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Exchange Rates and Trade

The Impacts of the Euro on bilateral Export Flows

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Abstract

The purpose of this paper is to investigate how exports are affected by exchange rate risk, by analyzing the effects of the European monetary union (EMU) on exports. This is achieved by using a gravity model for nine EMU and nine non-EMU countries for the time period from 1996 to 2012. Total export values are first analyzed before the change in exports is investigated. The main finding is that the EMU membership does not affect export flows for the sample countries when time dummies are included in the model. Missing time effects to capture business cycles might be an explanation while previous researches find a positive currency union effect on trade. The variables influencing exports are the size and location of the countries rather than the currency union. The second approach investigates the influence of the currency union on changes in exports. A negative effect for the dummy variables for EU and EMU on changes in exports is found. The negative effect is unexpected and further research is needed to explain this. The time invariant distance measures in this model are not able to explain variation in exports, while the size still has a significant impact. The results suggest that the currency union does not increase export of member countries.

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1 Introduction

"The euro is far more than a medium of exchange… It is part of the identity of a people. It reflects what they have in common now and in the future." (Wim Duisenberg)

When the Treaty of Maastricht was signed in 1992 and the idea of a common currency in Europe was born, political members of the joining and supporting countries argued that a common currency increases trade by removing the transaction costs of different currencies. Now, after nearly two decades of the Euro as the common currency, it is possible to investigate if exchange rate risk is influencing export flows between highly linked developed countries or if a political alliance like the European Union has higher impacts on trade flows. These questions are especially interesting for countries with the economic conditions to join the currency union, like Sweden, Denmark and the United Kingdom. To join a currency union is an extensive decision, connected to high costs. Therefore it is important to know if these costs can be motivated by the advantages due to a common currency.

The main purpose of this paper is to analyze to what extent uncertainty about the exchange rate influences export flows. This is accomplished by investigating the effect of the European Monetary Union (EMU) on the export values of its members. The research question is studied with the gravity model approach, which is the most common method for this kind of research. Nevertheless, since European trade flows, especially intra-EU, are sufficiently high even before the Euro was implemented, it is questionable if there is a statistical significant effect of the EMU on export. Therefore this study uses a second model, which focusses on changes in exports, to examine if the EMU has an impact on short term changes in export flows.

The currency union effect on trade is a wide research field in economics. Empirical literature shows mixed evidences on the effect of the EMU on trade. Earlier studies show a positive currency union effect, while many other studies cannot find any significant influence on trade flows. This study tries to combine the strengths of several of these studies to investigate the effect from two perspectives. While the previous studies focus on the effect on total trade flows, this paper emphasizes on the exporting country and therefore on export flows. However, since export flows are supposed to grow over time, the second model is used to investigate if some of this growth in export can be explained by the monetary union in Europe.

The advantage of the analysis of the EMU is the possibility to investigate the pure currency union effect, rather than the mixture of the currency union and free trade agreement effect. The countries of the Euro already had free trade with each other before the common currency was implemented. The major difference due to the common currency is the vanished uncertainty about exchange rates. This leads to the opportunity to investigate the pure currency union effect.

The analysis is executed with a panel data gravity model over the time period from 1996 to 2012 for 18 countries. Nine of these countries are currency union members while the other nine European countries form the control group. Both research questions are analyzed for the total time period as well as for sub samples to see if the common currency has a positive effect directly after implementation and if the financial crisis' effect on trade flows differs for currency union members.

The results show, that the EMU is not able to increase export flows for the member countries. No positive effect can be stated for the EMU coefficient, neither for the total

export values, nor for the changes in exports. Contrariwise to the expected positive effect of the currency union, a negative impact on changes in exports is investigated. The same unexpected negative effect occurs for the EU variable on changes in exports, while this variable has a positive impact on total export values. The results of the structural variables show that these structural determinants are more important for total exports and changes in exports than the EMU and EU.

This study has some limitations. First of all, the time period limits the robustness of the results. Due to data availability this period could not be expanded. Another problem of the time period is the large impact of the financial crisis on all economic measures, therefore it is possible to examine if the currency union members are less affected by these exogenous shocks. Second of all, the used econometric method is a weakness of this study. Time invariant variables are applied in the model and these cannot be regressed with a fixed effect model. Thus the regression has been made with a random effect model, although the Hausman test recommended a fixed effect model.

For the purpose of this study the used theories are stated in section 2. The optimum currency area theory together with the transaction cost theory motivates the currency's importance on trade flows. Afterwards an overview of previous literature of the gravity model is given. Section 3 presents the linkage between the general gravity model approach and the used econometric model. All variables are justified and their expected influence on export values described. The results of the econometric model are presented and analyzed in section 4. Section 5 then summarizes the findings and gives conclusions before suggestions for further research are stated.

2 Theory and Literature

2.1 Theory of Optimum Currency Areas

"It is obvious that the monetary union among 17 very different European countries does not work. As an economist, I know that the Eurozone is not an optimum currency area, as defined in economic theory." (Vaclav Klaus)

Nowadays, the Euro as a currency is part of the daily life of more than 340 million people all around Europe. An analysis of the economic parameters of all member states can lead to the question if the currency union should be considered as economic or political project. The quote of Vaclav Klaus is exaggerated but might still contain some relevance. Therefore it is necessary to use the theoretical background to analyze the EMU in this context. Mundell's (1961) theory of optimum currency areas provides several theoretical principles to investigate the most favorable conformation for a currency union from an economic viewpoint.

The principles of the theory of optimum currency areas can be separated in two main groups, the traditional criteria, predominantly implemented by Mundell, Friedman, Kenen and McKinnon in the late 1960s, and the modern criteria, applied in the early 1990s. After implementing the Bretton-Woods system, by using the US Dollar as the reserve currency and fixing it to the gold price, a discussion started about the advantages of this system and the optimum composition of a currency union. The idea is to find the necessary requirements where the advantages of a currency union exceed the costs. The traditional criteria are aiming for the aftereffects of demand and supply changes. Additionally favor how countries of a currency union can absorb these changes without the possibility to adjust by floating exchange rates.

Mundell (1961) states that high labor mobility for a region is necessary to be considered as an optimum currency area. The idea is that changes in demand and supply are influencing labor demand. If the population is mobile and willing to move, these changes can be intercepted by the migration of employees to other countries or regions. Relocation and labor mobility is also a factor for trade values. Habits and behavior of migrants, as well as existing business connections, can be a reason for rising export values due to migration. A similar effect is captured by the flexibility of wages and prices. It is easier to adjust to demand and supply changes if regions and countries have flexible wages and prices. Friedman (1953) argues that if a region has this rigidity, they do not require an elastic exchange rate to adjust to shocks and/or supply and demand changes. McKinnon (1963) states the openness for trade has to be high to build an optimum currency area. A high openness for trade reduces the costs of losing a floating exchange rate for price adjustments due to the mechanism that the prices in open economies react to price changes in another member country. This is one of the most important criteria when it comes to a common currency's effect on trade. Economies with tariffs and trade barriers might not be able to increase trade values due to a common currency. These different principles are used together to describe an optimum currency area. When more of these traditional criteria are fulfilled, a region or group of countries is able to overcome the problems of losing the floating exchange rate mechanism.

While the traditional criteria are aiming for neutralizing the effects of a fluctuation in demand and supply, the modern premise can be seen as macroeconomic measures (Mongelli, 2002). They are used to analyze if a country can give up the exchange rate fluctuations without additional costs and if the countries are willing to adapt a common economic policy. The decisive criteria are the mobility of capital, price stability and fiscal

policies. Capital mobility has to be high without any given financial borders to help to overcome the arising problem of missing exchange rate fluctuation. Price stability is another important measure for a successful currency union. The countries should have similar inflation rates combined with a jointly political aim for price stability. In a system with floating exchange rates, different inflation rates are well-balanced by exchange rate fluctuations; this has to be taken into consideration before forming a currency union. Price stability also supports trade. Long term contracts and business relations are strengthened due to a low inflation rate in both economies. Companies do not have to consider price changes based on different inflation rates. Another central modern criterion for an optimum currency area is the fiscal policy. Kenen (1969) argues that currency union members should be aware of the problem of a stable exchange rate. In the case of asymmetric shocks they should be able to invest in an economic stimulus plan. Furthermore he recommends that countries centralize their fiscal policy in the optimum case to be able to overcome any asymmetric shocks.

Some of these criteria support the argument of the EU that the common currency can positively affect trade values. Trade openness might be considered as the best criteria to support exports flows. Since the European countries have a high degree of trade openness, this criterion is supporting the hypothesis that the EMU increased trade. Additional are flexible prices and wages affecting trade. A decreased price, due to lower wages or other input factors can affect trade decisions and make a country more competitive. The third important criterion for trade is the price stability, due to a low inflation rate. A low and constant inflation rate makes future prices predictable and affects in this way trade decisions (Terlau, 2004).

By taking these principles into account it is possible to classify the Euro area. Just trade openness and the diversification of the economies are completely given for the EMU countries, while low labor mobility and in short run low flexibility of wages and prices are arguments against the European Monetary Union (Peters, 2006). Fiscal transfers between the EMU member are prohibited in the Treaty of Maastricht. Now, after the financial crisis these transfers are executed between EMU countries. This brings the EMU closer to a theoretical optimum currency area (Taylor, 2009).

Because of the modern criteria the EMU is not considered as an optimum currency area due to the missing central fiscal policy and differences in the price stability. However, nowadays countries are converging and the EMU is getting closer to the modern theoretical optimum currency area (OCA) criteria (Ohr, 2012; Nähle, 2013). These discrepancies from the theoretical OCA are one of the motivations to analyze the currency union effect on trade flows. Reasoned by the fact that the expected increase in trade was one of the main arguments for the currency union, it can be questioned if this effect occurred under the conditions that the EMU cannot fulfill the criteria for an optimum currency area. However, the openness for trade, the close political and economic linkage and the already high trade values between these countries support the statement of the EU that a common currency can increase trade flows even though the OCA criteria are not satisfied.

The aim of the OCA theory is to find a currency union composition in which the costs of implementation are lower than the exchange rate uncertainty costs. These uncertainty cost can be considered as a transaction cost. The next section introduces the transaction cost theory.

2.2 Transaction Costs

The transaction-cost-theories by Coase (1937) and Williamson (1979) focus on the organization form of using a market. The aim is to explain why and how transactions can be organized in an efficient way to minimize costs and maximize utility. The classic perfect competition theory neglects any form of transaction costs and to overcome this weakness transaction cost theory is used to optimize any transactions between contracting parties. Transaction costs are defined as any kind of expenses arising when an individual is participating in the market. These can be divided into three broad categories:

- search and information costs
- bargaining costs and
- policing and enforcement costs.

Search and information costs occur when the market participant tries to find the demanded good for the best price and to get information about the conditions, availability and other needed characteristics. The bargaining costs are the actual costs that arise to formalize a contract. Policing and enforcement costs are the costs to make sure that both parties are complying with the arranged contract. Even when this theory focusses on a micro level, rather than a macroeconomic perspective, it reflects each individual decision to trade. Each of these decisions is affecting the total amount of exports and has to be taken into consideration.

For the analysis of the effect of exchange rates on exports and especially of the European currency union on export flows, the theory of transaction costs is a central brick. Floating exchange rates are considered as transaction costs due to the uncertainty of future exchange rates. The relationship between the European monetary union and transaction costs is described by De Sousa and Lochard (2004):

> *"EMU reduces transaction costs. Among others: (i) it reduces currency conversion costs; (ii) it suppresses in-house costs of maintaining separate foreign currency expertise; (iii) it eases price decisions and comparison of international costs; (iv) it removes intra-euroland exchange rate volatility and thus increases the certainty-equivalence value of expected profits of risk averse firms and avoids the need of costly hedging techniques. (p. 2)* (De Sousa and Lochard, 2004)*"*

However, they do not state how strong these effects are and if or how they are measured. This transaction cost effect in Europe is studied by De Grauwe (2012). He predicts that approximately between 0.25% and 0.5% of the national GDP's are spent on transaction costs. It sounds like a relatively small number, but taking into consideration the total amount of GDP in Europe these small percentages have significant value. This shows the importance of exchange rates from a transaction cost perspective and supports the argument of the EU that the monetary union is able to increase trade flows or at least reduce trade costs.

Bernard, Jensen, and Schott (2006) examine the response to changes in export costs and therefore transaction costs changes, on a firm level. The common currency can be considered as a decrease in transaction costs. They find in their analysis that lower export costs are followed by a higher productivity growth, an increasing number of exporters and higher total export values. Their findings support the expected growth in exports for the EMU countries. The decreasing transaction costs are stimulating the economy and followed by increasing exports.

However, not just the exchange rate is affecting transaction costs. The theory can also be used to motivate some of the explanatory variables. An important factor of transaction

costs are the transportation costs. These transportation costs provide a motivation for the explanatory distance variables as well as the border dummy. A smaller distance between two countries or a common border reduces transportation costs and makes them more economic similar. This affinity reduces transaction costs due to a common language, similar business cycles, related consumption behavior or similar cultures. The size of the economy also affects transaction costs. A larger economy is considered to have a higher variety of goods and services. To trade with a bigger market can now reduce transaction costs due to the knowledge spillover effects from previous trade relations. It is less costly to trade with a familiar market then to build a new trade relation with an unfamiliar market. This motivates the usage of a proxy for the size of an economy.

2.3 Review of Empirical Findings

When analyzing the currency union effect on bilateral trade the majority of studies are using a gravity model approach, but because of different data sets and methods the existing results are significantly different. An early and often cited study about the effect of the Euro on trade is from Rose (2000). Rose is thereby using the classic structure of the gravity model and adds different dummy variables for his purpose. He analyzes the expected return from a common currency by using cross sectional data for 186 countries for two decades (1970 to 1990). His results are often declared as the "Rose effect" (Baldwin, 2006), due to his large positive effect with up to tripling bilateral trade flows between currency union member countries. Flam and Nordstrom (2003) even argue that this effect will enlarge over time when the currency union unites. This large impact is not found by Eicher and Henn (2009) when they compare bilateral trade data of Germany and Ireland to data from Germany and England. They conclude that the intra-Euro trade from Germany to Ireland increases by 30 percentage points more than German-English trade. One possible reason why Rose found this surprisingly large effect is his dataset (Persson, 2001). The used currency unions are mainly built by very small or poor countries adopting the currency of a larger nation. Due to the currency union these small economies have access to a huge market and therefore can increase their trade flow dramatically (Micco, Stein, and Ordoñez, 2003; Glick and Rose, 2002).

Micco et al (2003) find that the impact of the Euro on trade between member states is positive between 5 percent and 10 percent, while being a neighbor state to a large currency union increases trade by 9 percent to 20 percent. They use a panel of 22 developed countries for the years 1992-2002 and argue that the effect between the EMU members is lower than for neighboring countries due to the homogeneous group of states, with already large trade patterns, entering the EMU.

While all these studies are using a similar gravity model, Bun and Klaassen (2007) extend this approach by testing for a deterministic time trend. They argue that previous research overestimates the currency union effect on trade by not taking time trends into account. By considering these trends they estimate a 3 percent increase in trade due to the common currency. As a result of the implementation of a deterministic time trend they argue that other studies overestimate the currency union effect and therefore question the robustness of the results of previous researches. De Souza (2002) also analyzes a gravity model for the EU15 countries and includes a time trend. He is not able to state any significant effect of the currency union on trade, as long as he uses this trend and concludes that the actual growth in bilateral trade flows is due to a time trend rather than the currency union.

A growing field of research about the econometric problems and mistakes of the gravity model started due to the large amount of research about the currency union effect on bilateral trade. Researchers therefore try to find reasons for the immense differences in estimated results. The control group problem and the endogeneity problem are two often stated reasons. Sadeh (2014) claims the effect on trade is highly influenced by the selected countries and time periods in the sample set. The formed control group of countries should be as similar as possible to the currency union members to be able to control for the real effect of the common currency (Baier and Bergstrand, 2007). Another problem occurs by using a biased dataset with too few currency union or control group countries (Sadeh, 2014). This leads to low external validity. Especially the approach of Rose (2000), to use a single dummy variable for the effect of currency unions, with several small currency unions, is questionable.

Other reasons for endogeneity could arise due to the selection of countries joining a common currency, as well as the fact that countries which are already trading with each other might join a currency union. This endogeneity is leading to omitted variable bias (Tenreyro, 2001). Selection bias that occurs when analyzing currency unions cannot be solved. It is important to form a similar control group to minimize effects of this bias.

An additional discussion in the literature is caused by zero bilateral trade flows in the dataset, specifically in Rose´s work (Micco, Stein, and Ordoñez, 2003). This problem does not occur when analyzing European countries in a decent time period due to the significant intra-European trade flows as well as complete data. Another problem is that most of the previous studies combine non-stationary and time invariant variables (such as trade and distance) in one regression even by knowing that this leads to spuriously significant estimates and exaggerated R^2 (Sadeh, 2014).

3 Empirical approach

3.1 Method

The gravity-model approach is nowadays the standard method to measure different effects on trade flows. Tinbergen (1962) and Pöyhönen (1963) invented the gravity model to investigate the effect of economic mass and distance on trade flows between countries. Their idea was to transfer Newton's physical gravitation theory to economics. Tinbergen and Pöyhönen use the gross domestic product as a proxy for economic proportions and the distance between the countries is used as a space measure. These proxies and variables are still used today to explain trade flows and also to investigate the currency union effect on trade. In order to study the exchange rate effect on trade flows, the gravity model is a frequently used and powerful approach (Kepaptsoglou and Karlaftis, 2010). Equation 1 shows the formula Tinbergen uses as a starting point to analyze trade.

$$T_{ij} = C * \frac{Y_i Y_j}{D_{ij}} \tag{1}$$

$\boldsymbol{T_{ij}}$ is hereby the trade between country i and j. $Y_i \; and \; Y_j$ are the mass coefficients and show the size of the country, often defined by GDP. D_{ij} is the variable for the distance between both countries and stated in the distances between the capitals.

Due to the non-linear form of equation (1), Tinbergen linearized this equation by transforming it in a log-log form to be able to use this model for a linear econometric analysis. Equation 2 shows this linearized form of the standard gravity model with a time subscript. This time subscript implicates that the model is to be analyzed with a panel data set.

$$\ln(T_{ijt}) = \beta_0 + \beta_1 \log(Y_{it}) + \beta_2 \log(Y_{jt}) + \beta_3 \log(D_{ij}) + u_{ijt} \tag{2}$$

A panel data set can be investigated as a fixed effect or random effect model. While the fixed effect model eliminates unobserved country specific effects by applying within transformation, these effects are treated in a random effect model as random variables (Wooldridge, 2010). The advantage of eliminating the country specific effects with a fixed effect model is that it allows for endogeneity and correlation between the unobserved country specific effect and the explanatory variables, while in the random effect model the country specific effects can lead to correlation between them and be followed by biased estimates (Kézdi, 2004). Due to the fact that the fixed effect model does not allow variables to be without variation over time, the analysis is done with a random effect model. The distance measure is stable over time and has to be excluded caused by collinearity in a fixed effect model. Nevertheless, the distance is an important variable in the gravity model and can explain some variation and distribution of export values.

The basic idea of the random effect model is that the intercept changes for each country pair. The intercept β_{0ij} differs for each country pair and therefore becomes the subscript ij.

$$\ln(T_{ijt}) = \beta_{0ij} + \beta_1 \log(Y_{it}) + \beta_2 \log(Y_{jt}) + \beta_3 \log(D_{ij}) + u_{ijt} \quad (3)$$

However β_{0ij} is not treated as fixed, it is assumed that the intercept is the mean value β_0 (without subscripts) of the whole population. This intercept β_{0ij} can be expressed as the β_0, the mean value of the intercept from the whole population, plus a random error term ε_{ij}. This error term has a mean value of zero with a variance of σ^2.

$$\beta_{0ij} = \beta_0 + \varepsilon_{ij} \quad (4)$$

Accordingly, the group of sample countries is drawn from a much bigger population of countries with a common intercept β_0 and an individual difference, represented by the individual error term ε_{ij} (Gujarati, 2008). By substituting this into the model it follows:

$$\ln(T_{ijt}) = \beta_0 + \beta_1 \log(Y_{it}) + \beta_2 \log(Y_{jt}) + \beta_3 \log(D_{ij}) + \varepsilon_{ij} + u_{ijt} \quad (5)$$

This leads to the above stated used research model:

$$\ln(T_{ijt}) = \beta_0 + \beta_1 \log(Y_{it}) + \beta_2 \log(Y_{jt}) + \beta_3 \log(D_{ij}) + w_{ijt} \quad (6)$$

with the error term $$w_{ijt} = \varepsilon_{ij} + u_{ijt} \quad (7)$$

The error term now consists of the cross-sectional error term ε_{ij} and the time series and cross section combined error term u_{ijt}.

EMU effect on total export values

Equation (6) now demonstrates the standard gravity model in the form of a random effect model. For the purpose of this paper it is needed to add several dummy variables. Equation 8 represents the model used in this paper. All variables are described in table 1.

$$\log(ex_{ijt}) = \beta_0 + \beta_1 \log(GDPex_{it}) + \beta_2 \log(GDPim_{jt}) + \beta_3 \log(KM_{ij}) + \beta_4 BOR_{ij} + \beta_5 EU_{ijt} + \beta_7 FTA_{ijt} + \beta_6 EMU_{ijt} + \beta_{1N} D_t + w_{ijt} \quad (8)$$

Dummy variables for the EU, free trade agreements (FTA) and the European monetary union (EMU) as well as time dummies are added. The variable D_t is a vector of time dummies.

EMU effect on changes in export values

To analyze the EMU effect on changes in export are some modifications in the model required. Equation 9 represents the model for this purpose. The dependent variable is now the change between the logarithmic values of export flows while for the previous approach used the absolute logarithmic values. This indicates that the value for each year is calculated by subtracting the actual export value from value of the previous year.

$$\Delta\log(ex_{ijt}) = \beta_0 + \beta_1\log(KM_{ij}) + \beta_2\Delta\log(GDPex_{it}) + \beta_3\Delta\log(GDPim_{jt}) + \beta_4\log(GDPex_{it}) + \beta_5 BOR_{ij} + \beta_6 EU_{ijt} + \beta_7 FTA_{ijt} + \beta_8 EMU_{ijt} + D_t + w_{ijt} \quad (9)$$

A similar transformation is done for the mass coefficients. Both GDP values are also used as the change between the logarithmic values. Additional is the GDP of the exporting country as a proxy for the size added. The exporter's size is expected to influences changes in exports. Bigger countries with a more diverse market are expected to be less affected by asymmetric shocks. This leads to fewer changes in exports for bigger markets due to an asymmetric shock.

For both models some diagnostic tests are applied to proof the credibility of the results. The first test examines mulitcollinearity between the variable. A problem occurs when variables are correlated with each other. For this purpose the variance inflation factor (VIF) coefficient is used, which measures how much the variance of the estimated coefficients increase due to collinearity. The VIF value is 3.61 for all variables; that indicates no mulitcollinearity problem in the variables. A VIF value of 10 or higher may merit, as a rule of thumb, further investigation.

Another important test needs to be accomplished for the estimated residuals. Normal distributed residuals indicate that the probability of systematic regression mistakes is low. The residual and the normal distribution are showed in figure A3 in the appendix. It is visible that the estimated residuals are normal distributed.

Additionally, a test for heteroskedasticity is realized. Heteroskedasticity is the variance of the error terms in the regression and leads to biased standard errors. The significance level cannot be trusted under heteroskedasticity. A Breusch-Pagan (BP) test is used with a null hypothesis that the variance of the residuals is constant. The BP-test rejects the null hypothesis and indicates heteroskedasticity. The impact of this problem is reduced by using robust standard errors for the following models (Kézdi, 2004).

Table 1 Variable description

Variable	Description	Source
$\log(ex_{ijt})$	Dependent variable. Natural logarithm of the export value between country i and j in current US Dollar, time variant variable	www.comtrade.un.org
$\Delta\log(ex_{ijt})$	Change of the export values between country i and j in current US Dollar, time variant variable	www.comtrade.un.org
β_0	Constant	
$\log(GDPex_{it})$	Natural logarithm of the economic activity of the exporter country i, time variant variable	www.databank.worldbank.org
$\Delta\log(GDPex_{it})$	Change of the natural logarithm of the economic activity of the exporter country i, time variant variable	www.databank.worldbank.org
$\log(GDPim_{jt})$	Natural logarithm of the economic activity of the importer country j, time variant variable	www.databank.worldbank.org
$\Delta\log(GDPim_{jt})$	Change of the natural logarithm of the economic activity of the importer country j, time variant variable	www.databank.worldbank.org
$lnKM_{ij}$	Natural logarithm of the beeline distance between country i and j, time invariant variable	www.luftlinie.org
BOR_{ij}	Dummy variable for a common border between two countries, time invariant variable $BOR_{ij}\begin{cases}1\ if\ both\ countries\ have\ a\ common\ border\\0\ otherwise\end{cases}$	www.eurogeographics.org
EU_{ijt}	Dummy variable for the European Union membership, time variant variable $EU_{ijt}\begin{cases}1\ if\ both\ are\ members\ of\ the\ EU\ at\ time\ t\\0\ otherwise\end{cases}$	www.europa.eu
FTA_{ijt}	Dummy variable for a free trade agreement between two non EU countries or an non EU country and the EU, time variant variable $FTA_{ijt}\begin{cases}1\ if\ both\ countries\ have\ a\ free\ trade\ agreement\ with\ each\ other\ at\ time\ t\\0\ otherwise\end{cases}$	www.europa.eu
EMU_{ijt}	Dummy variable for the Euro currency, time variant variable $EMU_{ijt}\begin{cases}1\ if\ the\ exporter\ is\ member\ of\ the\ EMU\ at\ time\ t\\0\ otherwise\end{cases}$	www.ecb.europa.eu
D_t	Time dummy variables at time t	
w_{ijt}	Error term for country pair i and j at time t	

3.2 Data and Descriptive Statistics

Dependent variable

The dependent variable in the gravity model in general is the natural logarithm of the total bilateral trade value. This study uses the export values from one country to the other sample countries for each year measured in current US-Dollar[1]. The idea is to focus on the effect for each country as an exporter and to analyze if the economy of the country is positively affected by implementing the Euro and benefit from the advantages of having the same currency. The first model (equation 8) uses the logarithmic absolute export value from country i to country j at time t, while the second approach (equation 9) uses the difference logarithmic export values from country i to j at time t. The difference between the value of the actual year and the previous export value is used.

Gross Domestic Product

The GDP values of country i and j are the economic attractors (De Benedictis and Taglioni, 2011). The idea is that bigger countries trade more and so the coefficients are expected to be positive. The exporter country i is increasing its GDP by 1 percent, bilateral trade flows with country j are supposed to be β_1 percent higher. The positive sign is explained with the fact that growing economies produce more goods and are have higher exports. A similar interpretation is possible for β_2 as the importing country. Both GDP values in equation 9 are used as the difference in GDP of the actual and the previous year.

Distance measure

The distance between both countries has an analogical interpretation as the distance in the gravitation approach of Newton. The bigger the distance of two objects, the lower is their force of attraction. In the gravity model approach the distance coefficient is expected to be negative. The further two economies are afield the lower are their expected trade values. The distance is defined as the distance between the capitals of both countries. However, this measure can be imprecise and can lead to misinterpretation. Although, the capitals of two neighboring countries are relatively far away due to their location in the country or the size of the country, it is no indicator for lower trade values. To overcome this drawback of the distance measure the dummy variable for a common border is included in the model. A common border suggests that the countries have high trade values with each other and is thus expected to be positive. By having the distance variable and the dummy for a common border it is possible to analyze the distance effect in more details.

EU dummy

The following three dummies are the main variables of interest for this study. The EU dummy measures the policy effect for the countries of the European Union. Over the last decades Europe was growing together to become closer to a single economy. To show this impact, the percentage of intra-European trade of the total trade flows for each country is shown together with other country specific descriptions in table 2. For some countries the percentage is above 90 percent (European Commission, Eurostat, 2014). For the total European Union (EU28) in 2002, 68.3 percent of all trade flows have been intra-European; in 2013 it was still 62 percent. These shares illustrate that inner-European trade is sufficiently high and might not be influenced by exchange rates, but is highly influenced by the European Union. For this reason it is expected that the EU dummy is positive.

[1] Data for export values in Euro are not available for all sample countries and time periods.

FTA dummy

The FTA dummy variable captures the effect of free trade agreements between the countries. Since the dummy for the EU already captures the effect of open borders and free trade in the EU, this dummy is just used for non EU member countries and their free trade agreements with each other or with the EU countries. The dummy for free trade agreements is also expected to be positive due to vanished trade barriers between these countries. However, just a few sample countries have signed a new free trade agreement in the selected time period. This drawback might influence the results of this study for the FTA dummy.

EMU dummy

The EMU dummy is the variable of interest in this model to investigate the currency union effect on trade flows. This dummy is positive if the currency union affects exports positively, but several arguments can be used against this effect on exports. Trade flows in Europe are already high due to structural reasons and all countries already have free trade agreements due to the EU and several other conditions for trade. The question now is, if the vanished uncertainty of exchange rates increases trade for the sample countries.

Additional to these variables a time dummy, D_t , is used for each year in some of the models. It is assumed that each year has some variation in trade patterns, which can lead to unobserved heterogeneity in these regressions. These unobserved effects are mistakenly added to the effect of other variables, when time dummies are not included. Each regression takes the first year of the time period as the base year to avoid the dummy trap.

These variables are analyzed for a panel data set for 18 countries on the European continent over the time period from 1996 to 2012. The countries are separated in EMU members and non-members. The EMU members are the nine countries that implemented the Euro as their currency in 1999[2] and the control group contains nine European countries without the Euro as their currency. All used countries are described in table 2. The first nine stated countries are the EMU members, followed by the control group. It is visible that most of the countries are EU members in the data set and have a free trade agreement with each other. More important are the proportions of trade with the European Union countries (EU 28). These shares are decreasing over time for all sample countries. This shows that oversea markets are getting more important for the European countries when it comes to trade.

The export values, how they change and if the currency union can influence these values, are the main interest of this study. Figure 1 is used to understand the export data by representing the average export values for the two sub-samples (EMU members and control group) with the index year 1996 for the time period from 1996 to 2012. The purpose is to understand that export values in general are growing over time for the sample.

[2] Belgium and Luxemburg are excluded due to data problems

Table 2 Country descriptions

Country	EU	Free trade agreement with the European Union	EMU	Proportion of trade with EU-28 (2002)	(2013)	Share of exports in GDP (2013)
Austria	+	+	+	76,1%	70%	53.5%
Finland	+	+	+	61.2%	55.3%	38.4%
France	+	+	+	65.2%	59.3%	28.3%
Germany	+	+	+	63.7%	57.0%	45.6%
Ireland	+	+	+	66.0%	56.9%	105.3%
Italy	+	+	+	61.7%	53.7%	28.8%
Netherlands	+	+	+	80.5%	75.7%	82.9%
Portugal	+	+	+	81.4%	70.3%	39.3%
Spain	+	+	+	74.9%	63.0%	31.6%
Bulgaria	since 2007	since 1999	-	62.3%	60.1%	68.4%
Czech Republic	since 2004	+	-	86.3%	81.1%	77.2%
Denmark	+	+	-	69.9%	63.5%	54.3%
Latvia	Since 2004	since 2004	Since 2014	77.8%	66.4%	59.4%
Lithuania	Since 2004	since 2004	Since 2015	69.3%	57.4%	84.1%
Norway	-	+	-	64,3%	58.9%	38.8%
Poland	Since 2004	+	-	81.5%	74.8%	46.1%
Sweden	+	+	-	58.6%	57.7%	44.0%
United Kingdom	+	+	-	61.4%	43.6%	30.1%

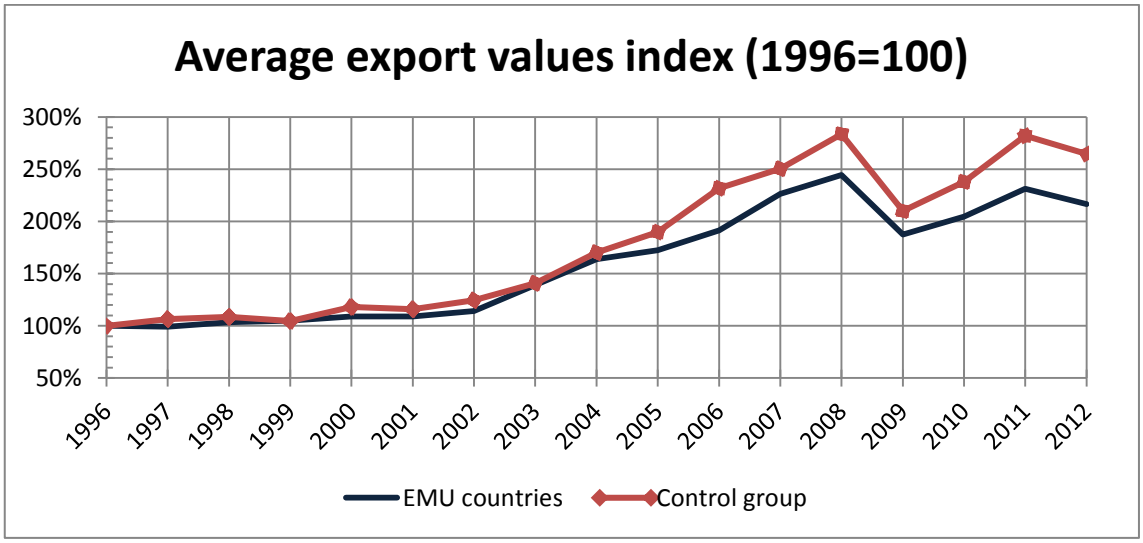

Figure 1 Average export value index (1996=100)

The index for the Euro group increases on average slower than for the control group. Nevertheless, both groups have similar growth pattern in trade. It is also visible that the financial crisis was followed by a drop in export values, which was nearly equal for both groups. In figure A2 in the appendix the absolute export values for this time period are

shown, rather than the export values with an index year. It can be seen that up to 2002 the EMU countries had a smooth growth rate of their export values to the other countries of the sample which was absolutely similar to the growth of the control group. From 2003 to 2008 the growth rate increased for both samples before the financial crisis lead to a drop in exports. However, it cannot be concluded at this point that this increase was due to the implementation of the Euro in 1999 or if other factors affected this growth. The control group's increase in trade in the same time period and the higher growth rate of exports for the control group in Figure 1 doubt the positive effect of the Euro on trade.

Table 3 Descriptive statistics

Variable		Total sample	EMU	Control Group
Export value	Mean	6.21e+09	9.10e+09	3.32e+09
	Std. Deviation	1.37e+10	1.76e+10	6.91e+09
GDP Exporter	Mean	7.01e+11	1.01e+12	3.90e+11
	Std. Deviation	8.85e+11	9.80e+11	6.44e+11
Distance in KM	Mean	1340.92	1367.18	1053.30
	Std. Deviation	677.40	679.64	684.65

Some of the descriptive measures are given in table 5. The fact that the EMU group consists of stronger countries with higher GDP values is visible, but it also shows that the deviation is wider in the group of Euro countries. The same can be stated about the export values, with a higher mean value but also a higher standard variation for the EMU countries than for the control group.

4 Empirical Results

This analysis is split into two parts to be able to investigate the real effect of the currency union on exports and together with this the influence of exchange rates on exports. The first section investigates the total effect of the EMU on export flows to answer the first stated research question. The second section is motivated to analyze the level of influence of the exchange rate on changes in export flows and investigates the second research question. The purpose of this model is the fact that European countries have high volumes of exports. This can be seen in the descriptive statistics in figure A2. It is important to know which factors can influence the changes in trade flows, in this case particularly if the currency union has an influence on these changes. This is done by using a random effect model for the change in export flows.

Both models are first analyzed without time dummies and then with time dummies, to see if an unobserved time effect occurs in the dataset. A decreased value of the EMU coefficient is expected and would confirm the results of Bun and Klaassen (2007) and De Souza (2002) that previous studies overestimated the effect of the EMU on trade by not taking time effect into consideration. The analysis is done for the total time period from 1996 to 2012 and then for two sub-periods. Figure 1 and figure A2 both indicate a smooth increase in exports until 2003 and afterwards a higher change in exports. For this reason the first time period contains the years 1996 to 2003 and the second period covers the years 2004 to 2012. Both sub-samples are also first investigated without time dummies and afterwards regressed with time dummies.

4.1 Effect on Total Export Values

The first analysis is done to study the currency union effect on absolute export values. The analysis is done with six different models, three with and three without time dummies. The analysis of the first time period is done to see if the early stage of the currency union affected changes in exports, while the second period investigates if the currency union has an effect in a period with higher ups and downs. First the regression for the complete time period from 1996 to 2012 is done and then again separated for each sub period. All 18 countries are used in every regression, which leads to 5202 observations in the total sample, 2448 observations for the period from 1996 to 2003 and 2754 for the period from 2004 to 2012.[3]

The variables of interest for this analysis are the three dummy variables for the European monetary union, the European Union and free trade agreements. As in previous studies, the coefficients for the EU and FTA are expected to be positive, while the coefficient for the Euro might not be significant.

The effect of the European monetary union in the models without time dummies is just significant for the time period from 1996 to 2003 (model (2)) at the 1% level. It seems like the Euro has a positive significant effect on export in this time period. However, this effect vanishes when time dummies are included in the analysis. This result shows that the time period might have unobserved heterogeneous events. These undetected effects are shown by positive significant time dummies for all years in the first sub sample, which explains the positive significant results when time effects are not taken into consideration.

[3] An analysis of this model as a fixed effect model confirms the results. Just in the second time period is the EMU coefficient negative and significant for both models.

Table 4 Regression results, absolute export values

Variable	Total sample no time dummies (1)	1996-2003 no time dummies (2)	2004-2012 no time dummies (3)	Total sample time dummies[4] (4)	1996-2003 time dummies[2] (5)	2004-2012 time dummies[5] (6)
Constant	-2.9401*** (1.0894)	-9.5631*** (1.3238)	-8.6780*** (1.0795)	-15.1782*** (1.4596)	-11.7323*** (1.5840)	-17.5478*** (1.3915)
lnKM	-1.0779*** (0.0960)	-1.1663*** (0.0837)	-1.1507*** (0.0822)	-1.1422*** (0.0752)	-1.1583*** (0.0830)	-1.1665*** (0.0779)
lnGDPex	0.6770*** (0.0297)	0.7724*** (0.0306)	0.7017*** (0.0301)	0.9212*** (0.0324)	0.8112*** (0.0318)	0.8901*** 0.0345)
lnGDPim	0.5002*** (0.0251)	0.6806*** (0.0258)	0.7159*** (0.0243)	0.7455*** (0.0334)	0.7208*** (0.0313)	0.8735*** (0.0295)
Border	0.8468*** (0.1259)	0.4879*** (0.1205)	0.6737*** (0.1148)	0.5038*** (0.1205)	0.4656*** (0.1224)	0.4767*** (0.1287)
EU	0.2953*** (0.0443)	0.6734*** (0.0854)	0.0444 (0.0375)	0.3327*** (0.0445)	0.5885*** (0.0878)	0.1014*** (0.0375)
FTA	0.0350 (0.0539)			-0.075 (0.0545)		
EMU	-0.0043 (0.0239)	0.0875*** (0.0171)	0.1523* (0.0823)	-0.089** (0.0406)	-0.0080 (0.0350)	-0.0958 (0.0802)
Observations	5202	2448	2754	5202	2448	2754
R^2	0.8830	0.9157	0.8940	0.9122	0.9186	0.9034

*** 1%; ** 5%; *1% significance level; standard errors in brackets; random effect regressions with robust standard errors

For the time period from 2004 to 2012 a similar effect is visible. Without time dummies the EMU has a positive effect at the 10 percent significance level, while this effect disappears when time dummies are included. As expected, the value of the EMU coefficient in the analysis decreases with time dummies. The EMU dummy then is just significant for the total time period and has a negative coefficient. This confirms the results of Bun and Klaassen (2007) and De Souza (2002). They argue that studies, such as Rose (2000) and Micco, Stein, and Ordoñez (2003) overestimated the effect of the EMU on trade by not taking time effects into consideration. The decreasing ratio of intra-European trade over time, as seen in Table 2 and the stronger growth of export of the control group (Figure 1), might be explanations for this effect. Another reason for this effect can be due to the countries in the control group. The Eastern European and Baltic countries opened up for trade after the collapse of the Eastern Bloc in 1989. The opportunity to trade with other Central European countries opened up a new market for these countries, followed by steeper increase in export values than for Central European countries.

The results for the EMU dummy support the previous research that the EMU does not have a significant positive effect on export flows. This can be explained by the fact that the countries in Europe already have sufficiently high trade values before the EMU was implemented. The intra-European trade flows are decreasing for the sample, as seen in Table 2 and other economies outside of Europe are getting more important for foreign trade of the European countries. A combination of this movement to higher shares of trade with non-European countries and the high volumes of trade before the Euro was implemented are potential reasons why the theoretical positive effect of a currency union

[4] yearly time dummies, 1996 base year
[5] yearly time dummies, 2004 base year

did not increase trade for the EMU countries. Since exchange rate uncertainty is considered as a transaction cost, and the common currency in Europe is connected with several factors reducing transaction costs, as stated in section 2.2, are the results for the EMU membership unexpected. From a theoretical perspective, the advantages of the currency union should increase exports.

Another effect occurs for the European Union dummy variable. Except for the time period from 2004 to 2012 in the regression without time dummies (model (5)) the EU coefficient is significant. The EU dummy has the highest coefficient for the time period from 1996-2003 (model (2) and (5)). This period distinguishes itself by very similar growth rates in export values without any ups and downs, as shown in figure 1. In general the EU dummy has a positive significant effect on exports. This positive coefficient for the EU variable was also found by Bun and Klaassen (2007), Glick and Rose (2002) and several other studies. High and stable trade flows between the countries are one of the goals of European Union policies. It seems like the aim to increase trade flows in the European Union is reached, at least for this country sample.

The dummy for free trade agreement can just be included in the analysis for the total time sample because all countries have a free trade agreement with the European Union and all the other sample countries from 2004 on. This would lead to mulitcollinearity in the regression for the second time period and because of this the dummy for free trade agreement is just included in the total time sample. However, for the total time sample the FTA coefficient is not significant and no statistical effect can be proved. One of the reasons can be the relatively small group of countries without a free trade agreement included in the analysis, together with the high total trade values in the sample. Since Europe is grown altogether over the last 60 years and therefore trade flows between the economies are grown over time, nearly all countries are included in free trade agreements. Just Bulgaria, Latvia and Lithuania signed a free trade agreement in the time period of interest. For these relatively small countries there is no statistical significant impact measurable due to these agreements. Other studies with more diverse sample sets could find a significant positive effect on trade. Rose (2000) and Bun and Klaassen (2007) find a positive significant effect of free trade agreements on trade by using a bigger country set with more variation in free trade agreements. This confirms that the small variation in free trade agreements in the sample, together with the influence of the free trade due to the European Union affects the FTA dummy which is followed by a non-significant coefficient in this study.

The results for the control variables for the distance and size of the economy are as expected. The distance variable has a negative effect on trade flows and is statistically significant for the whole regression, while the border variable is positive and also significant for all estimates. The coefficients for the mass variables, the exporter's and importer's GDP, are also as expected. A higher GDP increases trade flows significantly. All results for the control variables are the same as in previous studies and therefore confirm these results (Bun and Klaassen, 2007; De Souza, 2002; Rose, 2000). The same can be stated about the model fitting. Previous studies obtained an R^2 value of around 0.9, which goes along with the findings in this paper.

4.2 Change in Exports

The previous approach shows that the European monetary union does not have a significant positive effect on the patterns of export. The purpose of this section is to test, if the Euro has a positive influence on the changes of export flows. Trade in Europe was, due to the proximity of the countries and free trade agreements, as well as historical grown trade pattern already high before the Euro was implemented. Even without the exchange rate uncertainty due to the common currency, the previous results show that these high export flows are not affected by the Euro. However, in particular in the second time period it is expected that the common currency was taken into consideration in the selection of trade partners, in this more volatile period. Therefore a positive effect of the EMU on changes in exports is expected. [6]

For this purpose the time period is reduced by one year and now contains the period from 1997 to 2012. The same transformation is done for the exporters' and importers' GDP values. The logarithmic absolute value of the exporters GDP is added, to study the effect of the economic size on the changes in exports. The other variables are used as in the previous model.

Table 5 Regression results, change in export

Variable	Total sample no time dummies	1997-2003 no time dummies	2004-2012 no time dummies	Total sample time dummies[7]	1997-2003 time dummies[5]	2004-2012 time dummies[8]
Constant	0.3052*** (0.0584)	0.1108 (0.0946)	0.3503*** (0.0737)	0.4063*** (0.0624)	0.1891* (0.0976)	0.3910*** (0.0830)
lnKM	-0.0032 (0.0054)	0.0067 (0.0099)	-0.0062 (0.0068)	-0.0042 (0.0053)	0.0062 (0.0096)	-0.0077 (0.0070)
dlnGDPex	0.4057*** (0.0526)	0.2333*** (0.0674)	0.4944*** (0.0717)	0.2941*** (0.0781)	0.2172* (0.1163)	0.3631*** (0.0934)
dlnGDPim	0.7284*** (0.0482)	0.3162*** (0.0661)	0.9850*** (0.0575)	0.6120*** (0.0537)	0.3104*** (0.0810)	0.8704*** (0.0661)
lnGDPex	-0.0093*** (0.0017)	-0.0029 (0.0032)	-0.0111*** (0.0024)	-0.0100*** (0.0019)	-0.0042 (0.0033)	-0.0114*** (0.0025)
Border	0.0031 (0.0070)	0.00188 (0.0110)	0.0013 (0.0075)	0.0008 (0.0069)	0.0018 (0.0110)	-0.0005 (0.0076)
EU	-0.0182*** (0.0064)	-0.0452*** (0.0078)	-0.0080 (0.0107)	-0.0204*** (0.0067)	-0.0471*** (0.0080)	-0.0067 (0.0105)
FTA	0.0044 (0.0140)			0.0003 (0.0132)		
EMU	-0.0229*** (0.0056)	-0.0143** (0.0073)	-0.0105* (0.0061)	-0.0170** (0.0066)	-0.0038 (0.1032)	-0.0149** (0.0063)
Observations	4896	2142	2448	4896	2142	2448
R^2	0.2357	0.0677	0.4060	0.3144	0.0883	0.4860

*** 1%; ** 5%; *1% significance level; standard errors in brackets; random effect regressions with robust standard errors

[6] An analysis of this model as a fixed effect model confirms the results. The EMU coefficient has the same sign for all models. Furthermore are the impacts of the other variables similar in the fixed effect model.
[7] yearly time dummies, 1997 base year
[8] yearly time dummies, 2004 base year

The negative significant coefficient for the EMU dummy is at the first moment unexpected However, as already observed in fFigure 1 export values are increasing faster for the control group than for the EMU-countries. This enhanced growth rate is the explanation for the negative coefficient in the second time period. The high export values in Europe and the decreasing shares of intra-European trade can be the reason for this negative sign. Still, the analysis shows that the common currency does not have a positive effect on exports changes. While time dummies reduced the EMU coefficient in the previous model, no clear effect is visible in this approach.

Similar is the impact of time dummies for the EU coefficients, no clear impact is visible The EU dummy has a negative influence on the change in exports and therefore reduces the export differences over years. Accordingly to the coefficient, member countries of the EU have less change in export values than other countries. Contrary to the outcome for the GDP coefficients the EU dummy is significant for the period from 1997 to 2003 and insignificant for the second period. The impact is also higher for the first period than for the total sample leading to the inference that the EU dummy decreases the changes in exports. However, the negative significant coefficient was not expected and further research is required to explain this negative effect. Free trade agreements do not have any significant effect on changes in exports. This might be due to the small changes in free trade agreements in the examined countries and time samples as already seen in the previous model.

The results for the control variables in this model again are as expected. The time invariant distance variables are not significant. Since distances and borderlines do not change, they cannot explain changes in exports. Both coefficients for change in GDP are positive and significant. A positive change in GDP leads to a positive change in exports. However, the negative coefficient for the absolute GDP for the exporting country is unexpected. Visible is, that in the second, more volatile time period, the GDP coefficients are higher and significant. This shows that changes in the GDP as well as the absolute GDP value has a higher impact on changes in exports in a more volatile period.

While the previous model has a high R^2, this value is lower for these models. It was expected that the used variables cannot completely explain the changes in exports. However, the R^2 value of 0.48 for the time period from 2004 to 2012 shows, that size and distance of the countries have a higher impact on changes in trade in a period with ups and downs in export, while the R^2 is just 0.08 for the first time period with smaller and stable export changes.

Similar results as in the first model are found. While the size and changes in the size of an economy are having an influence on changes in exports, the more political variables for EU and EMU have less impact. Additional to this are in both models the coefficients for the EMU negative when time effects are included in the model. This might have several reasons and can be influenced by the control group, but previous studies could also not find any positive effect on trade due to the monetary union (De Souza, 2002).

5 Conclusion

The effect of the European monetary union on export values is investigated with two different models. While other studies focus on the effect of total trade on the EMU countries, this paper first examines the currency union effect on pattern of exports, before a model is used to explore if the currency union has a positive influence on changes in export flows. For this purpose a random effect panel data model is applied to explain bilateral exports by using distance and size measures as well as a European monetary union, European Union and free trade agreement dummy variable.

The results of the first model do not indicate a statistically significant effect of the EMU on exports. It was expected, that the common currency leads to higher trade values but due to the constellation of the EMU countries, a non-significant effect is not astonishing. The low volatility of exchange rates in Europe before the EMU was implemented together with high dependences of the economies and the short distances can explain the results. Another factor is the European Union with its positive significant effect on trade values. Several advantages of a common currency were already captured by the EU before the Euro was realized in 1999. The common currency and thus the stable exchange rate reliability could not increase trade significantly. It can be concluded from the results that the advantages of a political union, such as the European Union with its free trade agreements and the common policy goals and implications, have a stronger influence on exports than the common currency. The vanished uncertainty about the exchange rate as one of the major advantages of the Euro seems to have no effect on exports. The transaction costs through exchange rates can be reduced by insurances for exchange rate uncertainty and improved methods to analyze the financial markets nowadays. Additional, costs of exchanging currencies are negligible. These risk and cost reductions are further reasons why the EMU has no statistically significant effect on exports.

The results that the distance and size coefficients are significant and have a strong impact on export suggest that structural patterns are more important than exchange rates and the common currency for the European countries.

The second model shows that the EMU and EU dummy have a negative effect on changes in exports. The negative effect of the EMU can be explained by a lower growth rate of exports in the sample. A similar explanation can be given for the countries of the European Union. However, both coefficients should be investigated in further research to analyze if these effects also occur for the other countries in Europe and the EMU. The structural variables are implying that countries are already trading a lot and export flows do not grow significantly.

Both models cannot support the arguments of the EU that the European monetary union increases trade for the member countries. They instead point out the importance of structural patterns for trade, such as location and size of the economies. For highly linked economies, like the European countries, exports are not affected by a common currency. However, these results just investigate the effect of the Euro on exports, while several other positive effects can occur due to the common currency. Therefore no policy implications for the countries willing to enter the currency union can be done by just analyzing the effect on exports. By just analyzing the export values, it is not possible to draw any policy implications for the EMU countries. Several other possible advantages due to the common currencies have to be taken into consideration to analyze the economic success of the Euro. For the supporter of the Euro are these results a drawback, but the impact on exports is just a small brick stone in the complex pros and cons of a currency union.

The lack of research in analyzing the currency union effect on changes in trade over time, or more generally the influence of exchange rates on changes in trade, should be investigated in further research. The negative impact of the European monetary and European Union was unexpected in this study. A further analysis for a wider country set should be investigated to control if the negative results are just explained by the selected countries.

Furthermore, a mixed effect model is suggested. The problem of time invariant variables is solved by using a mixed effect model without losing the main advantages of a fixed effect model. This should be done for a bigger sample, in the optimum case for all countries in Europe.

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Appendix

Figure A1 Map of countries with capitals; green colored EMU members, beige colored non-EMU countries source: www.stepmap.de

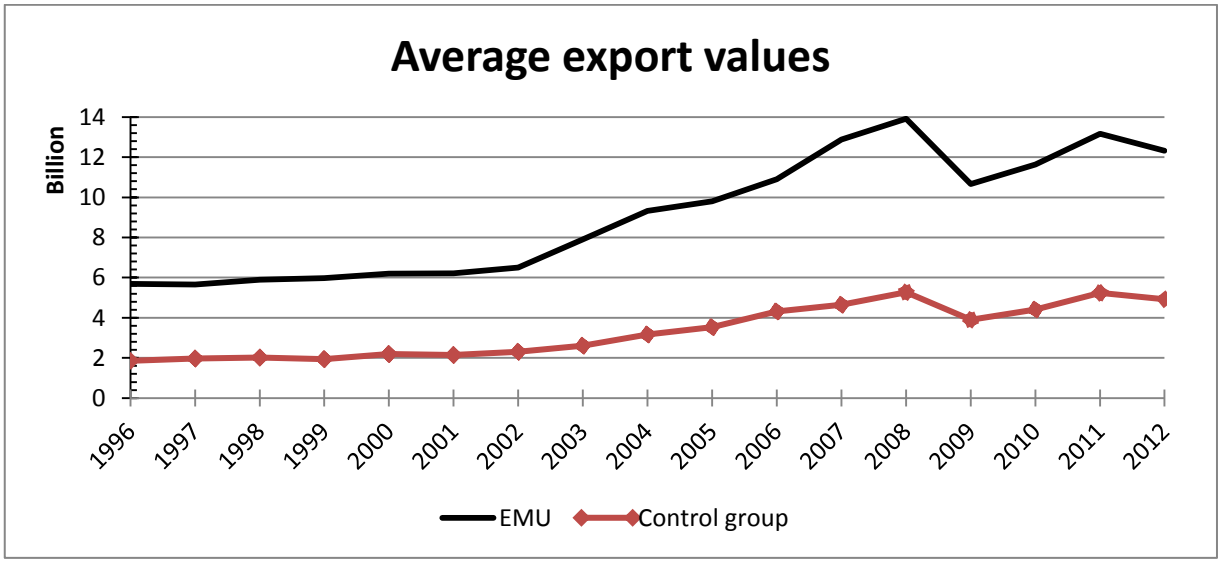

Figure A2 Average export values for 1996-2012, own figure with data from Comtrade

Table A1 Correlation matrix

	Ex	KM	GDP EX	GDP IM	Bor	FTA	EU	EMU
Exports	1.0000							
Kilometer	-0.2672	1.0000						
GDP EX	0.4844	-0.0899	1.0000					
GDP IM	0.4829	-0.0906	-0.0079	1.0000				
Border	0.4509	-0.4491	0.1380	0.1380	1.0000			
FTA	0.1626	-0.0188	0.1723	0.1723	0.0860	1.0000		
EU	0.2453	0.0102	0.2458	0.2458	0.0846	0.5061	1.0000	
EMU	0.3155	0.0180	0.2078	0.2068	0.0958	0.1785	0.3526	1.0000

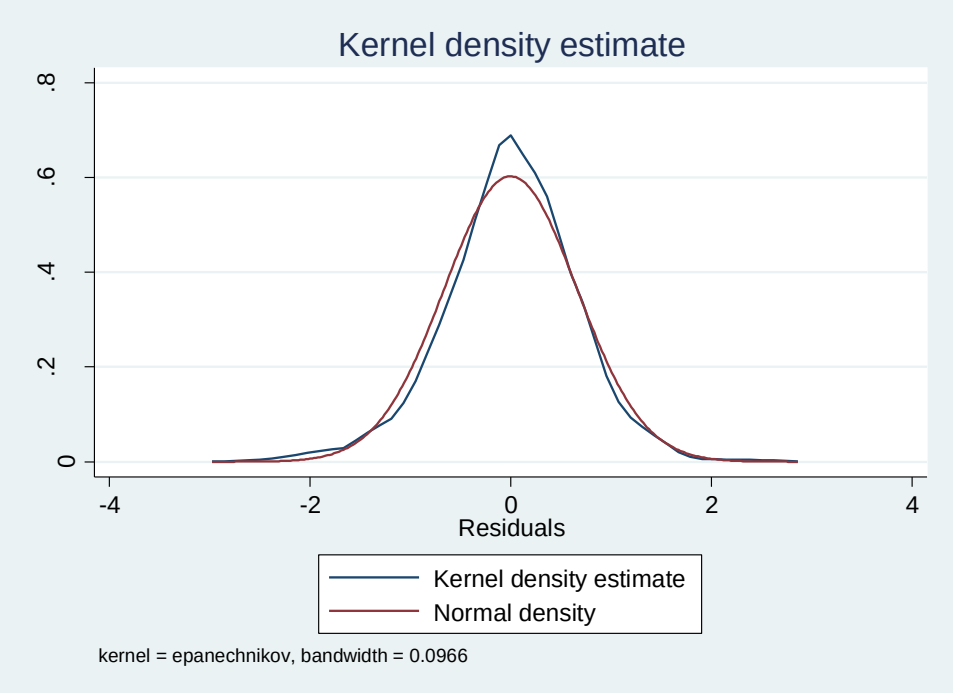

Figure A3 Residual distribution