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Impact of the European Integration on the EU-US Trade. Gravity Model of Trade Approach.

Master Dissertation

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Declaration of Authorship

I, Artem Parandiuk, hereby declare that the thesis “Impact of the European Integration on the EU-US Trade. Gravity Model of Trade Approach.” was written by myself and all presented results are my own, unless stated otherwise. The literature sources are listed in the bibliography section.

Prague, September, 2019

Signature 

Abstract

This dissertation attempts to investigate the real impact of comprehensive European integration on the trade flows between EU member states and the USA. To do so, the concept of gravity model of trade was applied, due to its universality and high level of utility. The impact of several economic, political, social, historical and geographical factors on the trade relations between countries was investigated. A Panel data was used in the research to test the effects. The investigation was based on a data, which provides the information about trade flows, geopolitical and historical relations between the EU members, the USA, Japan and Brazil for the last seventy years from 1948 till 2017. A data used in the research was taken from the World Integrated Trade Solutions (World Bank), CEPII, Transparency International. Results of the research proved the positive effect of European integration on the trade relations of EU member states not only with other countries of the European Union, but also with non-EU member states. Therefore, the deep and comprehensive integration to the EU has a trade creation effect.

Key Words

Panel Data, the EU, the USA, Gravity Model of Trade, European Integration, PPML

List of Abbreviations

EU	European Union
EU-28	28 members of the European Union – Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom
USA	United States of America
ECSC	European Coal and Steel Community
EEC	European Economic Community
CPI	Corruption Perception Index
CCI	Control of Corruption Index
GDP	Gross Domestic Product
LM	Lagrangian Multiplier
WITS	World Integrated Trade Solution
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
GNP	Gross National Product
WTO	World Trade Organisation
PPML	Poisson Pseudo-Maximum Likelihood
GSP	Generalized System of Preferences
PTA	Preferential Trade Area
FTA	Free Trade Agreement

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Introduction

The European integration is a wide, overall and extremely complicated process, which has a huge impact on the economies of every member of the European Union. After the implementation of all EU standards and norms, an economy and the direction of development of a new EU member state faces brand new changes and quite serious challenges. The process of European integration has the impact not only on the economy of the new member state, but on the strategical development of the country, as the EU member countries lose independent trade policy. Every European norm and law influences on the specific sector and industry, which can change the structure and the general nature of a potential EU candidate state's economy dramatically. The changes made by government and parliament of the potential EU member state can bring not exclusively positive results in many cases, but also negative ones. The result of implementation of a new for the country European regulation or law can easily influence negatively in the short run perspective and sometimes in the long run perspective, depending from the specification and the nature of the reformed industry.

The necessary pre-requisite of the EU integration for potential member state is to standardize and synchronize laws and economic, trade, production norms of the candidate state with the common EU directives. In spite of fact, that some decisions can cause a negative impact on the specific sectors, especially, in the short run perspective, the synchronization of laws and production standards in most cases influence positively on the economy of potential member states and in most cases increase the amount of trade flows between the newly integrated countries and already accessed EU member states. The process of EU integration, which launches the deep and comprehensive reformation of the country brings positive effects on the effectiveness of most sectors of the economy. The low corruption tolerance and high transparency requirements are core pillars of the EU integration process.

The final aim of European integration and reformation of candidate member states is the accession to the European Union. The estimated synchronization of trade, custom and production norms positively influence on the intra EU trade flows, increasing the amount of export from the newly integrated state to the already accessed EU members and vice versa. The creation of European Economic Union, introduction of common currency, common international policy and other strategic decisions demonstrate the true and obvious effect of the integration.

In the dissertation, the effect of common currency, regional free trade agreement, accession to the European Union, level of corruption, distance between countries and some other variables on the amount of export flows between the EU member states and the USA are estimated. The main reason, why I decided to add the USA, Japan and Brazil to the empirical estimation, is to demonstrate the effect of the comprehensive, overall European integration on the trade not only within the European Union, but also between the EU member states and countries, which are not members of the union and located far away from Europe. An adding of the United States of America, Japan and Brazil shows clearly the true effect of the EU integration on the process of global trade and emphasizes the impact of every aforementioned variable on the Export performance of EU members states, the United States of America, Japan and Brazil.

The gravity model of trade is one of the main instruments of econometric and empirical research. Therefore, the concept of gravity model of trade was used to evaluate the impact of several factors on the trade flows between countries using economic, political and trade data from 1948 till 2017. The chosen period from 1948 till 2017 was full of decisive events in the European and World history like creation of the European Coal and Steel Community (later the European Economic Community), accession of most European countries to the EEC and strengthening of European integration process, which give the opportunity to observe the comprehensive influence of that integration. An investigation of such a long period of time makes empirical results of the research more significant and detailed. The results of the research and estimations are shown in the main part of the dissertation. The process of European integration is not fully predictable and has its own impact on the trade policy vector of the EU member states and non-EU members. The dissertation demonstrates the relation between economic, political, historical, geographical variables and volume of trade flows between every EU member state, the USA, Japan and Brazil. The dissertation consists of logically sequential parts such as: literature review, theoretical background, empirical analysis, presentation of results and conclusion. In the literature review, assumptions about the role of the European integration in the global trade, previously published results and statistical issues, which tend to appear during the process of empirical estimation of the gravity model of trade are described. In the part of theoretical background, the utility of the gravity model in analysing of international trade phenomenon is proven, due to results of Tinbergen (1962), Anderson (1979), Blonigen & Soderbery (2009), etc. In the part of empirical analysis, the OLS approach to econometric estimation of gravity model of trade

and results of applied tests, exporter/importer/time, pair/time, time varying dummy variables, which can help to reduce possible problems with gold medal mistake, PPML estimator were applied to estimate effects. The presentation of results is the part, where found results of computation are commented and explained. Finally, the conclusion of this dissertation sums up the research and opens the way for further investigations related to the topic.

Theoretical Background

The concept of gravity model was applied in analysing of international trade flows in the middle 20th century by economist and physicist Tinbergen (1962). The scientist made the reference to the famous Newton's gravity law and decided to describe the logic of a gravity model using the equation (Table 1), where X_{ij} was a trade flow between two countries, Y_i was a GNP[1] of exporting state, Y_j was a GNP of importing state, D_{ij} was a distance between capitals of trade partners, α, β, δ were elasticities of trade related to the GNP of exporter, GNP of importer and geographical distance between trade partners, C was the gravitational constant (Tinbergen, 1962).

Table 1 (Tinbergen's Equation)

$$X_{ij} = C \frac{Y_i^{\alpha} \cdot Y_j^{\beta}}{D_{ij}^{\delta}}$$

Table 2 (Tinbergen's Model)

$$\ln \mathbf{X}_{ij} = \ln \mathbf{C} + \alpha \ln \mathbf{Y}_i + \beta \ln \mathbf{Y}_j - \delta \ln \mathbf{D}_{ij}$$

The following linearization of aforementioned equation of gravity model of trade (Table 2) let us to receive a two sided logarithm. According to Tinbergen (1962), the volume of trade flows is positively correlated with sizes of partners' economies. Consequently, the model proved an important effect of the GDP size on the size of bilateral trade. The volume of export is one of the most frequently used factors, which plays the role of dependent variable in most gravity models of trade (Egger, 2002). However, the empirical estimation of the model on import data, would be quite poor and absolutely not appropriate (Fukao et al., 2003).

[1] Gross national product

Using export flows variable as the dependent one, can demonstrate the impact of trade protection/liberalization policy on the total volume of export (Kalirajan, 1999). The idea of making the size of export the model's dependent variable can be clever, but still has got disadvantages, which cause imperfections in estimation of real effect (Rose, 2000). As official trade data does not include illegal trade between countries, caused by a desire to reduce the size of trade tariffs and taxes paid, very often it doesn't reflect a real situation between trade partners. The decision to increase or decrease the official value of export is very frequently used by companies, as it helps to obtain subsidies in some cases. As the result, export data becomes not exact and full of errors, which doesn't let to estimate a detailed effect of explanatory variables.

The process of gravity model of trade construction is not as simple as it seems, as it requires to use identical scales of measures and standardized approaches to describe the data. For example, it is necessary to define in which way the distance between trade partners will be represented. In case of using different scales of measures for description of data, the estimation and empirical results of the model will be incorrect.

Gross National Product and population explanatory variables are frequently used, as they are highly correlated with amount of export (Anderson, 1979). According to Anderson (1979), the usage of GDP data as explanatory variable in gravity model of trade is acceptable, as the volume of trade between developed countries, with high gross domestic product is much higher than between developing countries with smaller economies. Moreover, Carrere (2006) states that the dynamics of trade and its volume depends from the GDP per capita level of exporter and importer countries. Therefore, Carrere (2006) concludes that the amount of trade between developed countries is higher.

As in the Newton's model, a distance in models of international trade mirrors transport cost, which influence significantly on the amount of trade flows between states. The assumption looks very logical, as the delivery cost of some product from the United States to Germany in most cases will be higher than to deliver the same product from Netherlands to Germany. Serlenga & Shin (2004) claimed that the existence of common border line or its inexistence is another factor related to geographical distance and the usage of it as the dummy variable in the gravity model of trade is meaningful.

The introduction of additional dummy variables to the gravity model of trade like usage of the same language, existence of common colonial history and deep cultural ties, in some case can be really good idea (Henderson & Millimet, 2008). However, it should consider, if there are theoretical reasons for this and if it is usual in the literature. Above mentioned factors can have their own impact on stimulation of trade relations between countries, which is quite logical assumption (Eichengreen & Irwin, 1998). The ability to speak the same language and a clear understanding of cultural and ethical background of potential trade partner can reduce the risk of misunderstandings between negotiators and positively effect on the decision to increase the amount of trade to the intelligible market with understandable environment (Eichengreen & Irwin, 1998). The ability to speak the same language and having the same business traditions makes communication less expensive and reduces the transaction cost caused by the ease of information transferring (Zielinska-Glebocka, 1991). As the result, common language and strong cultural and historical ties influence on trade relations positively, making a trade cheaper and less risky.

The creation of trade unions or free trade agreements between countries in most cases positively influence on the dynamics and volume of trade flows between partners. The liberalization of trade very often causes a creation of new trade impulses between integrated member states. The policy of trade liberalization reduces the trade tariffs between member states, which makes the imported products cheaper on the internal markets. The reduction of trade tariffs increases the competitiveness of exporter on external market, which also positively influence on the volume of trade between partner countries (Greenaway & Milner, 2002). Moreover, the trade liberalization has its positive effect on the level of welfare, as consumers do not have to pay overprice for imported goods and have the excess to a larger variety of goods, which is welcomed by them and has its positive overall effect on the economic growth, according to Blonigen & Soderbery (2009). The process of trade liberalization also boosts a specialization of economies, which lets countries to produce and export more products that use abundant factor of production and import products that use states' scarce factors. Consequently, the liberalization of trade policy brings a vital effect for both exporter and importer countries.

Literature Review

The usage of the gravity trade models is very common today. The gravity model is a so called "Swiss Army Knife" of international trade experts. The versatility and ease of applying of the model make it a universal instrument to estimate effects of different variables, in case of gravity model of trade, on the trade flows between states. The gravity models are crucially important parts of quantitative studies of international trade (Eichengreen & Irwin, 1998). The usage of econometric techniques to estimate thousands of trade observations between states over time, taking into account explanatory variables, which clarify and describe characteristics of relations between countries, is a basis of the model (DeRosa, 2008). Gravity models of trade make possible to use several explanatory variables including political, geographical, institutional factors to specify and estimate the effect of every each of them on the trade flows between countries (DeRosa, 2008). The effectiveness of properly built gravity model and its elegancy in usage make the GM very common and absolutely useful instrument for every trade expert.

The gravity model of trade is very useful and elegant instrument to use. However, a usage of gravity model of trade is not as simple as it looks like from the first sight. Baldwin & Taglioni (2006) analysed attempts at empirical estimation and suggest that many tries have been completely incorrect, due to the fact that they ignored micro foundations like the MRT. Moreover, Baldwin & Taglioni (2006) tested the effect of possible specification biases on results. Baldwin & Taglioni (2006) emphasized the importance to solve three most popular mistakes, which are called "Gold Medal Mistake, Silver Medal Mistake and Bronze Medal Mistake". The concept of gold medal error on the example of Single European currency (Euro) introduction and its impact on international trade can be explained as the biasedness of Euro's trade impact, due to non-inclusion of omitted variables. However, the core issue can be the non-linearity of the trade resistance, which is much deeper problem than omission of some variables.

The silver medal error stems from averaging of double way bilateral trade flow instead of taking into account unidirectional flow of international trade. The silver medal error appears, if econometrist includes the log of the sum inter-countries' trade flows as a left hand side variable. The silver medal error will not create any biases if the inter-partners trade is in balance. However, Baldwin & Taglioni (2006) demonstrated on example of Eurozone

member states, that silver medal incorrect specification causes the upward biases. In case of Eurozone member states, the log of the sum does not estimates in the right way the sum of the log, as log of the sum and sum of the log are not the same (Baldwin & Taglioni, 2006). Consequently, it causes the overestimation of the amount of trade flows among member states of the Eurozone and leads to incorrectness of researcher's final results. The bronze medal error is connected to price deflators, as every single price in the gravity model is estimated in terms of a similar numeraire. Baldwin & Taglioni (2006) demonstrate that the addition of time dummy variables neutralizes bronze medal error. Therefore the addition of the time dummies became a universal practice.

According to McCallum results of gravity model empirical estimation proved that the existence of borders between trade partners declines the volume of bilateral trade flows significantly. Anderson & Wincoop (2001) found out that the effect is smaller than the extreme results previously published by McCallum. As the result, their results and the theoretical model they provided helped to understand the importance of the MRT. The impact of aforementioned variable on final result is crucial. Moreover, the huge border effect is explainable in terms of Anderson & Wincoop (2001) gravity model of trade, as it determines the real impact of the border on the international to intra-national trade ratio. The finding outs of Anderson & Wincoop (2001) demonstrate the different effect of border on small and large economies. The micro foundations used by Anderson & Wincoop (2001) played a key role in proving that the impact of border on the amount of small country's trade flows is much bigger than on the trade of a country with a relatively large economy, taking into account the fact that so called "omitted variables" biased the calculated impact of border upward.

The results of Anderson & Wincoop (2001) proved the eligibility of gravity equation estimation in terms of computation and explanation. The model can be used to find out and calculate the impact of different institutions and factors like common market, free trade agreement or currency union on the volume of bilateral trade flow. An incorrect formulation of gravity model and imprecise treatment of multilateral trade resistance can lead to biased results. However, it can be specified and improved using several dimensions like industry specification barriers. Therefore, dependence of trade on multilateral, as well as bilateral resistance will endure under a wide diapason of generalizations. Santos Silva & Tenreyro (2006) proved the incoherence of standard empirical methods, which are frequently used to estimate gravity equations. The core problem of nonlinear transformation of the model is the

existence of heteroskedasticity, which causes inconsequent calculations. Consequently, in case of heteroskedastic errors, transformed error will definitely be correlated with covariates. Another weak side of log-linearization is its dissonance with zero values in data of trade. The problem negatively influences on solutions, which makes them unacceptable. It leads to necessity to get rid of zero-trade pairs and following transformation of dependent variable, which makes estimation less valuable.

Poison pseudo-maximum-likelihood (PPML) method is used to address different problems with calculations. PPML estimator can be used for empirical estimation of trade pairs' determinants, which creates huge dissimilarities in the level of real effect of geographical distances, market sizes from ones forecast by standard logarithmic tradition (Santos Silva & Tenreyro, 2006). The comparison between PPML results and ones gotten from other approaches, which took into account zero trade observations can be found on (Table 3), which demonstrates results from different techniques for the traditional gravity equation.

Table 3 (Traditional Gravity Equation, Santos Silva & Tenreyro, 2006)

Estimator:	OLS	NLS	PPML	PPML3
Dependent Variable:	$\ln(T_{ij})$	T_{ij}	$T_{ij} > 0$	T_{ij}
Log exporter's GDP	0.938**	0.738**	0.721**	0.733**
	0.012	0.038	0.038	0.027
Log importer's GDP	0.798**	0.862**	0.862**	0.741**
	0.012	0.041	0.041	0.027
Log exporter's GDP per capita	0.207**	0.396**	0.396**	0.157**
	0.017	0.116	0.116	0.053
Log importer's GDP per capita	0.106**	-0.033	0.133**	0.135**
	0.018	0.062	0.044	0.045
Log distance	(-1.166)**	(-0.924)**	(-0.776)**	(-0.784)**
	0.034	0.072	0.055	0.055
Contiguity dummy	0.314*	-0.081	0.202	0.193
	0.127	0.1	0.105	0.104
Common-language dummy	0.678**	0.689**	0.752**	0.746**
	0.067	0.085	0.134	0.135
Colonial-tie dummy	0.397**	0.036	0.019	0.024
	0.07	0.125	0.15	0.15
Landlocked-exporter dummy	-0.062	(-1.367)**	(-0.873)**	(-0.864)**
	0.062	0.202	0.157	0.157
Landlocked-importer dummy	(-0.665)**	(-0.471)**	(-0.704)**	(-0.697)**
	0.06	0.184	0.141	0.141

Exporter's remoteness	0.467**	1.188**	0.647**	0.66**
	0.079	0.182	0.135	0.134
Importer's remoteness	(-0.205)*	1.01**	0.549**	0.561**
	0.085	0.154	0.12	0.118
Free-trade agreement dummy	0.491**	0.443**	0.179*	0.181*
	0.97	0.109	0.09	0.088
Openness	(-0.17)**	0.928**	(-0.139)	-0.107
	0.053	0.191	0.133	0.131
Observations	9613	18360	9613	18360
RESET test p-values	0	0	0.941	0.331

The comparison between ordinary least square and Poison pseudo-maximum-likelihood methods is quite curious. The level of distance elasticity is much greater under the ordinary least square method (-1.35 vs -0.75) according to Santos Silva & Tenreyro (2006). Another significant difference is a solid positive effect of having a common border under the PPML and non-existence of substantive effect of common border on bilateral trade under OLS. In spite of fact, that the usage of one language has similar impacts under OLS and PPML, the existence of common colonial history has significant effect only under ordinary least square method while PPML forecasts no essential effect on the bilateral trade. OLS method is used in several fields of econometrics, as it proved its utility and elegance in using, however, in case of having heteroskedasticity, the OLS method can potentially cause substantive biases. On the other hand, heteroskedasticity can cause incorrect estimation of standard errors only, which is not obviously a significant problem for the OLS. Therefore, in case of heteroskedasticity the PPML method should be used as the standard log linear model.

The usage of dummy variables in the gravity model of trade is very useful and even necessary decision, as they can reduce the severity of the golden error mistake. However, the dummy approach can also be considered as problematic one, due to the coverage of the variety of all pairs of countries' specific effects simultaneous with implementation of some trade agreements, liberalizations or other factors, which theoretically can influence on the amount of trade flows between countries (Cardamone, 2007). On the example of dummy variables, which describe the membership of countries in some trade unions or preferential trade agreements, it is visible that they treat all trade partners and members as a uniform group. Consequently, the dummy variable approach does not take into account the difference in the utilization level of trade union or agreement for each member country, which is in most cases different due to not homogenous level of integration of all participants (Cardamone,

2007). In fact, one can make different binary variables, for example for deeper agreements and thus test the differences amongst different types of trade agreements. Another problem of dummy variable approach is inability to distinguish various trade liberalization instruments like quotas, margins, and taxes, which can be treated as just PTA or some trade union, but effect on the trade flow between integrated countries differently. On the other hand, using a combination of several dummy variables can facilitate some of the issues.

As the result, the idea to substitute standard dummy variables with one, which provides more suitable information, is rather useful than pointless. On the other hand, the it can be meaningful to replace the less detailed dummy with a system of several dummy variables (depicted the features of trade agreements). In spite of fact, that it can positively influence on the accuracy of the model, there is another problem, such as availability of necessary data, which can be faced, due to lack of very specific and not popular data, which is required only by small group of trade experts.

The country heterogeneity is another econometric issue, which should be considered during the process of estimation. The usage of a fixed effect model gives a possibility to control factors, which are fixed over time (Cardamone, 2007). The distance variable, which describes the cost of trade between partners should be considered as not the most appropriate, as for example the transport cost per one geographical unit like kilometre or mile across land and water will be different. Moreover, the cost of transportation across economically developed and developing countries is different, due to the different level of infrastructure development in developed and developing countries. For example, the transportation cost tends to be lower in case of using developed road systems, which helps to save time for transportation of goods, due to the high quality of roads and ability to deliver goods faster, and decrease the cost of transport reparation. The necessity to use a less developed road system will negatively influence on the delivery time and technical conditions of transport, which increases the transportation cost.

Despite of fact that the concept of fixed effect model is undisputedly helpful and widely used by econometricians, it also ignores few significant problems (Anderson & Wincoop, 2001). The selection bias, which appears when two different processes are correlated is one of them. The selection equation depicts a decision of trade partner to export or not, which is so called “the first process”. The second one generates the amount of trade, which is called “the

outcome process". The problem can be solved by using of Heckman correction, which is a statistical algorithm created to correct biases from not random picked samples (Heckman, 1979).

The role of comprehensive European integration process, which includes synchronization of laws and norms with the EU system, creation of economic union and loss of independent trade policy, in the development and nature of today's EU economies should not be underestimated, due to the clear proofs, which confirm economic changes of newly integrated member states or potential candidates, which are on the way to the reformation and synchronization of laws and standards with the European ones. According to Boltho & Eichengreen (2008) the phenomenon of European integration, which is an extremely wide and comprehensive process accompanied by creation of common market and international policy, monetary system and introduction of Euro as the main European currency, is more positive than negative in terms of the impact on economic growth and trade relations between integrated countries (Table 4). The final statement of the Boltho & Eichengreen (2008) clearly supports and empirically proves the positive and even vital effect of dynamic European integration after the Second World War. Boltho & Eichengreen (2008) demonstrate the main role of European integration and positive effect of Intra-European export on rapid GDP growth of Western European countries like Germany, France, Italy, Netherlands, Belgium, Luxembourg after creation of the first common European community ECSC[2] in 1952 and EEC[3] in 1957. The process of European integration had another undisputedly positive effect on rebuilding of European economy, such as political stabilization and destruction of symbolic wall between Germany and France, which was a huge obstacle in diplomatic, trade and social relationships between countries.

Table 4 (The Importance of Intra-European Trade, Boltho & Eichengreen, 2008)

	Intra Western Europe	Intra Total Europe	Intra Americas	Intra Asia-Pacific
1938	52.2	61.4	33.3	…
1950	49.3	58.7	53.9	…
1970	67.3	73.9	46.9	35.1
1990	72.2	75.2	47.8	41.7
2006	78.8	76.5	59.7	50

[2] European Coal and Steel Community
[3] European Economic Community

According to Raines (2000), one of the most important results, which brought the positive effect on economic and trade growth of integrated countries was the removal of barriers to the mobility of labor. The liberalization and standardization of labor laws and norms caused the increment of labor migration between countries which increased the efficiency of integrated countries. On (table 5) it is clearly demonstrated that liberalization of labor migration influenced immediately on the workforce structure of integrated countries. As the result, the percentage of foreign workers in almost every labor market of EU member states increased. The freedom of labor movement boosted the process of economic specialization, as professionals from the same industry could move abroad and legally work increasing the effectiveness of companies and industries. The effect of liberalization in migration movement caused the specialization of integrated economies, which increased labor salaries and a level of welfare in general.

Table 5 (Foreign Workers in Member State Work Forces in %, Raines, 2000)

	1960	1970	1990
EC-6	3	5	4
EC-9	3	6	5
EU-15	3	5	7

The liberalization of border control between the EU member states is another key factor, which brought a huge positive effect on economies of integrated countries. Felbermayr et al. (2017) estimated that implementation of European Schengen Agreement in 1995 boosted trade between countries participants by 2.81% on average. Using the general equilibrium model of trade and yearly bilateral export data, which includes both goods and services, Felbermayr et al. (2017) analyzed trade flows between 40 countries taking into account CEPII historical and geographical data. The common approach to data collecting and analyzing of trade flows made me very curious about results of Felbermayr et al. (2017) research and first of all empirical find outs (Table 6).

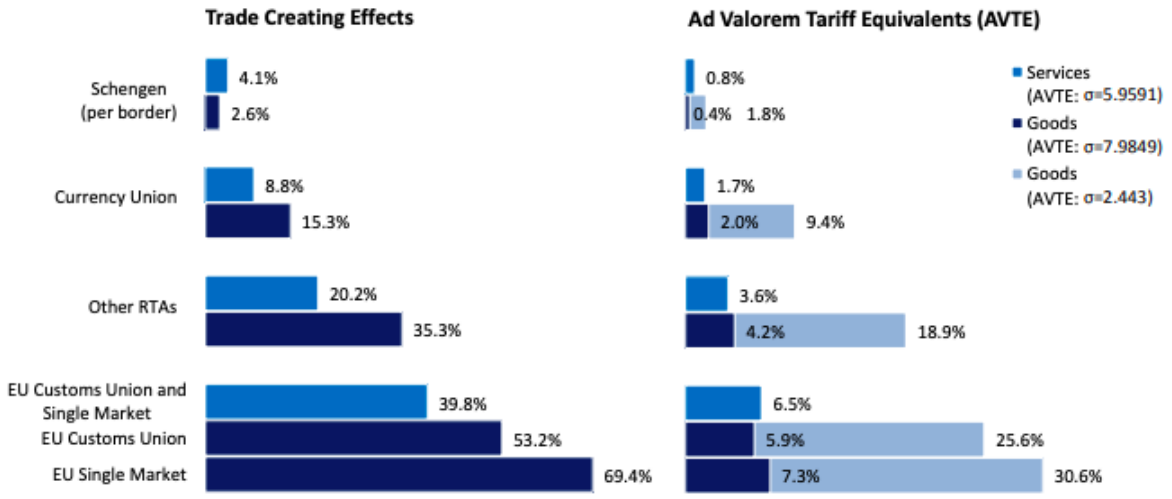
Table 6 (The impact of Schengen on Bilateral Export, Felbermayr et al., 2017)

	Total Trade		Goods		Services		
	1	2	3	4	5	6	7
Schengen	0.054***	0.0003	0.106***	0.026***	0.026***	0.067***	0.04*
	0.01	0.01	0.02	0.01	0.01	0.02	0.02

Both EU	0.617***	0.8***	0.527***	0.335***
	0.07	0.07	0.11	0.08
Both Euro	0.03	0.137***	0.142***	0.084*
	0.02	0.03	0.03	0.04
Other RTA	0.25***	0.294***	0.302***	0.184**
	0.07	0.06	0.07	0.07
Tariff			-2.443	
			0.57	

Being more specific, the unique effect of the Schengen border on trade flows between member states is around +2.6% in goods and +4.1% in services (Felbermayr et al., 2017). Above mentioned results mean that the overall EU integration has much bigger impact on the intra-EU trade than creation of Schengen zone only. The cumulative effect of custom union and single market augmented trade of services for 39.8% and trade of goods for 122.6% (Felbermayr et al., 2017). Estimated effects of custom union and single market on the export of services are 53% and 69% according to Felbermayr et al. (2017). The regional trade agreements and currency union increase the volume of trade in goods for 35.3% and 15.3% (Felbermayr et al., 2017). The impact of RTAs and the adoption of Euro on the trade in services is relatively smaller, but still more significant than the effect from introduction of Schengen zone. RTAs and the adoption of single currency caused the growth in trade of services for 20.2% and 8.8% (Felbermayr et al., 2017). (Table 5) shows results of Felbermayr et al. (2017). Calculations of (Table 7) are based on (Table 6).

Table 7 (Trade Creation Effects and Implied Ad Valorem Tariff Equivalents of Integration Policies, Felbermayr et al., 2017)



According to Felbermayr et al. (2017), the liberalization of border control between Schengen zone members was additional factor, which boosted economies of the European Union by solid increment in volume of goods and services trade. The opportunity to move between Schengen zone countries without any passport and custom controls let to increase the movement of people. On the other hand, the liberalization of cross border process did not effect on the intra-European trade of goods flows, as much as liberalization of trade movement of goods, labor migration laws, creation of economic union and introduction of common European currency.

A key reason, why the European integration can be considered as the positive decision for potential EU member states is the liberalization of trade relations within the union. The reduction of trade tariffs and synchronization of production norms, standards and laws is a surprisingly powerful engine of economic growth of the country. Since the creation of single European market, the intra-EU trade increased from 9 to 21% of EU GDP (Dahlberg, 2015). The vital effect of single European market on trade flows between integrated countries was achieved due to introduction of free movement of goods, services, capital and people. According to Dahlberg (2015), the single European market made EU member states more trade oriented, which increased the efficiency and productivity of large sectors and economies in general. Moreover, the rapid growth of intra-EU trade made economies more competitive, as only highly competitive and efficient players could survive in liberalized environment with larger variety of goods and services, which were not available before. The huge welfare improvement of EU member states positively influenced on the economic growth of integrated countries and provided their long term prosperity. The unprecedent increase of intra-EU trade was one of the core engines of economic boost of the EU member states.

The impact of European integration on intra-EU trade is a positive one, as deeper integration of several economies and creation of common standards and laws make the process of export within the European Union much easier, which causes the reduction of transportation cost, delivery time and custom bureaucracy. Consequently, the deep integration and strong rise of intra-EU trade could substitute the export of non-EU countries to the European Union, which sounds very logically. However, according to Sawani et al. (2004), the expectation about the negative impact of European integration on the US export to the EU is invalid. Moreover, the earlier stages of European integration increased the export from the United States of America

to the EU (Sawani et al., 2004). Results of Sawani et al. (2004) play an important role in understanding of a real influence of European integration on the amount of EU – US trade.

Results of Sawani et al. (2004) estimations demonstrated that increase in volume of export from the United States of America to the European Union for 1% causes a growth for 0.39041% in the volume of trade in the next year (table 8). The increment of exchange rate for one unit (Devaluation of USD) will cause the growth of export from the US to the EU for 33.223% (Sawani et al., 2004). The growth of the EU GDP for 1% increases the volume of export from the US to the EU for 1.8755% (Sawani et al., 2004). And the most unexpected result was the negative effect of introduction of Euro as the single European currency. The coefficient D3 is negative (-0.10649), which says that introduction of Euro as the single European currency caused the reduction of American export to the EU for 10.969% (Sawani et al., 2004).

Table 8 (Results of the estimations Sawani et al., 2004)

Variable	Coefficient	P-value
ln (ylag)	0.39041	0.001
ex	0.33223	0
ln (gdp)	1.8755	0
D1	0.78314	0.975
D2	0.086699	0.962
D3	-0.10649	0.057

A curious result of the above mentioned research proved the positive effect of the EU integration on the US export to the European Union, but unpredictable negative effect of the introduction of Euro, as the main European currency, on the US export to the EU member states Sawani et al. (2004). The paper demonstrated a diversity of EU integration consequences and persuade us that the process is not as predictable and unambiguous, as most experts and economists thought.

One of the most basic and important components of gravity models of trade is the distance between trade partners. As a longer distance between partners traditionally causes a higher transport cost, which reduces the competitiveness of exporter on the domestic market of importer, theoretical inference of gravity model of trade consider a distance as the proxy for

the transportation or transaction costs. However, the global economy and international trade relations are not as simple as it seems. Marimoutou et al. (2010) used a distance-varying gravity model to test the real impact of geographical distance between trade partners on the volume of trade between them. Marimoutou et al. (2010) used the data of export and import between the USA and 85 trade partners around the World and the their GDP sizes. The method of Bonus Vetus approach, which allows to approximate cost of international trade effects using gravity equations (Baier & Bergstrand, 2009), was used to estimate empirically the effect of GDP, distance and policy on the volume of trade flows between countries.

Table 9 (OLS results of the gravity trade model, Marimoutou et al., 2010)

Variable	Estimators	Std-errors	t-statistics	p-values
Constant	3.0224	0.8002	3.7769	0
GDP	0.9182	0.0585	15.6741	0
Distance	-1.0979	0.2016	-5.4459	0
Policy	-0.0061	0.0423	-0.1464	0.88
R-Squared = 0.804				

On (Table 9) it is visible that GDP coefficient is positive and coefficients of distance and policy are negative, which says that the increment of GDP level for 1% causes the growth of trade for 0.9182%, but the implementation of a new trade policy and the impact of geographical distance between countries influence negatively on trade (Marimoutou et al., 2010). Another finding of Marimoutou et al. (2010) is the different effect of distances and GDP sizes on the amount of trade, which changes with geographical distance between partners. In the first case, having less than 3500 kilometres between trade partners, the volume of trade flows is less sensitive to the size of GDP (Marimoutou et al., 2010). In the second case, when the distance is between 3500 and 10000 kilometres, the effect of the GDP size increases and the influence of distance on trade becomes exclusively negative (Marimoutou et al., 2010). In the third case, when the geographical distance between trade partners is over 10000 kilometres, the size of the partner's GDP becomes even more important, but the impact of distance declines (Marimoutou et al., 2010).

Marimoutou et al. (2010) and Fouquin & Hugot (2016), who investigated the changes in the role of geographical distance across history, proved that the impact of the distance between trade partners on the amount of trade flows started to decrease since the late 1840th, due to the reduction of transport cost caused by a process of technological improvement, which

leaded to the first wave of Globalization. As the result, in the late 20th, early 21st centuries, the geographical distance between countries was not the most important factor, which defined the volume of trade flows. Marimoutou et al. (2010) proves that the larger GDP[4] of the trade partner, the less is the effect of distance on trade flows. Moreover, the possibility for a large, economic powerful country to be a prime trade partner even if the geographical distance is huge really exists (Marimoutou et al., 2010). The negative effect of distance between trade partners can be compensated by the market size of the country (Marimoutou et al., 2010). The result of the research explains many international trade phenomena in today's comprehensive and extremely complex global trade.

The level of corruption is a crucially important indicator, which can explain many issues and reasons of crucial problems in a country's economy. The corruption exists in almost every country in the World. However, the level of corruption varies from country to country. There are different measures of corruption like CPI[5] and CCI[6], which are perception - based indexes used by Transparency International organization. According to Gil-Pareja et al. (2014), the impact of corruption on the volume of international trade is ambiguous, despite of logical assumption that corruption has strictly negative effect on the trade. On the one hand, corruption can influence negatively on the international trade, as it can increase the cost of doing business abroad, which will obviously cause the decline in competitiveness of export product on the internal market of import partner (Gil-Pareja et al., 2014). On the other hand, corruption can help exporters to get a cheaper excess to the external market and in case of cheaper corrupt excess to the external market than a legal one, the profitability of exporter can even grow, which attracts the interest of exporter to increase the volume of trade (Gil-Pareja et al. 2014). In case of having one low or middle income country in the trade pair, the positive effect of corruption on trade can appear, according to Gil-Pareja et al. (2014). However, the result of Gil-Pareja et al. (2014) research proved that in situation, when both countries are high income ones, corruption brings exclusively negative effects on the trade. In fact, the creation of regional trade agreements neutralizes the negative impact of corruption on the volume of trade flows.

[4] Gross Domestic Product
[5] Corruption Perception Index
[6] Control of Corruption Index

Empirical Analysis

The usage of gravity model of trade in the empirical part of the dissertation is justified due to its high level of utility and universality. Several factors like geographical distance, level of trade partner's GDP, population, trade and currency unions membership, existence of common colonial history, usage of the same currency, level of corruption and other were used to evaluate their effect of on the amount of trade flows between countries.

The data about trade flows (export) of countries was taken from the World Integrated Trade Solution (WITS)[7] source, which is a part of the World Bank dataset. The data used for describing of geographical distance between countries, level of countries' GDP, existence of common borders, colonial history, usage of a single currency and language, membership in the European Union and other important factors was taken from the CEPII[8]. The data taken from the CEPII dataset have been used by many researchers for the same purpose. The data related to the level of corruption among countries was taken from the Transparency International dataset. The Transparency International is a non-governmental organization, which monitors and controls the level of corruption in most countries of the World. The created dataset used in this research collected information about existence of common border, language, colonial history, membership in the European Union , General Agreement on Tariffs and Trade (GATT), regional trade agreement, GDP, population, geographical distance and volume of trade flows from 1948 till 2017 between the EU member states, the United States of America, Japan and Brazil.

As the main aim of the research is to estimate the impact of European integration on the trade relations between the EU member states and the USA. Basic variables, which are used in empirical estimation of the gravity model of trade are year, contig (dummy variable, 1 for contiguity), comlang_off (dummy variable, 1 for common language), distw (distance between two countries based on bilateral distance between the biggest cities of those two countries, which is weighted by the share of the city in the country's population), heg_d (dummy variable, 1 if country of export destination is a current or former hegemon of origin),

[7] The WITS is as one of the main data suppliers due to its strict specification focused on investigation and monitoring of international trade and trends in the World economy.
[8] CEPII is one of the leading research and expertise centres focused on the monitoring of the global macroeconomic processes..

heg_o (dummy variable, 1 if country of export origin is a current or former hegemon of destination), col_to and col_fr (dummy variables, 1 for country of origin and destination in colonial relationships), col_hist (dummy variable, 1 if common colonial history), col_cur (dummy variable, 1 if both countries had common colonizer), gatt_o (dummy variable, 1 if country of export origin is a member of GATT/WTO), gatt_d (dummy variable, 1 if country of export destination is a member of GATT/WTO), rta (dummy variable, 1 if free trade agreement between countries is implemented), comleg (dummy variable, 1 if both countries have common legal origins), comcur (dummy variable, 1 if both countries use the same currency), gsp (dummy variable, 1 if country of export origin is a donator in GSP[9]), gsp_rec (dummy variable, 1 if country of export destination is a donator in GSP), flow (the amount of export in USD million), cor_o (dummy variable, 1 if country of export origin is in top 20 least corrupt countries in the World), cor_d (dummy variable, 1 if country of export destination is in top 20 least corrupt countries in the World), EU_o (dummy variable, 1 if country of export origin is the EU member), EU_d (dummy variable, 1 if country of export destination is the EU member), BothinEU (dummy variable, 1 if both trade partners are in the EU), OneinEU (dummy variable, 1 if only one trade partner is the EU member state).

After successful collection and creation of data, pair- and time- dummy variables were used. Variables like flow, distance, GDP and population were converted into logs. Next step was to run pooled OLS regression with created time dummies. Fixed effects model was tested by function, that also includes a general F-test, which tests if inclusion of the fixed effects model makes sense (See Appendix 1). Was taken the decision to use the fixed effects model for exporter, importer and time, and the fixed effects model for the exporter-importer pair, and time, which was recommended by (Baldwin & Taglioni, 2006). The estimated coefficients are jointly significant at 0.05 significance level, errors u_i is equal to 0.2305, p-value of most explanatory variables are lower than 0.05, t-value for logs is higher than 1.96, R^2 is 0.8742 (See Table 10, Table 11).

[9] Generalized System of Preferences

Table 10 (Results of Fixed Effects Model with Robust Standard Errors)

Fixed-effects (within) regression — Number of observations = 41,022

Group variable: pair2 — Number of groups = 860

Robust

ln_flow	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_gdp_o	.4758354	.0459213	10.36	0.000	.3857043	.5659665
ln_gdp_d	.3969199	.0368284	10.78	0.000	.3246358	.469204
col_cur	.7738765	.3731338	2.07	0.038	.0415158	1.506237
gatt_o	.5638592	.0553637	10.18	0.000	.4551952	.6725232
gatt_d	.3014399	.0448893	6.72	0.000	.2133343	.3895456
rta	.156853	.0347401	4.52	0.000	.0886675	.2250385
comcur	-.001626	.0470062	-0.03	0.972	-.0938865	.0906344
gsp	-.1504667	.085919	-1.75	0.080	-.3191024	.018169
gsp_rec	-.0492879	.066532	-0.74	0.459	-.1798723	.0812965
cor_o	-.1117678	.0490902	-2.28	0.023	-.2081185	-.015417
cor_d	-.2553132	.0473276	-5.39	0.000	-.3482044	-.162422
EU_o	.0792844	.0389397	2.04	0.042	.0028563	.1557126
EU_d	-.1317999	.1454039	-0.91	0.365	-.4171883	.1535886
BothinEU	.3337329	.147059	2.27	0.023	.0450959	.6223699
OneinEU	.0554923	.1361608	0.41	0.684	-.2117545	.322739
cons	-5.07729	1.707761	-2.97	0.003	-8.429164	-1.725417

Table 11 (Results of Fixed Effects Model with Clustered and More Robust Standard Errors)

Fixed-effects (within) regression — Number of observations = 41,022

Group variable: pair2 — Number of groups = 860

Robust

ln_flow	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_gdp_o	.4758354	.0459213	10.36	0.000	.3857043	.5659665
ln_gdp_d	.3969199	.0368284	10.78	0.000	.3246358	.469204
col_cur	.7738765	.3731338	2.07	0.038	.0415158	1.506237
gatt_o	.5638592	.0553637	10.18	0.000	.4551952	.6725232
gatt_d	.3014399	.0448893	6.72	0.000	.2133343	.3895456
rta	.156853	.0347401	4.52	0.000	.0886675	.2250385
comcur	-.001626	.0470062	-0.03	0.972	-.0938865	.0906344
gsp	-.1504667	.085919	-1.75	0.080	-.3191024	.018169
gsp_rec	-.0492879	.066532	-0.74	0.459	-.1798723	.0812965
cor_o	-.1117678	.0490902	-2.28	0.023	-.2081185	-.015417
cor_d	-.2553132	.0473276	-5.39	0.000	-.3482044	-.162422
EU_o	.0792844	.0389397	2.04	0.042	.0028563	.1557126
EU_d	-.1317999	.1454039	-0.91	0.365	-.4171883	.1535886
BothinEU	.3337329	.147059	2.27	0.023	.0450959	.6223699

OneinEU	.0554923	.1361608	0.41	0.684	-.2117545	.322739
cons	-5.07729	1.707761	-2.97	0.003	-8.429164	-1.725417

The application of a random effects model, which in contradiction to the fixed effects model, assumes that variation across entities is random and absolutely not correlated with independent variables used in the model. One of the most significant advantages of the random effects model is the possibility to involve time-invariant variables, while in the model of fixed effects, time-invariant variables are absorbed. Consequently, the model of random effects considers that the error term isn't correlated with predictors, that lets unchangeable variables to be treated as explanatory ones. The estimation of random effects model showed results, which differ from the fixed effects model, as Wald chi2 (the test, which define if explanatory variables are significant) is equal to 268961.31, that is much greater than 0.05 (in the normal situation, Wald chi2 should be smaller than 0.05), rho is equal to 0.525 = 52.5% (Appendix 2).

Following step was to run the Breusch-Pagan Lagrangian test for random effects, which estimates if random effects are enough relevant against OLS. As the result, the null was rejected, which means that the random effect is more appropriate than the simple OLS regression.

Hausman test (See Appendix 3) allows to decide which model is preferred one, fixed effects or random effects. Moreover, it tests the correlation of so called "unique errors" with regressors. As Prob > chi2 = 0 and is smaller than 0.05, it proves that the usage of fixed effects model would be a correct way (See Table 13).

Table 12 (Fixed Effects or Random Effects: Hausman Test)

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
chi2 (85) = (b-B) ' [(V_b -V_B) ^ (-1)] (b-B) = 569.63
Prob > chi2 = 0
(V_b - V_B is not positive definite)

Following step was to run the PPML[10] with time dummies and clustered standard error (See Appendix 4) and estimation of PPML with fixed effects model (See Appendix 5). The main reason, why it was necessary to run the PPML model was the superiority of his option, due to heteroskedasticity issues and also ability to deal with zero trade flows (Santos Silva & Tenreyro, 2006). The PPML estimator became popular since Santos Silva & Tenreyro (2006), as the Poisson Pseudo Maximum Likelihood estimates biases due to existence of heteroskedasticity in trade data and ability to estimate the gravity equation in multiplicative form, which deals more successfully with zero trade data.

Presentation of Results

According to aforementioned estimations, the empirical results demonstrate the impact of each factor on the amount of trade flows between countries. The results of all previously applied models were taken into account to describe the effect of each factor on the volume of trade flows between the United States of America, Japan, Brazil and members of the European Union. However, due to detailed comparison of models and performed experiments run by Breusch Pagan Lagrange test, Hausman test, PPML, the results of PPML fixed effects model approach were treated as the most relevant and final ones. However, variables of interests are significant with traditional standard errors only (Table 14).

Coefficients on the variables in logs are interpreted as elasticities, which means that a change in the amount of gross domestic product for 1 per cent causes the change in the amount of trade flows for some percentage, as the example. The proper interpretation of dummy variables' coefficients in Log-Linear models is a bit more complex. As it requires to use the formula $100[\exp(c^{*}-\frac{1}{2}v^{*}(c^{*}))-1]$, where $v^{*}(c^{*})$ is calculated divergence of c*, which is the square of the standard error for c*.

The effect of increase in GDP level of country of export origin and country of export destination is predictably positive, which shows that the increase of GDP size of exporter for 1 per cent, causes a growth of export flow for 0.81 per cent (Table 14). The rise of importer's GDP for 1 per cent induces the increment of import size for 0.8 per cent. In situation, when

[10] Poisson Pseudo Maximum Likelihood

trade partners used to have a common colonizer and have close historical relations, the effect on the amount of trade flows is 320 per cent. In the opposite situation, the negative effect is -76.2 per cent. A membership of exporter country in GATT/WTO[11] can lead to the increment of trade flows for 30.5 per cent. If the export country is not a member of GATT/WTO, the effect is -23.4 per cent. However, the membership of country of export destination in GATT/WTO causes the increase of trade flows for 9.2 per cent. In case, when the country of export destination is not a member of GATT/WTO the effect on trade is negative (-8.5 per cent). The existence of active free trade agreement between countries can positively influence on the volume of bilateral trade adding 59.3 per cent. Otherwise, the inexistence of active free trade agreement between countries can reduce the volume of trade flows for 37.2 per cent. The usage of common currency by trade partners tend to augment the amount of trade flows for 16.5 per cent (otherwise -14.2 per cent). If country of export origin is a donator to Generalized System of Preferences, it adds additional 23.8 per cent to the volume of bilateral trade (otherwise -19.2 per cent). In situation, when country of export destination is the GSP donator, it can also positively influence on the amount of trade between countries, but has a smaller effect + 7 per cent (otherwise -6.5 per cent). Being in the group of top twenty least corrupt countries doesn't influence positively on the bilateral trade and reduces the amount of trade flows for 2.78 per cent (otherwise + 2.88 per cent), and for 0.28 per cent, if the country of export destination is in top 20 least corrupt countries (otherwise + 0.285 per cent). The EU membership's impact on the volume of trade between investigated countries is predictably positive, which demonstrates that if exporter is the member of the EU, it increases the amount of trade flows for 12 per cent (otherwise -10.7 per cent). If the country of export destination is the member of the EU, it decreases trade flows for 12.4 per cent (otherwise +14.12 per cent). If both trade partners are the members of the EU, it increases the amount of trade flows for 40 per cent (otherwise -28 per cent). In case, when only one country is the EU member state, it can increase the volume of bilateral trade for 4 per cent (otherwise -3.92 per cent). The insertion of time dummy variables plays a crucial role in neutralization of the cross sectional correlation between included variables and unnoticeable $\Omega P^{1-\sigma}$ term, which diminishes the above mentioned golden medal bias and also successfully deal with the deflator problems.

[11] World Trade Organization

Table 13 *(Results of the PPML Fixed Effects Model)* *(Results of the PPML Fixed Effects Model with Robust Errors)*

	PPML_FE		PPML_FE		PPML_FE		PPML_FE
	b/se		b/se		b/se		b/se
Main				**Main**			
ln_gdp_o	.5948684	**gsp**	.2133463	**ln_gdp_o**	.5948684	**gsp**	.2133463
	.0006791		.0024667		.0773905		.0964963
ln_gdp_d	.588796	**gsp_rec**	.0672853	**ln_gdp_d**	.588796	**gsp_rec**	.0672853
	.0007004		.002078		.0409341		.112866
col_cur	1.435715			**col_cur**	1.435715		
	.0702584				.2161058		
gatt_o	.2663926	**cor_o**	-.028259	**gatt_o**	.2663926	**cor_o**	-.028259
	.0028205		.0003734		.0967701		.0210994
gatt_d	.0882926	**cor_d**	-.002843	**gatt_d**	.0882926	**cor_d**	-.002843
	.0023942		.0003758		.0717657		.0227714
rta	.4659221	**EU_o**	.1135439	**rta**	.4659221	**EU_o**	.1135439
	.0009682		.0010325		.0616151		.0669222
comcur	.1530589	**EU_d**	-.132073	**comcur**	.1530589	**EU_d**	-.132073
	.0004276		.0032278		.0004276		.1639273
BothinEU	.3290649	**OneinEU**	.0399759	**BothinEU**	.3290649	**OneinEU**	.0399759
	.0033104		.0030544		.1726206		.1421664

The liberalization of trade process, movement of people, capital and goods caused by membership in the European Economic Union , usage of single European currency (EURO) are, undisputedly, decisive factors which make newly EU integrated countries closer to the rest of Europe. In spite of fact that the strength of trade, economic and political relations between the EU member states grows up, making the European market the most important for them, it does not launch the process of trade diversification, which is characterised by the changing of main export and import vectors and compensation of possible losses on the global arena by gains on the market of the European Union. Moreover, the membership in the European Union stimulate trade between countries and leads to the effect of trade creation.

To test the effect of trade creation/diversion, the dummy variables, such as: BothinEU (1 if both trade partners are members of the EU and 0 otherwise), OneinEU (1 if the country of export destination belongs to the EU but the country of export origin does not and 0 otherwise), were introduced. In case of positive coefficient of both variables, the accession of a member state to the EU has trade creation effect in terms of trade relations with the US. Otherwise, having a positive coefficient of BothinEU and negative one (OneinEU) says about the trade diversion effect (Table 15). In case, when both trade partners are members of the

European Union, the positive effect on the trade is 35 per cent, (-26 per cent, if not). If one country is the EU member state, but another one is not, it also leads to the positive effect, which is 4.3 per cent, (-4.1 per cent, if not).

Table 14 (Trade Creation Effect)

Column1	Coef.	Std. Err.	P > |z|
BothinEU	0.3290649	0.0033104	0
OneinEU	0.0399759	0.0030544	0

The research demonstrates that the overall effect of the European integration on the amount of EU – USA trade flow is rather positive than negative, due to the absence of trade diversion effect after country's accession to the European Union. The main pillars of European integrations like introduction of transparent laws, reformation of economic, legislative and political sectors strictly negatively influence on the flourishing of corruption, increase of contraband flows and collection of political and economic power in hands of some small groups of people, which leads to the birth of brand new country with rapid increment of competitiveness on the internal market, effectiveness of economy, specialization and strongly integrated to the EU. Therefore, the essential effect of the comprehensive economic, legal and political integration created a trade creation effect.

Conclusion

This paper investigated the effect of comprehensive European Integration process on the EU – US trade relations. The research covers a long period of time from 1948 till 2017, which let to observe a real effect of different factors like geographical distance, level of trade partner's GDP, population, trade and currency unions membership, existence of common colonial history, usage of the same currency, level of corruption on the volume of trade flows between the EU member states and the USA. A possibility to work with proper and recent data gave an opportunity to make this study relevant for the international trade analysis.

A concept of the gravity model of trade played a crucial role in estimation of various factors' influence on the international trade, due to its high level of utility and elegance in usage. The comparison of results obtained from different approaches to the empirical valuation of the model, such as: ordinary least square method, method of fixed effects and random effects

models and PPML estimator, let to define the most appropriate and efficient way to run the research. The interpretation of final results was based on the outcome of PPML of fixed effects model analysis. The results of investigation can be considered as significant ones.

Summing up, it is necessary to notice the proven effect of a trade creation caused by the process of European integration. The integration of country to the European Union is comprehensive and long run process, which aim is to synchronize legislative, judicial and executive branches of power, which leads to the standardization of economic, political and social laws and norms. Consequently, an access to the single European market, allows newly integrated countries to strength trade relations with the EU members and make European countries the most attractive for export and import of goods and services. The research proved the vital effect of European integration on the increase of trade flows between the EU member states, caused by liberalization and neutralization of intra EU borders, which boost the movement of goods, capital and people within the territory of the European Union. As the result, the impact of European integration process on the amount of US – EU trade flows is rather positive than negative, which is caused by trade creation effect. Therefore, outcomes of the research can be considered as significant ones, which open the way for further investigation related to the topic.

Bibliography

Anderson, J. E. (1979). *A Theoretical Foundation for the Gravity Equation*. American Economic Review. Vol. 69, Iss. 1, pp. 106-116. ISSN 0002-8282.

Anderson, J. E. & Wincoop, E. (2001). *Gravity with Gravitas: A Solution to the Border Puzzle.* NBER Working Paper Series. National Bureau of Economic Research. Retrieved from https://www.nber.org/papers/w8079.pdf

Baldwin, R. & Taglioni, D. (2006). *Gravity For Dummies and Dummies for Gravity Equations.* Journal of Economic Integration. National Bureau of Economic Research. Retrieved from https://www.nber.org/papers/w12516.pdf

Blonigen, B. & Soderbery, A. (2009). *Measuring the Benefits of Product Variety with an Accurate Variety Set*. NBER Working Paper Series. National Bureau of Economic Research. Retrieved from https://www.nber.org/papers/w14956.pdf

Boltho, A. & Eichengreen, B. (2008). *The Economic Impact of European Integration.* International Macroeconomics and Economic History. Centre for Economic Policy Research. Retrieved from https://eml.berkeley.edu/~eichengr/econ_impact_euro_integ.pdf

Cardamone, P. (2007). *A Survey of the Assessment of the Effectiveness of Preferential Trade Agreements Using Gravity Model.* TRADEAG. University of Calabria. Retrieved from https://mail.google.com/mail/u/0/?tab=rm&ogbl#inbox/QgrcJHsTjWHQtNtnlshvpgFMfsCpqqwPmvG?projector=1&messagePartId=0.1

Carrere, C. (2006). *Revisiting the effects of regional trade agreements on trade flows with proper specification of the gravity model.* European Economic Review. Vol. 50, Iss. 2, pp. 223-247. ISSN 0014-2921. doi:10.1016/j. euroecorev.2004.06.001.

Dahlberg, E. (2015). *Economic Effect of the European Single Market.* Review of the Empirical Literature. National Board of Trade.
Retrieved from
https://www.kommers.se/Documents/dokumentarkiv/publikationer/2015/Publ-economic-effects-of-the-european-single-market.pdf

DeRosa, D. (2008). *Gravity Model Analysis*. Prospects for Greater Global and Regional Integration in the Maghreb. Peterson Institute for International Economics.
Retrieved from
https://www.piie.com/publications/papers/derosa0508b.pdf

Egger, P. (2002). *An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials*. World Economy. Vol. 25, Iss. 2, pp. 297-312. ISSN 0378-5920. doi:10.1111/1467-9701.00432

Eichengreen, B. & Irwin, D. (1998). *The Role of History in Bilateral Trade Flows.* The Regionalization of the World Economy. University of Chicago Press.
Retrieved from
https://core.ac.uk/download/pdf/6852703.pdf

Felbermayr, G., Gröschl, J. & Steinwachs, T. (2017). *The Trade Effect of Border Controls: Evidence from the European Schengen Agreement.* ERIA Discussion Paper Series. IFO Institute.
Retrieved from
http://www.eria.org/ERIA-DP-2016-36.pdf

Fouquin, M., Hugot, J. (2016). *Back to the Future: International Trade Costs and the Two Globalizations.* Working Paper. CEPII.
Retrieved from
http://www.cepii.fr/PDF_PUB/wp/2016/wp2016-13.pdf

Fukao, K., Okubo, T., Stern, R. M. (2003). *An econometric analysis of trade diversion under NAFTA.* The North American Journal of Economics and Finance. Vol. 14, Iss. 1, pp. 3-24. ISSN 1062-9408. doi:10.1016/S1062- 9408(02)00118-3.

Gil-Pareja, S., Llorca-Vivero, R. & Martinez-Serrano, J. (2014). *Corruption and International Trade.* The European Trade Study Group (ETSG).
Retrieved from
https://www.etsg.org/ETSG2017/papers/corruption-and-it_gil-et-al-2017.pdf

Greenaway, D., Milner, C. (2002). Regionalism and Gravity. Scottish Journal of Political Economy. Vol. 49, Iss. 5, pp. 574-585. ISSN 0036-9292. doi:10.1111/1467-9485.00249.

Heckman, J (1979). *Sample Selection Bias as a Specification Error*. Econometrica: Journal of the economic society. The Econometric Society. pp. 153-161

Henderson, D. J., Millimet, D. L. (2008*). Is Gravity Linear?* Journal of Applied Econometrics. Vol. 23, Iss. 2, pp. 137-172. ISSN 0883-7252. doi:10.1002/jae.974.

Kalirajan, K. (1999). *Stochastic Varying Coeffi cients Gravity Model: An Application in Trade Analysis*. Journal of Applied Statistics. Vol. 26, Iss. 2, pp. 185-193. ISSN 0266- 4763. doi:10.1080/02664769922520

Marimoutou, V., Peguin, D. & Peguin-Feissolle, A. (2010). *The « Distance-Varying » Gravity Model in International Economics: Is the Distance an obstacle to trade?* Group of Research in Quantitative Economics of Aix-Marseille.
Retrieved from
https://halshs.archives-ouvertes.fr/halshs-00536127/document

Raines, P. (2000). *The Impact of European Integration on the Development of National Labour Markets.* European Policy Research Centre.
Retrieved from
https://pdfs.semanticscholar.org/6244/e4b977659a84290cc28ada92b47e7309d9dc.pdf

Rose, A. K. (2000). *One Money, One Market? The effects of Common Currencies on International Trade. Applied Economics Letters*. Vol. 15, Iss. 30, pp. 7-46. ISSN 1350-4851. doi:10.3386/ w7432.

Sawani, M., Sawani, A. & Copeland, C. (2004). *The US-EU Relationship: How European Integration Affects US Exports to the European Union.* Journal of Case Research in Business and Economics.
Retrieved from
https://www.aabri.com/manuscripts/09173.pdf

Serlenga, L., Shin, Y. (2004). *Gravity Models of the Intra-EU Trade: Application of the Hausman Taylor Estimation in Heterogeneous Panels with Common Time-Specific Factors* [online]. [cit. 2013-10-02]. 32 p. (PDF).
Retrieved from
http://www.dse.uniba.it/Convegni/incontro_ cnr_2004/Serlenga_gravity.pdf.

Silva, S. & Tenreyro, S. (2006). *The Log of Gravity.* The Review of Economics and Statistics. MIT Press, vol.88(4), pages 641-658.
Retrieved from
https://www.mitpressjournals.org/doi/pdf/10.1162/rest.88.4.641

Tinbergen, J. (1962). *Shaping the World Economy: Suggestions for an International Economic Policy*. Periodicals Service Company. ISBN 978-052-702836-7.

Zielinska-Glebocka, A. (1991). *Theory of International Intra-Industry Specialization and Trade in Industrial Goods between Industrialized Countries*. Gdańsk University Press. ISBN 83- 7017-348-9.

Appendixes

Appendix 1

Overall Model Fit of Fixed Effects with Robust Standard Errors

Fixed-effects (within) regression	Number of obs = 41,022
Group Variable: pair2	Number of groups = 860
R-sq:	Obs per group:
within = 0.8720	min = 14
between = 0.5290	avr = 47.7
overall = 0.6716	max = 70
corr (u_i, Xb) = 0.2159	F (84, 859) = 265.11
sigma_u = 1.5609288	Prob > F = 0
sigma_e = 0.64639696	
rho = 0.85361561 (fraction of variance dur to u_i)	

Overall Model Fit of Fixed Effects with Clustered and More Robust Standard Errors

Fixed-effects (within) regression	Number of obs = 41,022
Group Variable: pair2	Number of groups = 860
R-sq:	Obs per group:
within = 0.8720	min = 14
between = 0.5290	avr = 47.7
overall = 0.6716	max = 70
corr (u_i, Xb) = 0.2159	F(86, 859) = 265.11
sigma_u = 1.5609288	Prob > F = 0
sigma_e = 0.64639696	
rho = 0.85361561 (fraction of variance dur to u_i)	

Appendix 2

Overall Model Fit of Random Effects with Robust Standard Errors

Random-effects GLS regression	Number of obs = 41,022
Group variable: pair2	Number of groups = 860
R-sq:	Obs per group:
within = 0.8703	min = 14
between = 0.8127	avg = 47.7
overall = 0.8332	max = 70
corr(u_i, X) = 0 (assumed)	Wald chi2 (90) = 24989.86
	Prob > chi 2 = 0
sigma_u = 0.67958581	

sigma_e = 0.64639696
rho = 0.52501396 (fraction of variance due to u_i)

Results of Random Effects Model with Robust Standard Errors

Random-effects GLS regression		Number of observations	= 41,022
Group variable: pair2		Number of groups	= 860

		Robust				
ln_flow	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_gdp_o	.6599835	.0297803	22.16	0.000	.6016151	.7183519
ln_gdp_d	.5607913	.0245982	22.80	0.000	.5125797	.6090028
ln_distw	-.7184515	.0567438	-12.66	0.000	-.8296672	-.6072358
contig	1.0801	.1249827	8.64	0.000	.835138	1.325061
comlang_off	.5871325	.1350968	4.35	0.000	.3223477	.8519174
heg_d	.6449805	.2234782	2.89	0.004	.2069712	1.08299
heg_o	.5326243	.1997391	2.67	0.008	.1411429	.9241057
col_cur	.6402611	.339865	1.88	0.060	-.0258621	1.306384
gatt_o	.6292254	.0555574	11.33	0.000	.5203348	.7381159
gatt_d	.3580783	.0451482	7.93	0.000	.2695895	.4465672
rta	.1779435	.0351355	5.06	0.000	.1090792	.2468078
comleg	.1033211	.0921189	1.12	0.262	-.0772286	.2838708
comcur	-.0034614	.0467645	-0.07	0.941	-.0951181	.0881952
gsp	-.1447371	.0888377	-1.63	0.103	-.3188558	.0293816
gsp_rec	-.0226363	.067038	-0.34	0.736	-.1540284	.1087558
cor_o	-.0568842	.0474095	-1.20	0.230	-.1498052	.0360367
cor_d	-.1990885	.0463846	-4.29	0.000	-.2900007	-.1081763
EU_o	.0640155	.0378532	1.69	0.091	-.0101755	.1382065
EU_d	-.0671753	.1431459	-0.47	0.639	-.3477361	.2133854
BothinEU	.2212804	.1457379	1.52	0.129	-.0643606	.5069214
OneinEU	-.0213258	.1352674	-0.16	0.875	-.286445	.2437934
cons	-4.461006	1.475266	-3.02	0.002	-7.352474	1.569538

Overall Model Fit of Random Effects

Random-effects GLS regression	Number of obs = 41,022
Group variable: pair2	Number of groups = 860
R-sq:	Obs per group:
within = 0.8703	min = 14
between = 0.8127	avg = 47.7
overall = 0.8332	max = 70
corr(u_i, X) = 0 (assumed)	Wald chi2 (90) = 268961.31
	Prob > chi 2 = 0
sigma_u = 0.67958581	
sigma_e = 0.64639696	
rho = 0.52501396 (fraction of variance due to u_i)	

Results of Random Effects Model

Random-effects GLS regression — Number of observations = 41,022

Group variable: pair2 — Number of groups = 860

ln_flow	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_gdp_o	.6599835	.008439	78.21	0.000	.6434434	.6765236
ln_gdp_d	.5607913	.0085851	65.32	0.000	.5439649	.5776177
ln_distw	-.7184515	.0301082	-23.86	0.000	-.7774624	-.6594405
contig	1.0801	.1066465	10.13	0.000	.8710763	1.289123
comlang_off	.5871325	.1500072	3.91	0.000	.2931238	.8811413
heg_d	.6449805	.1925448	3.35	0.001	.2675997	1.022361
heg_o	.5326243	.192534	2.77	0.006	.1552645	.909984
col_cur	.6402611	.2024162	3.16	0.002	.2435326	1.03699
gatt_o	.6292254	.0156766	40.14	0.000	.5984997	.659951
gatt_d	.3580783	.0156422	22.89	0.000	.3274202	.3887365
rta	.1779435	.013898	12.80	0.000	.1507039	.2051831
comleg	.1033211	.0597909	1.73	0.084	-.0138669	.220509
comcur	-.0034614	.0152848	-0.23	0.821	-.033419	.0264962
gsp	-.1447371	.0203489	-7.11	0.000	-.1846201	-.104854
gsp_rec	-.0226363	.0206642	-1.10	0.273	-.0631374	.0178647
cor_o	-.0568842	.0141474	-4.02	0.000	-.0846127	-.0291558
cor_d	-.1990885	.0140465	-14.17	0.000	-.2266192	-.1715579
EU_o	.0640155	.0152563	4.20	0.000	.0341137	.0939173
EU_d	-.0671753	.0344757	-1.95	0.051	- .1347465	.0003958
BothinEU	.2212804	.0395638	5.59	0.000	.1437367	.2988242
OneinEU	-.0213258	.0315201	-0.68	0.499	-.0831041	.0404526
cons	-4.461006	.4551627	-9.80	0.000	-5.353108	-3.568904

Appendix 3

Hausman Test

Coefficients

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	FE_ST	RE	Difference	S.E.
ln_gdp_o	.4758354	.6599835	-.1841481	.0066689
ln_gdp_d	.3969199	.5607913	-.1638714	.0068004
col_cur	.7738765	.6402611	.1336154	.0728312
gatt_o	.5638592	.6292254	-.0653661	.
gatt_d	.3014399	.3580783	-.0566384	.
rta	.156853	.1779435	-.0210905	.
comcur	-.001626	-.0034614	.0018354	.
gsp	-.1504667	-.1447371	-.0057296	.
gsp_rec	-.0492879	-.0226363	-.0266516	.
cor_o	-.1117678	-.0568842	-.0548835	.
cor_d	-.2553132	-.1990885	-.0562247	.

EU_o	.0792844	.0640155	.0152689	.
EU_d	-.1317999	-.0671753	-.0646245	.
BothinEU	.3337329	.2212804	.1124525	.
OneinEU	.0554923	-.0213258	.076818	.

Appendix 4

Results of PPML with Time Dummies and Clustered Standard Error

		Robust				
flow	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_gdp_o	.7848561	.0669323	11.73	0.000	.6536712	.916041
ln_gdp_d	.7990614	.0245999	32.48	0.000	.7508465	.8472763
ln_distw	-.8386414	.0470052	-17.84	0.000	-.93077	-.7465128
contig	.3116968	.08812	3.54	0.000	.1389848	.4844088
comlang_off	.2689994	.0836683	3.22	0.001	.1050126	.4329863
pop_o	-.0002541	.0015977	-0.16	0.874	-.0033856	.0028773
heg_d	.0167358	.2102283	0.08	0.937	-.3953041	.4287757
col_hist	-.1185333	.1625485	-0.73	0.466	-.4371224	.2000559
col_cur	1.492656	.5112505	2.92	0.004	.4906232	2.494688
gatt_o	.921715	.1290092	7.14	0.000	.6688615	1.174568
gatt_d	.5533611	.1188587	4.66	0.000	.3204024	.7863198
rta	-.092612	.0945415	-0.98	0.327	-.2779099	.0926859
comleg	.2080106	.0617838	3.37	0.001	.0869165	.3291046
comcur	.0674992	.0694221	0.97	0.331	-.0685657	.203564
gsp	-.2058604	.1436772	-1.43	0.152	-.4874625	.0757418
gsp_rec	-.1692487	.1430597	-1.18	0.237	-.4496405	.1111431
validmirror	.183254	.1621367	1.13	0.258	-.134528	.501036
cor_o	.1503542	.0507802	2.96	0.003	.0508269	.2498816
cor_d	.0427024	.0564051	0.76	0.449	-.0678496	.1532544
EU_o	-.3366794	.3289964	-1.02	0.306	-.9815006	.3081417
EU_d	.0428987	.238793	0.18	0.857	-.425127	.5109244
BothinEU	-.1222142	.2854666	-0.43	0.669	-.6817185	.4372901
OneinEU	-.5139215	.1498783	-3.43	0.001	-.8076776	-.2201655
cons	-6.134392	.9240551	-6.64	0.000	-7.945506	-4.323277

Appendix 5

Results of PPML with Fixed Effects Model

Conditional fixed-effects Poisson regression	Number of observations	=	41,325
Group variable: pair2	Number of groups	=	860
	Obs per group:		
	min	=	14
	Avg	=	48.1
	Max	=	70
	Wald chi2(84)	=	5.38e+07
Log likelihood = -3052488.4	Prob > chi2	=	0.0000

flow	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_gdp_o	.5948684	.0006791	875.93	0.000	.5935373	.5961994
ln_gdp_d	.588796	.0007004	840.66	0.000	.5874233	.5901688
col_cur	1.435715	.0702584	20.43	0.000	1.298011	1.573419
gatt_o	.2663926	.0028205	94.45	0.000	.2608645	.2719207
gatt_d	.0882926	.0023942	36.88	0.000	.0836	.0929852
rta	.4659221	.0009682	481.22	0.000	.4640244	.4678197
comcur	.1530589	.0004276	357.91	0.000	.1522207	.153897
gsp	.2133463	.0024667	86.49	0.000	.2085117	.2181809
gsp_rec	.0672853	.002078	32.38	0.000	.0632125	.0713582
cor_o	-.0282594	.0003734	-75.67	0.000	-.0289913	-.0275274
cor_d	-.0028437	.0003758	-7.57	0.000	-.0035804	-.0021071
EU_o	.1135439	.0010325	109.97	0.000	.1115203	.1155674
EU_d	-.1320732	.0032278	-40.92	0.000	-.1383995	-.1257468
BothinEU	.3290649	.0033104	99.40	0.000	.3225766	.3355533
OneinEU	.0399759	.0030544	13.09	0.000	.0339895	.0459624

Results of PPML with Fixed Effects Model and Robust Error

		Robust				
flow	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_gdp_o	.5948684	.0773905	7.69	0.000	.4431858	.7465509
ln_gdp_d	.588796	.0409341	14.38	0.000	.5085666	.6690254
col_cur	1.435715	.2161058	6.64	0.000	1.012155	1.859274
gatt_o	.2663926	.0967701	2.75	0.006	.0767267	.4560584
gatt_d	.0882926	.0717657	1.23	0.219	-.0523657	.2289508
rta	.4659221	.0616151	7.56	0.000	.3451587	.5866854
comcur	.1530589	.0441693	3.47	0.001	.0664887	.2396291
gsp	.2133463	.0964963	2.21	0.027	.024217	.4024755
gsp_rec	.0672853	.112866	0.60	0.551	-.1539279	.2884986
cor_o	-.0282594	.0210994	-1.34	0.180	-.0696135	.0130948
cor_d	-.0028437	.0227714	-0.12	0.901	-.0474749	.0417875
EU_o	.1135439	.0669222	1.70	0.090	-.0176213	.244709
EU_d	-.1320732	.1639273	-0.81	0.420	-.4533648	.1892185
BothinEU	.3290649	.1726206	1.91	0.057	-.0092652	.6673951
OneinEU	.0399759	.1421664	0.28	0.779	-.2386651	.318617