (the NT panel data). This helps us to analyse both the structure of trade and changes in trade over time. We will be using data on EU countries between 2001 and 2015 obtained from the Statistical Office of the Republic of Serbia, the Eurostat, and the Trade statistics for international business development. Estimated results of the study prove the relationship between the economic size, the market size, and the distance on the one side, and the bilateral trade flows on the other.

The paper is structured as follows: the overview of Serbian foreign trade is given in the Section 2; Section 3 relies on the reference books on the gravity model as the theoretical basis for the study and the research; Section 4 presents the methodology used and the application of empirical results; the final section concludes the paper.

2 Overview of the Gravity Model of International Trade

Smith's theory of absolute advantage says that a country has an advantage over its neighbour when it can produce goods more efficiently using the same amount of time. The difference in resources possessed tends to create an absolute advantage for all countries that have an abundance of resources. But some countries simply cannot be best at anything. At the same time their resources are limited. This has led to Ricardo's theory of comparative advantage which explains that nations should specialise in producing goods at lowest opportunity costs (all that you have to give up in order to make a choice). According to the classical theory, countries that are less similar tend to trade more, but this theory fails to explain how intra-industrial trade works out. The Heckscher-Ohlin (H-O) model envisages that the trade will be exclusively inter-industrial while the new theory model states that trade is intra-industrial. This is of utmost importance for developed countries like those in the EU where most of the trading is done within the same sector. New international trade theories explain the world trade through the economies of scale, imperfect competition, and product (and export) differentiation (Krugman, Obstfeld, Melitz 2012, pp. 137). Consequently, the volume of international trade among industrialised countries is likely to be determined mainly by the extent of product specialisation and factor proportions differences.

In a globalised world of today, for small open economies characterised by several productive factors, a few sectors, and imperfect competitiveness the achieving of external economies of scale (EES) is of critical importance. A portion of the increase in trade reflects the fragmentation of manufacturing across borders as individual production stages are located in places where the costs of production are lowest (Baldwin, 2011).

According to Subramanian and Kessler's estimates (Subramanian and Kessler, 2013), the world is now in its fourth era called hyperglobalisation during which the world trade has soared much more rapidly than the global GDP. Over the last two decades merchandise exports-to-GDP ratios soared from 15% to 26%, and goods and services exports to about 33%. Such a rapid increase is not that surprising given that transport costs have declined as well as the costs of information and communication (that decreased significantly).

3 Serbian External Trade

Almost the whole of its foreign trade Serbia realises with European countries. Specifically, Serbia trades with the EU (under a multilateral agreement), neighbouring countries, Turkey, the United States (GSP), and the Russian Federation. Serbia has signed trade agreements with all its trading partners, and they all differ. With the EU Serbia has signed the SAA, and with neighbouring, former Yugoslav countries Serbia makes up the CEFTA. With Russia there is a preferential trade agreement in place (the Customs Union composed of the Russian Federation, Belarus and Kazakhstan). In this paper we will concentrate only on trade with the EU. Our goal is to investigate only the bilateral trade between Serbia and twenty-eight EU countries[1].

Owing to a stronger cooperation with the EU, Serbia has an excellent opportunity to prosper economically. Over the last 15 years many contracts with EU and neighbouring countries have been signed and the total value of Serbia's international trade has increased. Figure 1 presents the values of trade between Serbia and a group of countries, from 2001 to 2015.

[1] The EU countries are: Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the UK.

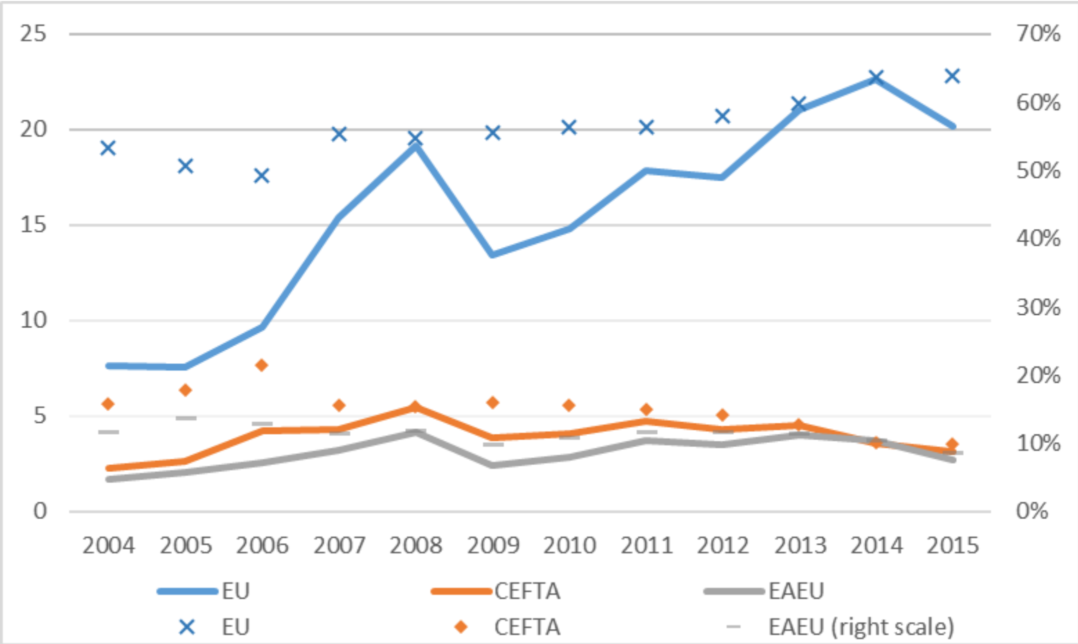

Figure 1. Trade values between Serbia and regions from 2001 to 2015

Source: Authors calculation according the Statistical Office of the Republic of Serbia

As can be seen, Serbia was fulfilled more than 80% of the total external trade with these three groups of countries during the reporting period. The largest volume of trade Serbia realize with EU countries, over 50%. The volume of trade with CEFTA countries was changing from year to year. In 2007 there was a decline because Romania and Bulgaria became EU members, while 2013, when Croatia associated to the EU, recorded a slight decrease. Hence, during the period, the volume of trade with EU countries was increasing while with CEFTA countries was decreasing.

The biggest problem for Serbia is that its main trading partners did not change significantly during this period. Apart from Russia, Germany, and Italy, Serbia is largely concentrated on the Balkan countries. With the Balkan (CEFTA) countries Serbia has a trade surplus owing to the export of agricultural products, iron, and steel. The surplus helps to diminish the deficit with EU countries. Exports could even be higher if the current level of trade was not much lower than its potential.

As in other transition countries, with the opening of the economy the level of Serbia’s external trade with EU countries rose in relation to other countries, especially neighbouring ones. In economy this is called the trade direction, and together with the trade creation it presents one of the two most important effects of a free trade agreement (FTA). In the case of Serbia the situation is slightly different. Namely, many countries included in the CEFTA agreement are former Yugoslav republics and Serbia is linked with them in economic and political fields. Having said that, the level of the total trade between Serbia and other CEFTA countries could be much higher.

4 Data and Methodology

Data for each variable in the model are collected from the same source for the entire analysed period. The difference in sources exists only between variables. In the next table we will define the variables used in the model and specify their sources.

Table 1. Variable definitions

Variable	Definition	Data sources
tt	Total trade in current US dollars	Statistical Office of the Republic of Serbia, Eurostat and Trade statistics for international business development
GDP	Exporting countries' gross domestic product in current US dollars	Eurostat and Trade statistics for international business development
GDP*	Importing countries' gross domestic product in current US dollars	Eurostat and Trade statistics for international business development
POP	Population of exporting countries in millions	Annual statistics of the World Bank
POP*	Population of importing countries in millions	Annual statistics of the World Bank
distance	The distance in kilometres (expressed in the distance between each country's capital)	CEPII
border	A dummy variable that takes the value 1 if countries i and j share the border, 0 otherwise	
language	A dummy variable that takes the value 1 if countries i and j share the common official language, 0 otherwise	

Gross domestic product is used as a measure of the economic size. Countries with a higher (lower) income tend to trade more (less). This means that the bigger the country is, the higher the exchange of goods and trade overall will be. In fact, the size of an economy is directly related to the volume of imports and exports. The population is used to estimate the market size. The larger the market, the greater is the trade. The geographical distance is included in the model as an explanatory variable and represents transportation costs in international trade. It is also a proxy for transportation costs. We have also included some control variables which reflect individual characteristics of countries including borders and the language.

The estimations will be done through the Random and Fixed Effects Model. The results of the Hausman test will show us which method is better, the one with fixed or the one with random effects. This actually depends on the treatment of effects from the model – do we treat them as random or as fixed effects? The total number of observations is 420 panel observations [N= 28; T=15]. All the evaluations have been carried out using the statistical software Stata S / E, Version 13.0.

Starting from the theoretical approach of the gravity model, the following hypothesis will be proved:

Hypothesis 1: There is a positive effect of the economic size and the population (the market size) on the total trade (exports).

Hypothesis 2: There is a negative effect of the distance on the total trade (exports).

Hypothesis 3: There is a positive effect of the border and the language on the total trade (exports).

4.1. Gravity Model

The whole story of the gravity model is based on the Newton's Law of Gravitation. The Law describes the gravity force between two bodies. It states that the force is positively correlated with their masses and negatively correlated with their distance. The same notion is adopted in economy and this model has been used successfully in economic research and predictions in the past.

The gravity model of international trade has been widely used as a baseline model. Since early 1940s the gravity model has been applied to a wide variety of goods and production factors moving across the regional and the national boundaries under differing circumstances (Martinez-Zaroso & Nowak-Lehmann, 2003, pp. 3). Mrs Ilic (2012) remarks that the gravity model has been used in international trade since 1960s and emphasises that Tinbergen and Lineman were among the first who applied this model but that Anderson and Bergatrand were the first to improve the model. One of the Anderson's hypothesis refers to the 'identical preferences across regions, i.e. identical Cobb-Douglas preferences which together with the availability of constant prices at the equilibrium value leads to perfect specialisation when only one product is produced in a country (in compliance with Keynesian trade model)' (p. 18). More recently Deardorff has proven that the gravity equation characterises many models and can be justified through standard trade theories. According to these and other authors, multilateral trade resistance factors should be added in the empirical estimation to correctly estimate the theoretical gravity model (Martínez-Zarzoso and Horsewood, 2005, p. 6). However, the greatest interest in this model appeared only in the 1990s when the majority of Eastern European countries shifted to the market economy. The model is then primarily used for evaluating the potential of trade between Western European countries and the countries in transition in Central and Eastern Europe (CEE). In these research papers (Hamilton and Winters and others), the assessment of opportunities for increasing the trade between the two groups of countries was conducted on the basis of the analysis of gravity model residuals, i.e. based on the relationship between the estimated potential and the actual level of trade (Dragutinovic-Mitrovic, 2005, p. 78).

There has been a lot of research into international trade activities of different countries so far using the gravity model. All of them use the total trade or exports (imports) of those countries as dependent variables, and GDP, GDP per capita, population, distance, language, border, area, exchange rates, culture, and remoteness as independent variables over various periods of time. Almost all of them show the positive effects of GDP, population (market size), border, area, and the exchange rate (real depreciation/devaluation), and the negative effects of distance, but no effects of history.

We have decided to illustrate the gravity model based on the panel data in order to avoid the wrong specification of the gravity model using only the cross-section data. More specifically, in most empirical research papers and studies the gravity model is evaluated on the basis of the cross-section data. As Dragutinovic-Mitrovic (2005) emphasised, 'it is a newer approach that allows the analysis of the regional structure of foreign trade, as well as the analysis of changes in the structure that occur over time. In addition, a greater degree of variability in the panel data in relation to the time series and cross-section data provides the basis for a precise evaluation of regression model parameters.' (p. 78)

In this section we will explain the simplest form of the gravity model in economy describing the bilateral trade between countries, and stating that the trade is positively correlated with the size of economy (GDP) and the market size (population) but negatively correlated with the distance between them. This means that we will have three main variables: GDP, population, and distance.

Equation 1 The basic form of the gravity panel model:

$$X_{ijt} = \beta_0 Y_{it}{}^{\beta_1} Y_{jt}{}^{\beta_2} POP_{it}{}^{\beta_3} POP_{jt}{}^{\beta_4} DIST_{ij}{}^{\beta_5} F_{ij}{}^{\beta_6} u_{ij}$$

where X_{ijt} indicates exports (the total trade) of country *i* in country *j* in year *t*; Y_i (Y_j) indicates the GDP of the exporter (importer); POP_i (POP_j) is the exporter (importer) population; $DIST_{ij}$ measures the distance between the two countries' capitals; F_{ij} represents any other factors (variables), e.g. this dummy could show whether countries belong to the regional integration or not, and takes the value 1 if they do and 0 if they do not. Finally, u_{ij} is the error term of the model, which consists of individual effects, time effects, and the error. The model implies that the variation per unit of observation and time are covered by the random error across its components. At the same time, regression parameters with the explanatory variables are constant.

As a rule, panel data contain a large number of observation units and relatively short time series, while the time effects in the model of the panel are usually taken as fixed. On the other hand, individual effects (fixed or stochastic) are specifically tested with the Hausman test. The results of this test illustrate consequences of the choice between the model of fixed and the model of stochastic effects – the difference between estimates of the regression parameters of the two models is not statistically significant; if the specification of the Random Effects Model is correct, then Random effect provides a more efficient estimates.

Taking the natural logarithm, the equation will show the linear relationship between two explanatory variables X_{1t} (GDP) and X_2 (distance).

Equation 2 Linear regression

$$Y_{it} = \beta + \beta_1 X_{1t} + \beta_2 X_2 + \varepsilon_{it}$$

where Y is a dependent variable and X_1 and X_2 are independent variables; i = 1, 2, …, N (cross-sections); t = 1, 2, …, T (time series).

In this gravity panel model we have two different groups of variables. The first group includes variables whose values vary by countries and over time. The second group of variables refers to the variables whose values vary by countries but are constant in time (time-invariant variables).

Equation 3 Regression equation of the gravity model including main explanatory variables

$$X_{ijt} = \beta_0 + \beta_1 Y_{it} + \beta_2 Y_{jt} + \beta_3 POP_{it} + \beta_4 POP_{jt} + \beta_5 DIST_{ij} + \varepsilon_{it}$$

where:

X_{ijt} are the total trade (exports) from country *i* to country *j* in the period *t*.

Y_{it}, Y_{jt} indicate the GDP of countries *i* and *j* respectively, in the period *t*.

POP_{it}, POP_{jt} denote the population of countries *i* and *j* respectively, in the period *t*.

$DIST_{ij}$ is the great circle distance between countries *i* and *j*.

The combining of the cross-section data (N) with the time series data (T) increases the size of the sample (NT panel data), while a limited number of observations increases the efficiency of estimation of the regression parameters. By including variations that occurred during such a long period, the model can measure additional effects of the variables that are not detectable, i.e. do not constitute a part of the initial model (time-invariant variables).

The Gravity model will be broadened with other explanatory variables or dummies such as GDP per capita, common border, common language, signed agreements, etc.

$$X_{ijt} = \beta_0 + \beta_1 Y_{it} + \beta_2 Y_{jt} + \beta_3 POP_{it} + \beta_4 POP_{jt} + \beta_5 DIST_{ij} + \beta_6 bord_{ij} + \beta_5 lang_{ij} + \varepsilon_{it} \quad (4)$$

where:

$bord_{ij}$ denotes a common border between countries *i* and *j*,

$lang_{ij}$ denotes a common border between countries *i* and *j*.

A high level of income in the exporting or the importing country indicates a high level of production and higher imports. Therefore we expect β_1 and β_2 to be positive. The coefficients of population (β_3 and β_4) have a twofold sign (positive or negative), depending on the absorption effect (whether a country exports less when it is big) or the economy of scale (whether a big country exports more than a small country). Another factor that may affect the population is the composition effect that influences the demand and the supply. The coefficient of distance (β_5) is expected to be negatively marked since the longer the distance between two countries, the higher the costs of trade. In addition, our model includes dummy variables (D_{ij}) for trading partners that share a common border ($bord_{ij}$) and a common language ($lang_{ij}$). In the table 2 we show descriptive statistics for all the variables.

Table 2. Descriptive statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
total trade	420	793.3653	1843.876	0.445	12186.97
export	420	265.9814	843.376	0.08	7908.49
GDP1	420	26889.14	6939.771	12820.9	34262.9
GDP2	420	440993.3	680938.9	4541.1	3025900
POP1	420	7333236	130543.2	7130576	7503433
POP2	420	1.78E+07	2.26E+07	393028	8.25E+07
distance	420	1534.393	825.6194	389	3283
border	420	0.076191	0.265619	0	1
language	420	0.004762	0.068924	0	1

We also include some control variables which reflect individual effects, i.e. characteristics of countries such as culture or signed agreements. If there are no individual effects, the pooled model will be the best choice. However, if individual effects are there and they must be reflected in the model, then the Fixed Effects Model and the Random Effects Model will be the preferred models. According to Gujarati (2003), the Fixed Effects Model will be chosen in this case if there is a correlation between individual effects and explanatory variables. By including fixed effects in the gravity model we were able to omit the time invariant variables like the distance, the border or the language. But if the individual effects (of the entities) are random and not correlated with explanatory variables, the Random Effects Model will be more effective. In this way the Random Effects Model considers the residuals of each entity uncorrelated with explanatory variables using them as new explanatory variables and giving us the opportunity to estimate the invariant factors such as gender, border, distance, etc.

We will estimate the bilateral trade of 28 countries (Serbia and 28 trading EU partners) over the period 2001-2015. In this segment we will explain the gravity model estimation using the Ordinary Least Squares (OLS) method to calculate the single country equation as well as the Fixed and Random Effect using the panel data for the mentioned period. Our data set is a strongly balanced panel with 420 observations.

The trade equation will be estimated through two models (Random Effect and Fixed Effect), followed by the Hausman test that will be applied in order to select the most appropriate model for interpreting the estimated results. The variables which do not change over time (distance, border, language) cannot be estimated with the Fixed Effect model. The Hausman test gives us better results so we have decided to use the pooled model with the Random Effects model for estimation. With the Random Effect model we will be able to estimate these invariant variables (Binh, 2012). In fact, we should be dealing with unobserved heterogeneous individual effects and their correlation with regressors (time variant and time invariant) to avoid any potential biases.

5 Estimation Results

The value of F-statistics shows that the model is correct. We used the F-test to see whether all the coefficients in the model are different from zero. At the same time, we obtained high values of the R-square, which shows the amount of variance of Y (a dependant variable) explained by X (an independent variable) with a high degree. We have also calculated the Breusch and Pagan Lagrangian multiplier test for random effects. The result suggests that the hypothesis ‘individual effects from entities do not exist’ is to be rejected[1], which then indicates that the pool mode is of low effectiveness (Chi-square = 1103.97; Prob = 0.0000). Thus, we have decided to select pooled models and in the interpretation to focus on the estimation results obtained from these models. In the Random Effects Model differences across units are uncorrelated with regressors. Contrary to this, in the Fixed Effects Model the correlation between the errors and the regressors does exist.

As mentioned above, the Hausman test is performed to compare the fixed and random effects estimators. The null hypothesis states that the preferred model is the random effects model vs. the alternative model which is based on the fixed effects. The statistical result takes a value (Chi-square = 2.73; Prob = 0.8415), which is an overcritical value with a degree of freedom (over 0.05). This suggests that the random effects model is a better choice than the fixed effects model. It means that

[1] Null Hypothesis: There is no significant difference across units

our analytical efforts will be focused on the random effects model. We do some diagnostic tests to relax the assumption of the Random Effect Model (see Appendix).

Table 3 shows the results of regression estimations of the Gravity model with OLS models and the fixed and random effects. We use the equitation (4) as explained above. Table 3 presents estimated coefficients for the whole period from 2001 to 2015. The pooled OLS model gives us an effective estimation but estimation results will be biased due to neglected individual heterogeneity. The Fixed Effect Model does not allow for the estimating of coefficients against time invariant variables (distance, language). The Random Effect Model takes into account the heterogeneity of all explanatory variables, giving us the opportunity to estimate the parameters on both time-variant and time-invariant variables, simultaneously.

Table 3. Estimation results

Dependant variable: tt

Variables	*Model OLS*	*Model RE*	*Model FE*
gdp1	0.5767142**	0.5838173***	0.5178489***
gdp2	0.9885124***	0.9302415***	1.014912***
pop1	-7.303024*	-7.830015***	-7.157964***
pop2	-0.0092523	0.0713453	1.170637
dis	-2.106161***	-2.054325***	0
border	-0.0603483	0.0260544	0.092593
language	0.7750987	0.1817252	0.1414991
_cons	118.169*	125.573***	82.45119*
obs	420	420	420
R^2	86.29	90.00	55.64

Note: ***; **; * are statistically significant at 1%; 5%; 10% levels

Table 4 shows that GDP (income) remains fairly constant during the period of analysis. The estimated coefficient has nearly all the expected signs, except for the border and the population in the domestic country (in Serbia). The population has a negative sign for two reasons: (1) a small and poor Serbian market, and (2) it is less self-sufficient. In all the models estimations of the language and the border are insignificant and have no effects on bilateral trade between Serbia and EU-28. The estimation of the Fixed Effect Model may be biased because individual effects in the pooled model were ignored. So we will concentrate on the estimations of the Random Effects Model.

Economic size variables measured by GDP yield results that are significantly positive related to the total trade in Serbian economy. A 1% increase of Serbian GDP will push the bilateral trade up by 0.58%. At the same time, the importing country's GDP has more significant and stronger effects on the total trade, and an increase of 1% will increase Serbian total trade by 0.93%. This shows that the Serbian trade depends more on the elasticity of demand of foreign countries than on domestic demand. The impact of foreign GDP, however, is lower because the demand growth has been more intensively driven by domestic factors in recent years. The impact is also reduced due to a lower elasticity of demand for the product range of countries from the Balkans, including Serbia. This reflects the fact that the intra-industry trade constitutes the main segment of the total EU trade (over 70%).

The market size, as measured by the population variables, produces expected results. The population of the exporting country (Serbia) has a significant negative impact on the total trade. This is due to increasing purchases of imported goods and the rise of salaries denoted in the national currency during the period of the *de facto* fixed exchange rate regime. The import of consumer goods rose dramatically (a positive absorption effect) during the first years of the transition period. This is the period when Serbia, as a small country, tends to be more open than large economies. There is also a negative sign of the exporter's population, i.e. the Serbian economy exists due to an increasing influence of exported capital-intensive goods (especially since 2010). On the other side, the impact of the importer's population is also significant but too low, which has led us to the conclusion that exports to EU countries include mostly luxury and expensive goods. A positive effect of the importer's population indicates that large countries import more than small ones.

The estimated coefficient of the geographical distance is statistically significant, as high as 1%, and anticipates a negative influence on the total trade, which is in line with expectations considered during the construction of the model. With an increase of 1%, the total trade value will decrease by 2.1%.

The border and language variables turn out to have an expected sign but both are insignificant. The reason for such results may lie in the fact that the neighbouring countries have become members of the EU recently and there are no language barriers between them. Another reason is that EU countries were more closed during the financial crisis. In addition, Serbia realises more voluminous trade with EU countries that are farther (Germany, Italy and others) than with its immediate neighbouring EU member states (Romania, Bulgaria, Hungary, and Croatia).

Results estimated through this model are similar to those obtained in some earlier studies of the application of the gravity model to the evaluation of the bilateral trade. The economic and the market size play a major role in bilateral trade, confirming the hypothesis 1. The geographical distance, however, displayed negative effects on the bilateral trade between Serbia and the external trade partner from the EU, thus supporting the hypothesis 2. In addition, the border and the language also show positive effects on the bilateral trade, thus proving the last hypothesis.

Estimated results show that Serbia traded more with the already mentioned countries from the EU during the selected period such as Germany and Italy. The main reason for this lies in the structure of Serbian exports, which has not changed (or has changed only a little) in recent years. Namely, most of the Serbian exports are made up of labour-intensive products, while imports predominantly include capital-intensive products. Since exports are far more sensitive to market changes, the pressure on the trade deficit becomes stronger.

Results obtained after the regression show that the total trade (or the value of exports) of (from) Serbia increases in parallel with the rise of GDP in foreign countries. Conversely, the distance negatively affects the total trade (the exporting value).

6 Conclusion

In this paper we specify and estimate factors which affect the bilateral trade between Serbia and EU countries. The gravity pooled model is used as an ingenious approach to examining multilateral trade flows. We talk about a tractable model that yields gravity-type equations for international trade flows. It includes data from 28 countries covering the period from 2001 to 2015. Empirical results clearly demonstrate that the total trade (exports) is affected by the economic size, the population as a measure of the market size, and the geographical distance but not by the border and the language in the case of Serbia.

The model shows that Serbia has not thoroughly exploited all the trade capacities in trading with EU countries, and that Serbia's trade with EU countries displays considerable room for growth. The best way for Serbia to boost trade with EU countries is to change the structure of exports. A significant portion of such a trade strategy can be related to the total investments (domestic and foreign) and imports needed as inputs for export production.

The relationship between technologically intensive products and a faster economic growth or sustainable growth shows that shifting resources from less to more technologically intensive production activities (the transformation from labour-intensive goods to capital-intensive goods) will lead to a sustainable economic growth. This means that openness could have positive effects on the economic performance. In other words, structural characteristics of production, production specialisation, and export diversification prove to be of crucial importance for economic growth and development. The higher the diversification of export, the faster the economic growth. It provides more benefits for less developed countries and helps improve the economic performance (Krugman, Obstfeld, Melitz 2012, pp. 17).

Estimated results are interesting and we can say that they are expected. The findings of this paper may be of great help for policy makers in improving trade relations between Serbia and EU countries in the following period.

7 Appendix

Table A1. Correlation in the dataset

	tt	*gdp1*	*gdp2*	*pop1*	*pop2*	*dis*	*border*	*language*
tt	1							
gdp1	0.2352*	1						
	0							
gdp2	0.6683*	0.1135*	1					
	0	0.02						
pop1	-0.2257*	-0.8440*	-0.1042*	1				
	0	0	0.0328					
pop2	0.7070*	0.0071	0.8896*	-0.0073	1			
	0	0.8845	0	0.8809				
dis	-0.4375*	0	0.2539*	0	0.0274	1		
	0	1	0	1	0.5762			
border	0.2536*	0.1762*	-0.0976*	-0.1703*	0.0642	-0.4783*	1	
	0	0.0003	0.0457	0.0005	0.1888	0		
language	0.0648	0.0578	-0.0489	-0.1081*	-0.0294	-0.1047*	0.2409*	1
	0.185	0.2371	0.3171	0.0267	0.5482	0.0319	0	

Table A2. Breusch-Pagan/Cook-Weisberg test for heteroscedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of tt

chi2(1) = 18.69
Prob > chi2 = 0.0000

Table A3. The variance inflation factor of independent variables

Variable	*VIF*	*1/VIF*
gdppc1	1081.96	0.000924
gdp1	1080.44	0.000926
gdppc2	1.88	0.532254
dis	1.57	0.636906
border	1.49	0.672996
gdp2	1.36	0.73715
language	1.08	0.928799
Mean VIF	309.97	

Note: A vif > 10 or a 1/vif < 0.10 indicates trouble.

8 References

Baldwin, R. (2011). Trade and Industrialization after Globalization's 2nd Unbundling: How Building and Joining a Supply Chain Are Different and Why It Matters. *Working Paper 17716 NBER*, Cambridge, MA.

Binh, D.T. (2012). *Applying Gravity Model to Analyze Trade Activity of Vietnam*. Foreign Trade University, Vietnam.

Dragutinovic-Mitrovic, R. (2005). Limitation of the Gravity Model in Econometric Analysis of the Foreign Exchange. *Economic Annals no. 167*, October-December 2005, pp. 77-106.

Gujarati, D. N. (2003). *Basic Econometrics* (4th ed.). New York, NY: The McGraw-Hill.

Ilic, S (2012), *Is there potential for trade growth? A gravity approach in the case of Serbia*, Central European University, Department of Economics, Budapest, Hungary

Krugman, P., Obstfeld, M., and Melitz, M. J., (2012). *International Economics: Theory & Policy*. 9th ed. Pearson

Martinez-Zaroso I., Nowak-Lehmann F. (2003). Augmented gravity model: an application to Mercosur-European Union trade flows. *Journal of Applied Econometrics 18*: 291-316.

Montanari, M. (2005). EU trade with Balkans, large room for growth? *Eastern European Economics*, vol. 43, iss. 1, pp. 59-81

Subramanian, Arvind & Martin Kessler (2013). The Hyperglobalization of Trade and Its Future. *Global Citizen Foundation*, Working Paper 3, pp. 6.

Martínez-Zarzoso, I. & Horsewood, N. (2005). *Regional trading agreements: dynamic panel data evidence from the gravity model*, JEL: F14, F15.