



EUROPEAN EXPORTS TO BRICS COUNTRIES. MODELING TRADE THROUGH A GRAVITY APPROACH.

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EXPORTS FROM EUROPEAN UNION TO BRICS COUNTRIES

Abstract

The Trade flows are increasingly gaining importance around the world. Actually, all the world is involved in the global trade, so this topic creates a great interest for all the countries. The main objective of this analysis is to evaluate the determinants of the European exports to BRICS countries and, particularly, the determinants for the agricultural and manufacturing sectors. The period under study spans from 1992 to 2013. It has been estimated a gravity equation that allows quantifying the influence of the income levels, population, size and the geographical proximity. Using the estimations results of the gravity equation we can conclude that European exports are positively correlated to income of both European and BRICS countries. Likewise, distance affects negatively trade as element of resistance.

KEY WORDS: EXPORTS- TRADE EQUATIONS - GRAVITY MODEL- EU- BRICS

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1. INTRODUCTION

Nowadays the trade flows are very important worldwide, and international trade it is considered one of the most relevant engines for economic growth. Since the end of the II World War, an increasing part of global trade has taken place between developed countries but in the recent years the developing countries have increased their shares in the world merchandise exchanges. Besides, trade has increased faster in developing countries than in developed countries, so that reflects a great opportunity for this group of countries to develop their economies and reach a better share in the global market. For this reason this topic is a current issue for all the countries.

"Trade has become the lens through which development is perceived, rather than the other way around" (Rodrik, 2001 p.5). The trade has grown along the last decades thanks to the reductions of the costs of the transport and the improvements of the communication. Firstly, this great growth began with the Industrial Revolution which introduced a model of growth that has led to an economic development from the beginning of the 19th century, but really it was after the II WWI when trade grew more dramatically.

Overall, the great growth of the global trade has been fostered partly due to the creation of several international institutions such as GATT (General Agreement on Tariffs and Trade), the UNCTAD, the WTO (World Trade Organization) or the OPEC (Organization of the Petroleum Exporting Countries) and as regards agricultural field exists the agreement of basic prices. All these organizations has helped to reach an integration between countries and a economic convergence which allows to improve the global trade. This aspects has attracted the attention of many researchers.

This topic it has been chosen because of its actuality and its importance around the world. Why the countries trade? Everybody take part in the trade routinely but small scale purchases, thus this topic it can be interested for the population as well. And moreover, emerging countries are growing faster than developed countries and are reaching great market positions, mostly China who seems not to have limits in its expansion. Thus it is possible that the global trade changes in the next years and China becomes the number one of the world, since "Asia plays an increasingly important role in world trade" (WTO, 2013). As a matter of fact, the WTO indicates that "among 1980-2011, the developing economies has increased their share of the world exports from 34% to 47% and its share of imports world from 29% to 42%".

As the trade between two areas creates economic expectations and as a consequence it improve the relationships between them as well as it generates a huge integration. Generally, The trade might provide great gains since allows offer to the countries a series of advantages: (1) exploit its comparative advantages; (2) reach greater economies of scale; (3) ensure the competition with a wider range of products and an stability of the prices. Thus, the global trade generates an improvement of the production level. And as a result it promotes the economic development and the well-being of the population.

For this reason, this topic attracts a great deal of interest for many professional economists and experts. Because of the importance of the issue for the economic performance it has been considered to study this topic deeply. Along the study, the main aim of this paper, is to study the influence of the variables in the trade as well as the account of the European exports have been exported to BRICS countries, both in agricultural field and manufactured field.

Against this background, taking in account the great relations between the variables, their significance and their expected sign it has been created a several hypothesis:

- It is expected that the trade increases as the European GDP's or emerging GDP'S increases.
- The distance which separates the considerate countries has a negative impact on the trade.
- Different market behavior in the difference sectors. It is expected that the trade in the manufacturing environment is larger than in the agricultural sector.

This project has been structured in six sections. Firstly, it has been carried out a literature review about the trade flows, which indicates us what we know about this topic at the present time and how the researches have drawn their conclusions. Secondly, it has been made an investigation about the Europeans exports in the agricultural field and manufactured sector and its results have been commented.. Thirdly, it has been described the methodology of the data and how they have been obtained. Also how the variables have been created to be used in the gravity equation. In the next section, it has been elaborated a gravity model which determinate the relations between the variables and their significance. Finally, on the basis of the results obtained it has been drawn a several conclusions of the European exports to BRICS.

2.LITERATURE REVIEW

Many studies and theories have been written regarding the trade flows between two different geographic areas. This has provided the author a general background about the issue and it has contributed ideas to put forward a new model which explains the trade flows between European Union and emerging countries BRICS.

There are two theoretical frameworks -the classical and neoclassical theories- that dominated the economic thought until middle of nineteenth century. Some classical theories, as for example the Ricardian theory (Ricardo,1816), justify that the global trade is based on the comparative advantages theory, the theory of the absolute advantage (Adam Smith, 1779) or the specific factors theory (Heckscher-Ohlin). However, all these classical theories were static models and the comparative advantages may change over the time generating important modifications in the trade patterns. In consequence, The New Trade Theory (NTT1) is based on dynamic comparative advantages. Nowadays, most global trade is performed in industrialized countries where the exchange of differentiated products is the most important although they belong to the same industry. Then,the intra-industry trade is the predominant (Helpman, 1999). Thus, new theories appeared throughout the eighties which were suited to the real existing market environment. One of the authors of these new theories was Krugman (1985).

Despite many of the documents used to support this paper are not specific studies of EU and BRICS, they have been analysed following the same pattern.

Most of the economists and scholars have based their studies on the gravity model to determinate the trade flows between two difference areas. The majority of the papers and investigations are supported by the Tinbergen´s article (1964). In his test he figures the discrepancy between developed countries and developing countries. He makes reference to the differences of the taxes and the tariffs and its consequences. So, Tinbergen claims that the economic development is the main problem of the economic world. For this reason, he studies in greater depth these aspects since the trade flows help to accelerate the growth of a country. He was who determinated that the main determinants of the trade pattern between countries are the size of the countries and the distance that separates each country. After his studies, he concluded

¹New Trade Theory: is a collection of economic models in international trade which focuses on the role of increasing returns to scale and network effects, which were developed in the late 1970s and early 1980s.

that the developing countries might be benefited from the trade flows because developed countries trade with countries that have a smaller size.

Anderson (1979) focused on the differences of products and he showed that the gravity equation might be derived from the cost models under the conditions of the different products. After that, Bergstrand (1985) demonstrated that the classic gravity model was wrongly specified since it omits some relevant variables as the prices. Then, this model cannot explain the trade flow. Thus, Bergstrand presented a model of the general equilibrium of the world trade. From this model the general gravity equation was created, which includes the prices. He showed that if the trade flows were differentiated by its country of origin, the omitted prices variables would generate a specification error. He strongly argued that the general gravity equation was more appropriate than the classical equation. However, if we think about the premise of the international substitution of goods, the general equation will be reduced as the classical gravity equation.

After that, appeared a theory based on the monopolistic competition. Feenstra (2002) explained that the increasing returns to scale could be an explication of the trade. His theory was based on the monopolistic competition model, so the countries are absolutely different in the production of goods. He used the gravity model to determinate the trade flows between two areas, however to meet the differentiation of products supposition it takes into account an identical demand between countries, besides the free trade. Feenstra concluded that the countries with similar size tend to trade more.

Most of the studies have been based on the gravity model, and it has been determined by simple gravity equation which variables are the GDP and the distance. However, with this equation most of the variables which might affect the trade flows are not considered. (Bergstrand,1985). Thus, many authors guided by their experience have included new variables that analyse these unconsidered aspects.

There a lot of studies that have applied the gravity model to determinate the trade flows. Trade flows between the European Union and MERCOSUR were studied in 1999 through an exports function during the period 1967-1995. (Cuadros "*et al*", 1999). The data used was annual with 28 periods (1967-1995). (1) The European exports, the European relative prices with regard to MERCOSUR, (2) the European relative prices with regard to EEUU, (3) the income of MERCOSUR and (4) the income of European Union were the variable used for the research. First of all, they made an analysis to know the seasonality level of the variables, being then possible to

determinate the most appropriate econometric model. For this analysis, it was used the Dickey-Fuller "augmented" contrast, both for variables in level as for variables in first differences. Since all the variables at levels resulted non-seasonality, they had to use the co-integration technique in order to obtain the analysis of regression avoiding the problems of non-seasonality; therefore it was necessary to apply a multivariate model and the Johansen methodology.

Finally, they end up with a demand equation about EU exports to MERCOSUR, pretty stable and according to expected. They concluded that the evolution of trade flows between Europe and MERCOSUR showed clearly importance since the 90s motivated by the liberalisation process as result of the institutional frame regarding the economic agreements between both blocs. Besides, the relation between the relative prices and the rent were enforced at the time they achieved to have a valid model. Because of being a long-term analysis, it can be stated that exists a stable relation between the model variables, with expected results.

A similar study carried out by InmaculadaMartínezZarzoso, J.IsmaelFernández Guerrero and Manuel CantavellaJordá(2003)estimated a gravity equation for the study of international trade flows between 34 countries, but they especiallyanalysed the effects derived from the preferential agreements European Union (EU), North America Free Trade Agreement (NAFTA), Caribbean Community (CARICOM) and Central American Common Market (CACM). Such applied estimation had as objective the explanation of the impact of many variables (such as trade preferences, geographical distance, population, common languages... etc.). The data used along this study are also annual in order to determine the temporary impact (20 years period) of the variable already mentioned. This study was characterized by panel data based on 22.440 observations, and were applied several methodologies. Firstly, it was made a global regression where Ordinary Least Squares (OLS)were used for annual estimations. Then, for 5-years period average data estimations, they applied the estimator *entre-grupos*. Finally, for estimations with only one exporter country (whether Spain or Mexico), it has been applied *intra-grupos* estimators. For this particular case, it was concluded that the gravity equation presents a higher co-relation coefficient for Spain than for Mexico. Besides, the fact of sharing language (Spanish) has been crucial, and its integration into the EU evidences a positive impact. The results got regarding the estimation of this study generally show expected outcomes with relevant variables. At the time, the results have been related and justified by political events linked with the topic. In fact, along this paper has been determined that the trade

between EU, Mexico and Spain is positive, and this can be justified by the free-trade agreement "EU- Mexico."

Other essential paper to gain knowledge about this topic is the European Central bank paper. Its purpose is to analyse the trade integration of the Central and European Countries (CEECs) within the Euro Zone in the past ten years, and to draw conclusions for further integration. It is based on panel data econometrics, and its study includes 61 countries from 1980 to 2003. Also some dummy variables have been included in this paper. One of them is the dummy variable for common countries, which includes the countries that in the past 20 years were a member of the same country. Another one is the common language variable, that is to say that dummy variable takes value one if in both countries most of the population speaks the same language. Finally, other dummy variable is the one of sharing the same border. As a result of this paper, all the variables applied are relevant and have the expected signs because of the geographical proximity between CEECs and euro area and their GDP.

Moreover, the result of the regression suggests that at the beginning of the period, the trade was lower than at the end of the period when it had a convergence and a trade improvement. Apart from studying the level of the convergence, this paper also shows some important methodological issues. First of all, the paper establishes the significant heterogeneity of the trade intensity across countries, which supposes a significant bias in OLS estimations. Secondly, it is also analysed the issue of non-stationary variables, which seem to have implications in this context, as suggested by the robustness of DOLS estimations. Finally, it has been demonstrated that the predicted trade values of the gravity model can be biased if it does not take into account adjustments to standard trade conditions after the opening-up of Eastern Europe, which can produce distorted estimations for the fixed effects.

The results obtained show that most of the largest CEE countries have progressed towards a better trade integration in the whole economy. However their trade is lower than the regression has showed, most of the small European countries show a low degree of trade within the euro area and the world economy. Thus, as the potential for market integration of the CSEE countries with more distance, more industrialized and emerging countries is higher than within the euro zone, it is possible that the relation trade between the euro area declines.

²Dummy: Dummy variables are qualitative variables, also known as binary variable. They just take values 0 or 1 to indicate the absence or the presence of some categorical effect that might be expected to shift the outcome.

More authors who applied the gravity model were Cárdenas and García (2004) such as the Colombian case. They also applied the gravity model as a tool for explain the trade flows between countries. They used panel data between 178 countries, for the period 1948-1999. They estimated by fixed-effects the gravity equations and determined the effect on the trade in each sector of the free trade agreements that has been agreed by US with other countries but are the same for Colombia.

This study argue that a free trade agreement between Colombia and US, would increase the bilateral trade in 40,5%, whereas the trade will decrease in 57,6% if the agreement were not signed. Moreover, also it settled that the costs of the transport are a determinate as they have realized that the American imports elasticity's regarding to the costs of the transport is -0,5%. So this indicates that a cost reduction in 10% would increase the exports of a country to US in 5%

In the same way, Umaña (2011) also established the effects of the free trade agreements but among US, Colombia and EU. Umaña, exposed the absence of the theory for the gravity equation, while claim that to explain the empirics results, it have been necessary lot of effort. In his paper, he concluded that the free trade agreements among EU, US, and Colombia provide benefits for the Colombian economy. However these agreements do not supply enough economic growth for the development of Colombia. Finally it has been demonstrated that the gravity equation is suitable with the new theory of the Global Trade.

Regarding to the trade between EU and BRICS, there are some researchers that have been interested in the emerging economies since they are growing faster than other developed economies. It has been found a paper that highlights the main trends of the trade flows and the investment between EU and BRICS in comparison with Japan and USA and the determinants that encourage to this flows and their consequences. This paper has been written by Lulia Monica from the Romanian Academy, Institute of World Economy in 2011. As a result of this paper, it can be said that the relations between BRICS and developed countries is the key for the modernization and innovation strategies. Moreover, the quantity of Europeans exports is being exceeded by the exports of those emerging countries that are the most powerful emergent economies all around world. So European exports are following a downward trend meanwhile BRICS are substantially increasing. According to this paper, the trade flows between both areas have increased in the last ten years, emphasizing the great evolution of Chinese and Russian shares on the market of Europe. In 2009, China was the third major exporter for the European market, and the

main import source for Europe. Russia was the fourth exporting country, India the eighth and Brazil the 12th. In reference to the imports: China is the first import source for Europe, Russia is the third one, Brazil the ninth and India the tenth. As a result, this paper indicates that EU is the most important trade partner of the BRICS countries, both in the sector of exports and imports. However, in the services sector, the trade flows are not as big as in the goods market. Nevertheless, even if the lower share held by the BRICS group in the services European market, the EU-BRICS balance of trade in services recorded a surplus in 2009, which represented a quarter of the EU surplus of their relationships. Another critical point that this paper proposes is that the FDI (Foreign Direct Investment) of the EU is much lower than the trade flows that are flowing. However, it has been estimated that in the next years the investments flows between BRICS and EU will improve. Also the movement from producing to innovating will deepen the trade relations between both areas. Finally, this document concludes that the BRICS will develop much faster since China hopes to become innovation-oriented country by 2020 and expects to become a leader in science and technology by 2050. India hopes to be a developed country before 2020 and Russia aims to become a competitive and innovative nation at global level. Brazil –which is very powerful in the strategies in energy and agriculture- has the goal to accelerate innovative processes. Consequently, developed countries and the EU-which are worldwide leaders in innovation and services- will continue having an essential role in the process of innovation of the BRICS group. Then, it is expected that EU and BRICS continue to have the trade relations.

Regarding to the trade of goods and services between EU and BRICS, Peter Havlik, Olga Pindyuk and Roman Stöllinger's paper is crucial. The aim of this paper is to analyse the external trade of goods and services between EU and BRICS. It is based on the idea that EU is the worldwide leader exporter of goods and the second largest importer, behind US. The analysis of this paper indicates that China and Russia are the main EU trading partners among BRICS and that the EU trade with BRICS grew up faster than the average during the period from 2000 to 2008. It also shown that the Europeans imports from the BRICS were rapidly rising. The main European exports represent manufacturing industry with about 91% of the total. This is because the high level of technology of Europe. However other industries are smaller, such as agriculture. Although in the case of the imports the bulk of overall Europeans imports are more diversified, the manufactured products prevail, especially from China and India. Apart from the manufacturing imports, the imports of mining products are important as well. Brazil imports non-energy mining products and Russia imports

mostly crude oil and natural gas and the agricultural imports are only imported by Brazil. Regarding the service sector, this paper indicates that the trade of services is much less important than the good trade .The share of the BRICS in global services trade is much lower than developed countries, in particular the most powerful countries in services trade among the BRICS are India and China. However, this situation may change in the future as all BRICS countries have been increasing their services exports much faster than the Europeans countries, because nowadays they are rising very fast. In fact, the services exports of India has increased more than 5 times during the period 2000-2007, thus the service trade of BRICS is increasing over the years.

3. DESCRIPTIVE FRAMEWORK

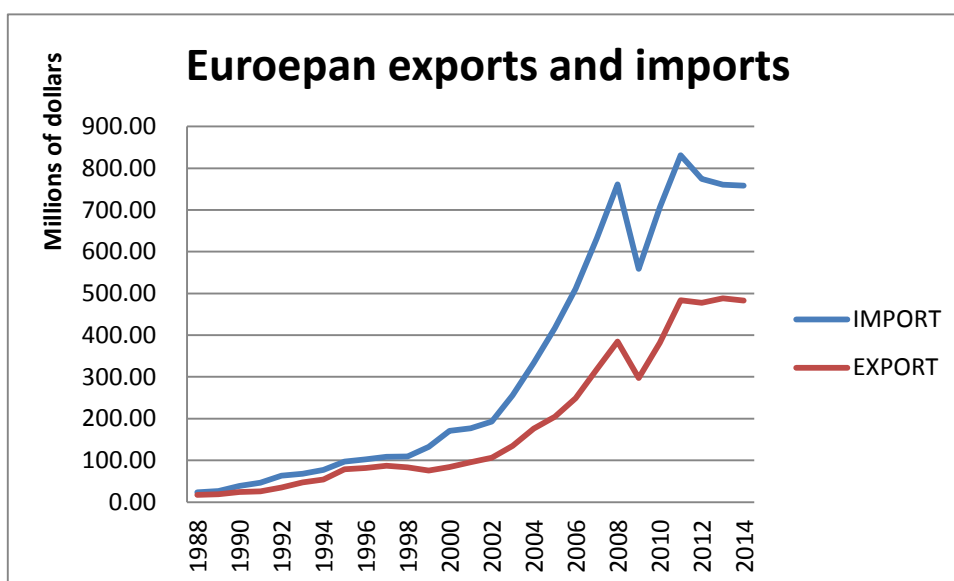
In the last years the interest on how to evolve exports and imports between two areas has increased, especially the in emerging economies as they are the countries that have grown faster in recent years. They also adopted new technological advances that have favored the production and development. BRICS economies are benefited by their size and their dynamic of their economies since it allows them to increase their capacity of generate innovation because: (1) these countries can innovate on a much larger scale, than other economies, based on their own investments in research and development and improvement of labour force. (2), They have the financial capacity to acquire new technologies, (even the High-Tech (HT) companies). (3) All the BRIC countries represent attractive locations for foreign direct investments (FDI). From the five emerging countries, China is the most powerful in fact "China opened its huge domestic market" (OECD, 2010, p. 121).

Thus, this section attempts to describe the exports from Europe to the BRICS countries. Firstly global exports, that represents what is trade enters Europe and BRICS, will be analyzed. And secondly, in particular, will be treated agricultural exports and exports of manufactures. It is worth mentioning that European countries considered in this study are not all EU members, only the main exporters of European Union which are Germany, France, UK, Italy, Spain and Belgium, which together account for 82% of total EU exports.

First of all an analysis of the overall trade between the two areas will be made, both in terms of exports and European imports. The graph below shows an evaluation of the flow of imports and exports of European countries mentioned above from 1988 to 2014. These data were obtained from the base of Datacomex Database in thousands of dollars, but for explain the graphic 1, the data have been transformed in millions of dollars.

³Throughout this document The main European exports refer only to the six countries considered. (Germany, France, UK, Italy, Spain and Belgium)

Figure 1: Exports and Imports from a selected group of European countries (1988-2014)



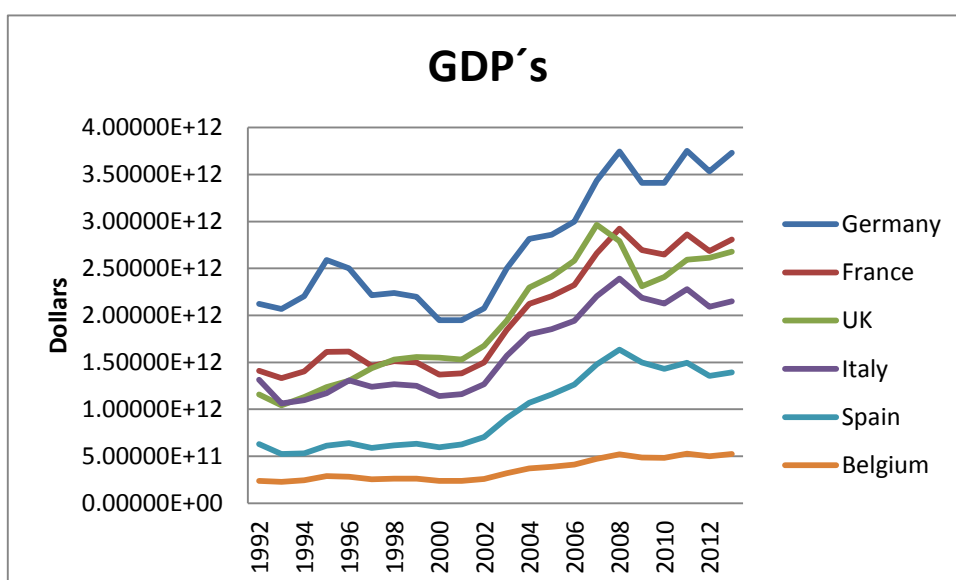
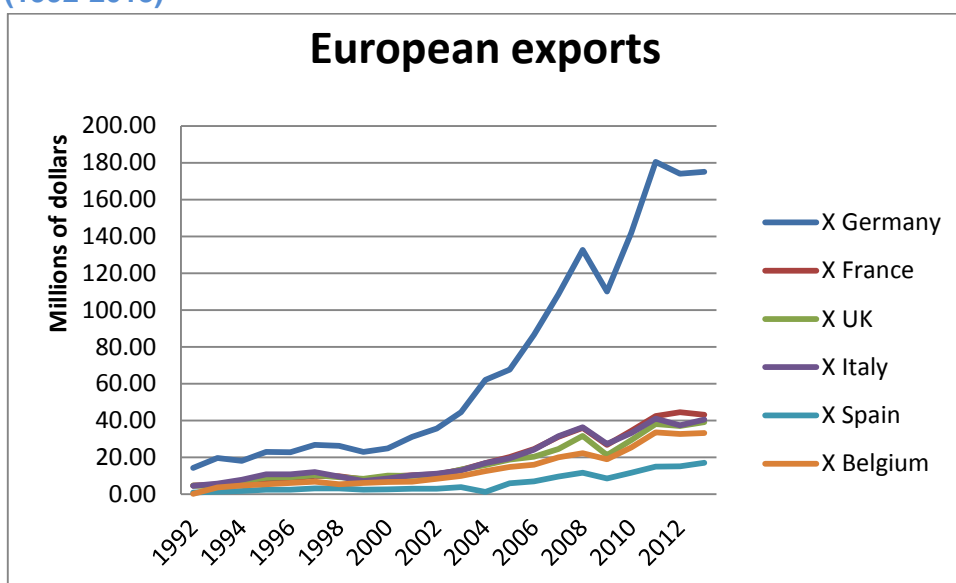
Source: Own elaboration from Datacomex

As can be seen the evolution of the flow of imports exceeds that of exports throughout the course, so we can say that Europe purchases more than sells. This may be due to several factors. One of them is the difference in GDP between European countries and the BRICS, as the GDP of European countries is higher, and this reflects that European countries are richer existing material and have greater production of goods and services, (which provides greater purchasing power for goods). In the early years, flows are more uniform in ascending but not very fast. They are more steadily. From 2000, we can see that growth between the two starts blunted growing imports of European exports. At this time the world trade volume grew more than expected and it came backed by the recovery of growth world GDP, by the good results of the EU in terms of growth and the recovery of the countries of Southeast Asia. In 2000, Europe reached a GDP of approximately 3.4% while BRICS approximately 2.3%. However it is noteworthy that the BRICS countries exceed the growth rate at 7.9% while the advanced countries have been around 2% in the years 2000-2010. This difference in growth is due to growth in activity in Brazil, and also because of the growth of India that has joined the great growth of China. Then in 2008 it can be observed a peak expansion in both exports and imports between 2008 and 2009. After that, it suffered a drastic fall as a consequence of the effects of the financial crisis, which was reflected after the turmoil in financial markets. This crisis was originated in the United and States quickly spread to all financial markets in the world. But rather the crisis hindered the

European trade creating greater losses, more than in other continents or areas. With regard to the effects of the global crisis to the BRICS, their balances were more unstable, especially for those commodities and products derived from natural resources that reflect a significant portion of their exports. Both the decline in European imports from the BRICS countries, and the fall in European exports to the BRICS countries justify the fall of both lines in figure 1 in 2009. From 2010 it is reflected a slight recovery, but the global economy weakened again in 2012, particularly within Europe. The trend of imports decreased more than exports as many European countries are in critical situations because of the debt, high unemployment rates and financial fragility, so it is no longer possible to buy as much as in previous years, and this in turn indirectly affects the emerging form, through reduced demand for exports .

It is expected that trade flows are proportional to each country's GDP, since GDP measures the economic growth of a country, that is what a country earns during a period of time. In addition, "numerous studies have found that the sensitivity of trade to GDP has been increasing over time" (Bank of Spain, 2010). The following charts show the trends of both GDP and the number of European exports flow in the same direction and simultaneously.

Figure 2: Exports and GDP's from a selected group of Europeans countries. (1992-2013)



Source: own elaboration from Datacomex and World Bank

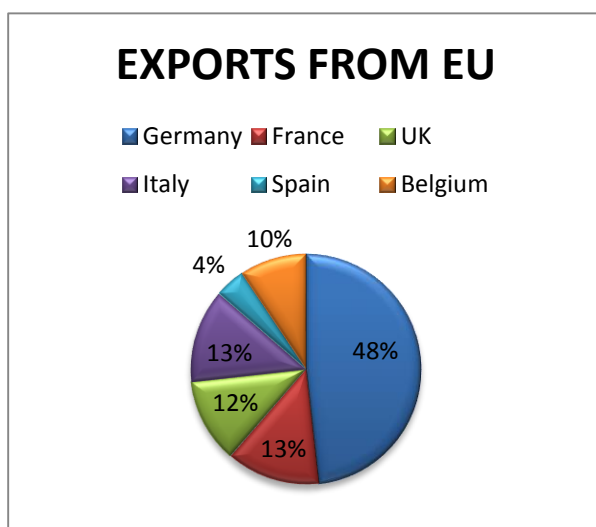
As shown in Figure 2 , trends in both lines follow the same path which means that the GDP has a positive effect on exports from the countries concerned. In other words, a country that has more income, that is bigger, that has more population and has increased production reflects an increase in exports from that country. For example we can see that in 2008 a fall in both graphs is observed and this is justified by the great recession that was then. This recession hurt to rich countries to each others, to European countries. Many experts say that this international financial crisis consequences reflected primarily in developed countries with a high inflation, what leads to a fall in GDP. It also leads to a fall in their exports and as a result, the decline in

exports had a negative effect on the BRICS because of their close trade links, since European countries decreased foreign investment and industrial production. However in 2010 we can see a recovery in both GDP and exports, and it can be thought that this is a consequence of the currency war that occurred in 2010. This year, countries lowered the price of their currencies to purchase competitive advantages and thus facilitate exports, so in this period a trend to an increase in exports helps to soften the crisis situation and in turn GDP recovery occurs.

Then, during the following years the changes in trade are not very significant, and as it said the WTO (2010) "trade remains discrete levels in 2013 after weak growth in 2012 because the European economies still face problems ". So, the trend of both GDP and exports in Europe is positive although the pace of growth is slower than that experienced in the years before the crisis. However, Germany is the country that stands out compared to other European countries and their exports in recent years show a high positive trend that is concordant to its GDP. During all the years Germany remains the main exporter and is who has the biggest GDP. So, this case can be observed clearly in the graphs above where the size of the GDP affects positively to the account of the exports.

3.1 European global exports

Figure 3: Exports from a selected group of European countries (1992-2013).



Source: OwnelaborationfromDatacomex

During 1992 and 2013 the European exports considered accounted for 82% of the total European exports. In particular, Germany was the leading exporter of Europe within the six countries considered (Germany, France, UK, Italy, Spain and Belgium) Firstly, during 1992 and 2013, Germany represents 48% of total exports within the six European countries determined in this work. Germany is regarded as "the engine of Europe" (JM. Morales,

2011). This can be justified by the prestige of German companies internationally, apart

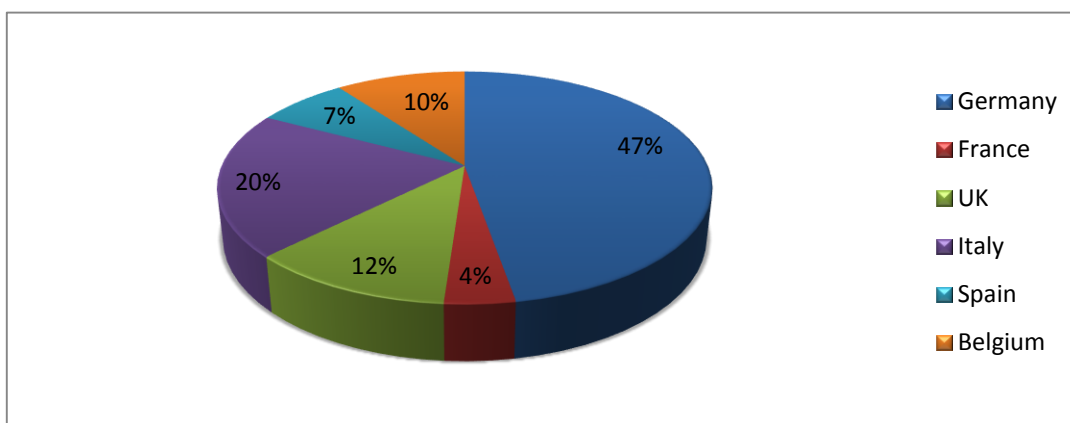
from being the largest market within the European Union. Germany is characterized by being an innovative economy, with a large investment in R & D (Research and Development). So it is a country specialized in development and manufacture of complex industrial goods, particularly innovative production technologies, making it grow even more strongly. Firstly, the German economy stands in mechanical engineering, automotive, electronics and the chemical industry. Secondly, Italy, France and United Kingdom, have roughly the same total and per capita output, so that the percentage of exports to the BRICS are similar, representing a 13% for the first two and 12% for United Kingdom. France's exports are positioned in high-tech products but mid-range, although it is more productive in the agricultural sector. It stands behind Germany and they are declining by growing exports of the BRICS. As far as Italian exports are driven primarily by clothing, food and luxury cars, but it also exports precision machinery, chemical and electrical products. However these products are not as important and are behind France and the UK.

The main UK exports are crude oil, prepared medicines, petroleum oils and preparations. Finally, Spain and Belgium are the least weight reflected in trade of European exports within the countries considered, representing 4% and 10% respectively. In relation to GDP of each country (relative terms), Germany is the leading European exporter because its large population and production, what drives the country to lead Europe.

3.2 Manufacturing exports.

In the next figure, it has been showed the percentages of the European exports of manufactures to BRICS countries from 1992 to 2013.

Figure 4: Manufacturing exports of a selected group of Europeans countries, in absolute terms (1992-2013)

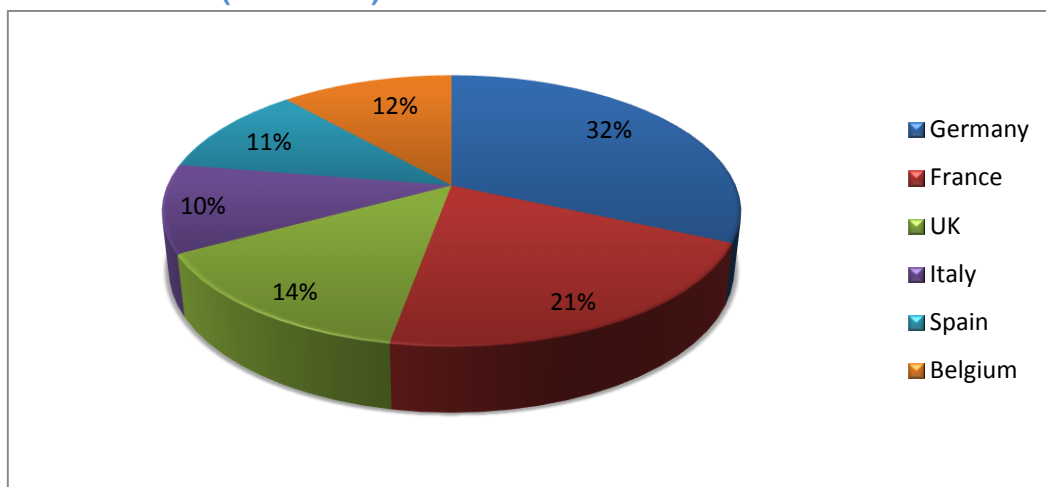


Source: own elaboration from Datacomex

It can be observed that Germany is the largest exporter within the manufactured sector. This sector has improved the German GDP, as a matter of fact, the increased demand of emerging markets in Asia has improved the growth of the German economic growth. Germany is characterized by the specialized sectors, such as mechanical engineers, electronic equipment, automotive industry and chemical products. But the automotive industry is one of the most important sector of the country, since is the third exporter of vehicles of the world. However France, is the least exporter of manufacturing products, since it is more focus on the agricultural sector. Italy is the second most productive in the manufacturing fields. In Italy the manufactures sector includes a majority of small and medium enterprises and the specialization in mature sectors. In United Kingdom the sector which more represents its economy is the service sector, although also it is competitive in transport material, biotechnology and chemicals products. Spain is not very competitive in exports of manufactures products because is stronger in the agricultural sector, as well as France, (in relative terms), this is because their climate and also because it can be possible that other Europeans countries such as Germany are more advanced in the field of the technology.

3.3 Agricultural exports

Figure 5: Agricultural exports of a selected group of European countries , in absolute terms (1992-2013)



Source: own elaboration from Datacomex

However, regarding the agricultural sector, export rates of the European countries listed above are not the same, as this sector is generally more restricted. Germany remains the leading exporter in the field of agriculture but represents less percentage than other sectors, such as industry sector. In agriculture, Germany represents 32% of total agricultural exports (in absolute terms). Germany remains the largest exporter because it is one of the most productive populations of Europe. However, this sector not provide much wealth the German economy. In fact, "the German agriculture represents less than 1% of GDP and employs 1,5% of the workforce" (TradePortal, Santander)

France is the second power representing 21% of EU agricultural exports. This percentage may be taken into account as it is close to the German rate. This is due to the large surplus in foreign trade in agriculture. This sector is for the French economy one of the most dynamic, and in recent decades has experienced large increases in productivity with high yields. Nevertheless, there are expectations that the agricultural field will decrease in the coming years, as since some years ago, the sector has been deteriorating due to a drop in income per farm. As a result, there has been a rise in fertilizers prices and contrary, the prices paid to farmers have not been increased. UK represents 14% of total agricultural exports. UK is characterized by the recognition of science and agro-technology research, by developing new crop varieties and new cultivation techniques in order to increase crop yields and improve efficiency. These breakthroughs lead to increased productivity in the UK, leading to an increase in

agricultural exports. Finally, Italy, Spain and Belgium are in similar situations with lower percentages from previous countries. However it is important to remember that this situation is the corresponding absolute terms. In the case of Belgium this percentage can be justified because Belgium mainly is a country of services, so the agriculture sector does not contribute to much money for the Belgian economy.

4. ANALYTICAL FRAMEWORK

4.1 Theoretical Foundations:

As we have seen in the literature review, normally, these kind of topics are analysed by Gravity models since Gravity modeling has experienced a rising popularity over the years and it is a commonly used method. This model is an effective tool for determining the trade flows between countries. The main idea of these models is to apply the Newton theory to the trade flows. That means: to link the attraction or gravity between two objects to the size of its mass and to the distance that separates the countries. In this regard, it can be said that some factors such as (1) the size of the economies of all the countries, (2) the distance between each, (3) the bilateral rate of exchange and the existence of a mutual border or (4) the language or the culture... among others, may influence directly in the trade bilateral flows. To put it the other way round, that means that the gravity models support that the bulk of the bilateral trade is proportional to the size and the incomes of the country and also inversely proportional to the distance between each country. "The gravity models are very popular in analyzing economic phenomena related to the flow of goods and services". (LászlóMátyás, 2003).

Following the lead of previous studies it has been empirically shown that, indeed, the appropriate method to analysed trade flows between two geographical areas are the gravity models. "Gravity has long been one of the most successful empirical models in economics" (E.Anderson 2011)

The gravity equation in international trade is one of the most robust empirical finding in economics. Actually, the first economist to apply the gravity model to know the determinants of trade flows was Jan Tinbergen (1962), who received the first Nobel Prize in economics. Other pioneers were Pöyhönen (1963) and Linnemann (1966). To determine the flow of international trade, they based their studies on the Law of Universal Gravitation. This law succeeded in determining trade flows considering the size of the countries studied, their income levels and the distance that separates them. The gravity model can also be perceived as a simple representation of supply and demand, because the more levels of income has an exporting country the more exports it may offer. From the demand view, the higher the levels of incomes of countries who receive the exports are, the higher the exports demand. So these income levels of countries are often measured by the GDP.

Regarding the distance between countries, which acts via a negative relationship, usually is measured by the distance between capitals, although exist other methods as using the formula *great circle distance* which also uses latitude or longitude and in addition the distance. It determines the location and degree of centrality in space apart from determinate the distance. Regarding to the theory, the estimate coefficient for the distance it is, in media terms, around -1.

At the beginning, the main criticisms of the gravity model was the lack of theoretical principles of gravity model, but around the end of the 70's, several authors shown that the function of gravity can theoretically could be based from several models of trade. First, Anderson (1979) proposed a gravity model which was based on differentiated products. After, it was performed a gravity model based on monopolistic competition by (Bergstrand, 1985). And then Helpman and Krugman (1985) were guided by differentiation products and by the increasing economies of scale.

In the nineties, Deardorff (1995) showed that standard economies could justify the gravity equation. However, in 2000 was Wincoop and Anderson who introduced a new term which identified a more complete and deep explanation of the empirical results derived of the gravity equation applied to trade flows.

Finally, there are many more authors who have participated in the improvement of the gravity model to model the global trade flows, such as Breuss and Egger (1999) and Egger (2000). There are others who have participated in the improvement of the explicative variables introduced into the model of gravity such as Helpman (1985).

4.2 Data used and construction of the variables.

This paperwork is based on secondary data. Theories and investigations related to trade flows proposed by researches and economist have been used along this research to be able to sum up with a final conclusion.

Thereby, the studies found as well as theories about the global trade are going to be deeply studied to gain knowledge about the topic. The vast amount of information and literature about this topic made by researchers and experts in the issue, have been highly valued and convenient for the analysis. After exposing the literature review in order to provide a general background of the trade flows and the gravity model, it has been created some variables in difference models. It has been estimated three different models which are differentiated by dependent variable. These variables are

considered secondary data also since they have been obtained by the Dtacomex's database or the World Bank's database.

To perform the analysis there has been first built the necessary variables. On one side appears the variable *trade* which determines the value of European exports to BRICS. Overall this analysis has considered Europe as the country of origin, i and the BRINCS countries have been considered as countries of destination j .

The data for creating the variables were obtained from the database of Foreign Trade Statistics in Spain (DataComex). This database contains reports on the Spanish foreign trade, which allows searching for: flow, country, territory, dates, transportation, delivery conditions and measures. It is published by the Ministry of Economy and Competitiveness. The database used to import the data and estimate the model of this study, contains 660 export operations from the 6 European countries considered (Germany, France, United Kingdom, Italy, Spain and Belgium) to the five BRICS countries (Brazil, Russia, India, China and South Africa) from 1992 to 2013. The six European countries included have been chosen because they are the ones that determine the main European trade flows, since they show 82% of all European exports. Other European countries such as Poland or the Netherlands have not been considered because their exports are not as representative as the others. Germany is Europe's largest exporter, representing a total of 48.21% of the total weight of European exports, followed by France and Italy with 13.16% and 13.09% after UK 11.87 % and lastly Belgium and Spain with 4% and 10% in absolute terms. It has been estimated three different models with three different dependent variables, one of each sector mentioned before.

Firstly, the dependent variable in the first specified model is *trade*, which involves the number of European exports to BRICS in thousands of dollars. Generally this would include exports plus imports, but for simplicity it has been considered the trade as a whole exports and regardless imports of European countries.

The independent variables included in the specification of the model and expected signs they are:

1. GDP $_i$: Represents the GDP of European countries, it includes the wealth of the European countries, its production, its population and even the development of the countries in dollars. The data to construct this variable were obtained from the official website of the World Bank. The expected sign of this variable is

positive, since as it increases the European GDP of countries is expected to increase the trade.

2. GDPj: It has the same features as above, but describes the GDP of the BRICS countries (countries of destination) thus has the same expected sign as the previous.
3. DIST: Determine the average distance in kilometers between European countries and the BRICS. It especially determines the distance between capitals. These data have been obtained from the database geography, *geodist* of research and study center in international economics in France (CEPII). The expected sign of this variable a priori is negative, since as an increasing distance between countries the trade flows decrease as transportation costs will be more expensive. In other words, the variable *dist* affects negatively trade as element of resistance.

It has been tried to include some *dummy* variables in the model, namely the seafront but since all countries had seafront it has not been possible to be introduced in the model. Another possible dummy was the common language between countries but it has not been possible because it was not considered relevant to this study, as each of the European countries speak a different language between them and each BRICS country also speaks different languages and none match among them, each country has its own language.

Secondly, in Model 2, was changed the dependent variable *trade* by *agriculture*. This variable contains the agricultural exports from European countries considered to BRICS. In particular, for determinate this variable it has been chosen the following sectors: food and raw materials of animal and plants. These data were obtained from the database of the Spanish Foreign Trade Statistics, measured in thousands of dollars. It can be said that with this new dependent variable, the other explicative variables will continue to have the expected signs and they will remain being significant. As for agriculture exports of European countries towards the BRICS countries, Germany remains the leading exporter of agriculture in absolute terms but with lower percentages in absolute terms.

Finally there has been estimated a third model, which is characterized by a new dependent variable, in this case, *manufacturing*. This variable determines the exports of manufactures from European Union to BRICS countries. These European countries are the same as those considered in previous models, and its exports also addressed to the BRICS countries. Within the total manufacturing have been selected

specifically 12 manufactures, which are: food preparation, all beverages except juices, dyes and paints, oils and perfumes, soaps, rubber and glassware, wood and wood products, footwear, furniture , chairs and lamps, toys and sporting goods. They have been selected under a selection criterion of its importance during 2013 on European exports. So we find the same pattern as the previous two models. That means that the previous explanatory variables are the same in the three models but they have different dependent variable. Thus, the expected signs of the explanatory variables have the expected sign. In this case, as we have indicated above Germany that it is the leading exporter of manufactured goods.

It is noteworthy that this analysis was performed using the *Gretl* econometric program, which has allowed us to estimate the different equations of gravity. The data have been regarded as panel data, since a temporal dimension is combined with a cross-section, is considered exports between European countries and the BRICS from 1992 to 2013.

4.3 Empirical analysis

Following considerations in the previous section, an estimate of the models on display will be held to analyze exports from Europe to BRICS counties, both global and in the field of agriculture as the manufacturing sector. To analyze the European exports to BRICS countries, it has been applied the gravity equation. According to the generalized gravity model of trade, the volume of exports between pairs of countries is a function of their GDP's (population, incomes, size of the countries ...) and their geographical distance. In This case there are not any dummy Because of Its difficulty of being found.

This analysis has been considered Europe as the country of origin, i and BRICS have been considered as the countries of destination j . It is worth recalling that when we talk about European exports we refers only to Germany, France, UK, Italy, Spain and Belgium.

From the variables obtained three gravity equations are estimated: one for global exports, one for the agriculture sector and the other one for the manufacturing sector. These equations of gravity allow us to compare the weight of the influence of the trade determinants such as the proximity between countries, and income in the trade. Specifically, in this paper we have estimated exports of European countries towards the BRICS in a period of 22 years (1989-2013) having a panel data of 660 observations ($5 * 6 * 22$). The function specific gravity used for this test is:

$$\text{Log trade}_{ij} = B_0 + B_1 \log \text{GDP}_i + B_2 \log \text{GDP}_j + B_3 \log \text{Dist}_{ij}$$

As a model, log-log the interpretation of the parameters of a regression model is closer to the model of "elasticity" between variables. In other words, the magnitude of the percentage changes in trade to a 1% change in the explanatory variable ($\text{GDP}_i, \text{GDP}_j$, and Dist_{ij}).

In model 1, as mentioned above, the dependent variable is trade_{ij} . This explicative variable shows the exports from EU to BRICS. The regression was estimated using ordinary least squares (OLS) and shows that all variables obtained the expected sign and all of them are significant. Thus, since the expected sign, the model indicates that a higher GDP both European countries and the BRICS, there will be more trade between the two areas. As we can observe in table of results, the variable distance also presents the expected sign, which means that the greater the distance between the countries, less trade will occur. As it is considered that if the distance is greater, transportation costs will increase proportionally.

Model 1: OLS combined, using 659 observations

have been included 30 units of cross section

Length of time series: minimum 21, maximum 22

Dependent variable: I_TRADE

	<i>Coefficient</i>	<i>Std. Typical</i>	<i>Statistical. t</i>	<i>P Value</i>	
const	-16,5188	1,25991	-13,1111	<0,00001	***
I_GDPi	0,710653	0,0381828	18,6119	<0,00001	***
I_GDPj	0,54813	0,0289509	18,9331	<0,00001	***
I_DIST	-0,401605	0,0551557	-7,2813	<0,00001	***
Media thevble. dep.	14,72355		D.T. of thevble. dep.	1,128231	
Sum. sq waste	331,9029		D.T. of the regression	0,711844	
R-square	0,603732		Corrected R-square	0,601917	
F(3, 655)	332,6399		Value p (de F)	3,5e-131	
Log-likelihood	-709,0827		Criterion of Akaike	1426,165	
Criterion of Schwarz	1444,128		Crit. de Hannan-Quinn	1433,128	
rho	0,939671		Durbin-Watson	0,063290	

- *Ceteris paribus*, an increase of 1% of GDP of European countries reflects an increase of 0,710% in exports of European countries to BRICS. Thus, the

model itself that presents the expected sign, since the more GDP European countries present more increase their exports. This happens because the variable of GDP reflects the richness of European countries, the size, production and population, so if these increase will have a positive effect on export growth.

- *Ceteris paribus*, an increase by 1% of GDP of the BRICS countries, representing an increase of 0,548% in European exports. So this variable also represents the expected sign as it was expected that an increase in GDP of emerging countries generates an increase of European exports since the recipient countries can afford more products from Europe.
- *Ceteris paribus*, an increase of 1% of the distance between the countries considered in the model will be reflected in a decline in European exports in a 0.401%. It is expected that the further apart two countries together, trade between them is likely to be reduced because transport costs increase, so that this variable does show the expected signs are.

As we can see the goodness of fit is 60% ($R^2 = 0.60$). This means that 60% of the variability of trade is explained by the explanatory variables used in this model.

The Model 2 has also been estimated by ordinary least squares, but in this case the dependent variable is the exports of manufactured goods (*manufacturing*) which represents the exports of the group of European countries considered to BRICS. So in this model all variables represent the expected signs and all of them are significant.

Model 2: combined OLS, using 660 observations

have been included 30 units of cross section

of the time series Length = 22

Dependent variable: I_MANUFACTURING

	<i>Coefficient</i>	<i>Std. Typical</i>	<i>Statistical. t</i>	<i>P Value</i>	
const	-14,8645	1,35049	-11,0067	<0,00001	***
I_GDPi	0,751842	0,040959	18,3560	<0,00001	***
I_GDPj	0,515131	0,0310538	16,5883	<0,00001	***
I_DIST	-0,892624	0,0590216	-15,1237	<0,00001	***
Media thevble. dep.	12,33676		D.T. de la vble. dep.	1,230144	
Sum. sq waste	382,5138		D.T. of the regression	0,763610	
R-square	0,616425		Corrected R-square	0,614671	
F(3, 656)	351,4095		Valor p (de F)	5,1e-136	
Log-likelihood	-756,4927		Criterion of Akaike	1520,985	
Criterion of Schwarz	1538,954		Crit. de Hannan-Quinn	1527,950	
rho	0,920680		Durbin-Watson	0,065233	

The goodness of fit of this model is 61%, so it is also a fairly explanatory model of manufactured exports between EU and BRICS. In this model the estimated coefficients generally have the expected signs as it can be seen that income elasticities of both countries of origin and destination, are positive. When referring to variable geographical distance (*Dist*) shows that its elasticity is negative and close to unity, indicating the obvious fact that a greater distance has an adverse impact on exports of manufactured goods as a result of greater difficulties arising such as increased transport costs.

- *Ceteris paribus*, an increase of 1% of GDP of European countries generate an increase in European manufacturing exports 0,75%. As it can be seen this ratio is about unity, so the theory defines, with the GDP of European countries (exporters) greater than the GDP of the BRICS (importers) shows an importance of productive capacity to increase exports.
- *Ceteris paribus*, an increase from 1% of GDP of the BRICS countries, result in increased exports of European manufacturing a 0,515%
- *Ceteris paribus*, an increase of 1% in the distance between the countries will produce a decrease of 0,892% in European exports of the manufacturing industry. As it has been said in the theoretical fundamentals of the gravity equation, the coefficient of the distance is around -1 in all the empirical analysis.

Model 3: combined OLS, using 659 observations
 have been included 30 units of cross section
 of the time series Length: minimum 21, maximum 22
 Dependent variable: I_AGRCULTURE

	Coefficient	Std. Typical	Statistical. t	P. Value	
const	-8,50415	1,76731	-4,8119	<0,00001	***
I_GDPi	0,526337	0,0535601	9,8270	<0,00001	***
I_GDPj	0,622173	0,0406102	15,3206	<0,00001	***
I_DIST	-1,33944	0,0773685	-17,3125	<0,00001	***
Media thevble. dep.	11,42218		D.T. of thevble. dep.	1,451202	
Sum. sq waste	653,0690		D.T. of the regression	0,998525	
R-square	0,528722		Corrected R-square	0,526563	
F(3, 655)	244,9456		Valor p (de F)	1,5e-106	
Log-likelihood	-932,1016		CriterionofAkaike	1872,203	
Criterionof Schwarz	1890,166		Crit. de Hannan-Quinn	1879,166	
rho	0,910280		Durbin-Watson	0,128559	

In the same way as previous models, the Model 3 has also been estimated by ordinary least squares, but in this case we focus on European exports agriculture, so in this model the dependent variable is *agriculture*. As we can see in the results table model 3, all variables are significant and represent the expected signs, so the variables behave in the same manner as in Model 2.

The goodness of fit of the latter model is 52%, so this model is less precious than the previous model. Thus this model shows that 52% of the variability of exports agriculture are explained by GDP of European countries, the GDP of the BRICS and the distance between different countries.

- *Ceteris paribus*, an increase by 1% of GDP of European countries, it will be reflected 0,526% in increased agricultural exports of European countries considered to BRICS. As it can be seen this ratio is about unity, so the theory defines, with the GDP of European (exporter) greater than the GDP of the BRICS (importers) shows an importance of productive capacity to increase exports.
- *Ceteris paribus*, an increase of 1% of GDP of the BRICS countries, is reflected in an increase in European agricultural exports by 0,622%. It may be thought that if the GDP of the BRICS countries increases there is a greater capacity to demand for European exports.

- *Ceteris paribus*, an increase of 1% of the distance between the countries will generate a decline of European agricultural exports by 1, 3%

5.CONCLUSIONS

After evaluating the determinants of the European exports to BRICS countries and, particularly, the central hypothesis proposed at the beginning of this paper two main conclusions can be asserted. First, it has been obtained that income levels have a positive effect on trade. Second, in line to what was expected, distance among countries has a negative effect on merchandise flows.

The objective of this work has been to explain trade performance through the estimation of a gravity equation for the European exports to the BRICS countries, in order to analyze its determinants and the explanatory power of them. The gravity model is based on the gravitational force concept as an analogy between trade and masses attraction, in which mass is associated to economic size of the countries with an element of resistance that in the case of trade is represented by geographical distance as a proxy for transport costs.

The results obtained indicate that the coefficients of the variables included in the three gravity equations have the expected signs and are significant. The negative value estimated for the distance coefficient shows that as a more geographically distant countries are, less trade will develop among them. In fact, as theory indicates, the coefficient for the distance variable is around -1 and is statistically significant in the majority of the empirical studies carried out. It may be noted that income elasticities (for exporter and importer) are positive and also around the unity also as theory would advance. Moreover, in the estimated models, 1 and 2 (*total trade and manufacturing*), income elasticity exporter has a greater magnitude than the one for importer, so that shows the importance of the productive capacity of a country to promote their exports. However, the estimated model 3 (*agriculture*), the income elasticity exporter is of a smaller magnitude than the importer. Although our specification does not incorporate elements for testing particular elements associated to the economic relevance of the Common Agricultural Policy, it is not too risky to consider this institutional framework an important background behind some results of the agricultural exporting sector in Europe. In any case, the overwhelming dominance of manufacturing exports in European trade is beyond discussion.

There are different lines to be developed that could improve the analysis of trade among the two geographical area considered in this work. First, a more disaggregated approach, that would allow to focus on technological differences and perhaps the introduction of variables as value added or some kind of transport

cost/price ratio. Second, the introduction of trade policy elements in the model specification that could frame more accurately the rules influencing strategies and actions taken by trade partners.

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7. APPENDICES

APPENDIX 1- Database of European GDP's.

Year	GDP					GDP Belgium
	Germany	GDP France	GDP UK	GDP Italy	GDP Spain	
1992	2,12313E+12	1,4087E+12	1,1576E+12	1,3163E+12	6,292E+11	2,3568E+11
1993	2,0686E+12	1,3301E+12	1,0431E+12	1,0618E+12	5,2365E+11	2,2558E+11
1994	2,206E+12	1,4016E+12	1,1302E+12	1,096E+12	5,2912E+11	2,4582E+11
1995	2,5905E+12	1,6099E+12	1,2356E+12	1,1712E+12	6,1294E+11	2,8912E+11
1996	2,5016E+12	1,6142E+12	1,3045E+12	1,3094E+12	6,41E+11	2,8079E+11
1997	2,2159E+12	1,4607E+12	1,4387E+12	1,2395E+12	5,8869E+11	2,541E+11
1998	2,2399E+12	1,5108E+12	1,5291E+12	1,2668E+12	6,1704E+11	2,5982E+11
1999	2,1967E+12	1,5003E+12	1,5583E+12	1,2491E+12	6,3319E+11	2,5967E+11
2000	1,9472E+12	1,3684E+12	1,5487E+12	1,1422E+12	5,954E+11	2,3734E+11
2001	1,9479E+12	1,3822E+12	1,5291E+12	1,1628E+12	6,2598E+11	2,374E+11
2002	2,0763E+12	1,5003E+12	1,6744E+12	1,267E+12	7,0515E+11	2,5839E+11
2003	2,5023E+12	1,8481E+12	1,9437E+12	1,5703E+12	9,0685E+11	3,1857E+11
2004	2,8156E+12	2,1242E+12	2,2981E+12	1,7992E+12	1,0696E+12	3,7046E+11
2005	2,8576E+12	2,2036E+12	2,4121E+12	1,8535E+12	1,1572E+12	3,8694E+11
2006	2,9985E+12	2,3249E+12	2,5828E+12	1,9434E+12	1,2645E+12	4,1068E+11
2007	3,4355E+12	2,663E+12	2,9633E+12	2,204E+12	1,4793E+12	4,7228E+11
2008	3,7471E+12	2,9236E+12	2,7919E+12	2,392E+12	1,635E+12	5,2011E+11
2009	3,4128E+12	2,6937E+12	2,3089E+12	2,1861E+12	1,499E+12	4,858E+11
2010	3,412E+12	2,6468E+12	2,4079E+12	2,1266E+12	1,4316E+12	4,844E+11
2011	3,7521E+12	2,8627E+12	2,5918E+12	2,2782E+12	1,4946E+12	5,2824E+11
2012	3,5332E+12	2,6867E+12	2,6149E+12	2,0918E+12	1,3557E+12	4,9885E+11
2013	3,7303E+12	2,8064E+12	2,6785E+12	2,1495E+12	1,393E+12	5,2481E+11

Source: Global Bank

APPENDIX 2- Database of the GDP's of the BRICS countries.

Year	GDP Brazil	GDP Russia	GDP India	GDP China	GDP South Africa
1992	3,906E+11	4,602E+11	2,933E+11	4,227E+11	1,30514E+11
1993	4,383E+11	4,351E+11	2,842E+11	4,405E+11	1,3431E+11
1994	5,462E+11	3,951E+11	3,33E+11	5,592E+11	1,39752E+11
1995	7,69E+11	3,955E+11	3,666E+11	7,28E+11	1,5546E+11
1996	8,397E+11	3,917E+11	3,998E+11	8,561E+11	1,47608E+11
1997	8,712E+11	4,049E+11	4,232E+11	9,527E+11	1,52586E+11
1998	8,438E+11	2,71E+11	4,287E+11	1,019E+12	1,37775E+11
1999	5,869E+11	1,959E+11	4,669E+11	1,083E+12	1,36632E+11
2000	6,447E+11	2,597E+11	4,766E+11	1,198E+12	1,36362E+11
2001	5,536E+11	3,066E+11	4,94E+11	1,325E+12	1,21516E+11
2002	5,042E+11	3,451E+11	5,24E+11	1,454E+12	1,15482E+11
2003	5,525E+11	4,303E+11	6,184E+11	1,641E+12	1,75257E+11
2004	6,638E+11	5,91E+11	7,216E+11	1,932E+12	2,28594E+11
2005	8,822E+11	7,64E+11	8,342E+11	2,257E+12	2,57773E+11
2006	1,089E+12	9,899E+11	9,491E+11	2,713E+12	2,71639E+11
2007	1,367E+12	1,3E+12	1,239E+12	3,494E+12	2,9942E+11
2008	1,654E+12	1,661E+12	1,224E+12	4,522E+12	2,8677E+11
2009	1,62E+12	1,223E+12	1,365E+12	4,99E+12	2,9594E+11
2010	2,143E+12	1,525E+12	1,708E+12	5,931E+12	3,75349E+11
2011	2,477E+12	1,905E+12	1,843E+12	7,322E+12	4,16597E+11
2012	2,249E+12	2,017E+12	1,836E+12	8,229E+12	3,97391E+11
2013	2,246E+12	2,097E+12	1,875E+12	9,24E+12	3,66058E+11

Source: Global Bank

APPENDIX 3- Database of the distance between European countries and BRICS countries.

COUNTRY i	COUNTRY j	DIST
Germany	Brazil	9601,955
Germany	Russia	1614,179
Germany	India	5785,567
Germany	China	7363,33
Germany	South Africa	8828,848
France	Brazil	8732,79
France	Russia	2494,316
France	India	6594,23
France	China	8225,232
France	South Africa	8692,812
UK	Brazil	8797,828
UK	Russia	2510,88
UK	India	6720,636
UK	China	8151,353
UK	South Africa	9033,48
Italy	Brazil	8913,18
Italy	Russia	2383,171
Italy	India	5922,222
Italy	China	8134,695
Italy	South Africa	7697,383
Spain	Brazil	7743,538
Spain	Russia	3449,3
Spain	India	7282,046
Spain	China	9232,299
Spain	South Africa	8070,031
Belgium	Brazil	8984,677
Belgium	Russia	2261,25
Belgium	India	6419,599
Belgium	China	7970,82
Belgium	South Africa	8838,753

Source: Cepii