The Effects of European Monetary Union on Macroeconomic Performance

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Abstract: *The purpose of this study is to show the effect of monetary union on macroeconomic performance for 24 OECD countries during the period 1988-2009. According to the findings, the European Monetary Union has a positive effect on foreign trade. On the other hand, it has a negative effect. The monetary union set up without a financial union has a negative effect on macroeconomic performance by limiting the implementations of policy makers even if it has a positive contribution on trade. Thus, monetary policy implementations not supported with financial policy have a negative effect on macroeconomic performance.*

Key Words: Monetary Union, European Union, Panel OLS, Gravity Model, Macroeconomic Performance.

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Introduction

Economic integrations can be put in order ranging from the narrow ones to the broad ones as follows: Free Trade Zone, Customs Union, Common Market, Economic Union, Monetary Union, and Full Economic Union. In this study, the monetary union will be discussed as an advanced stage of economic integration. The theoretical framework of the monetary union is formed by the Optimum Currency Area Theory. Optimum currency area draws a theoretical framework for the definition of the common currency area while presenting the characteristics of the countries that will form a monetary union. In this context, optimum currency area tries to find out optimum size of the currency area by investigating the costs and gains of the countries which prefer common currency. Mundell, who made important contributions to optimum currency area, emphasizes that optimum currency area is not a theoretical subject but an empirical one. Optimum Currency Area Theory shows the characteristics the countries should have to be a member. However, there is no definite determination about whether benefits or costs of the monetary union outweigh. In this context, the analysis of the effect of monetary union on the union countries becomes an empirical subject.

The countries which are members of the monetary union initially fix their exchange rates and transfer their monetary policy implementations to a supranational authority. Exchange rate hedging avails these countries by eliminating the harmful effects to be caused by exchange rate volatility among the member countries. However, monetary union has several other benefits and costs.

Losing autonomy in the monetary policy comes first regarding the costs of the monetary union for the member countries. The countries that become the members of the monetary union transfer their monetary policy implementations to a supranational monetary authority. Secondly, in case of growth differences among the areas, capital will prefer the countries where wages are lower and growth is relatively higher. In case of a demand shift in the union, the countries included in the monetary union will face inflation or unemployment. However, in case of downward and upward flexibility of wages in the member countries or labor's being mobile among the countries; demand shift will automatically be balanced. Payments disequilibrium will cause inflation rates to increase in the monetary union. On the other hand, mobile labor force and capital will move to the countries where tax rates are lower. Therefore, tax competition will emerge and there will be a downfall pressure on tax rates. With the transition to the monetary union, since the right of coining money is transferred to a supranational authority, seniorage income will be eliminated.

The main reason for the countries to join the monetary union is that monetary union reduces costs, increases price transparency and provides more efficient allocation of the resources within the union. In addition, when there is policy coordination, there can be a positive effect on the welfare level of the member countries. The most visible gain of the monetary union is that the cost of exchanging national currencies will be eliminated. The allocation of the resources used for the currency exchange to the production of goods and services will contribute to the welfare. The monetary union reduces the barriers for the financial integration with the decrease in exchange rate volatility and the use of a single currency in the market. Finally, monetary union reduces the amount of reserves the central banks should keep.

Monetary union has an effect on the countries included in the union and those not included in the union. However, the expected effects are based on estimations. Therefore, the effect of the monetary union on the countries not included in the union is a subject that needs to be investigated empirically. As stated by Mundell, trade among the countries which use a single currency will be easier and cheaper than those using their own currencies. Therefore, it is expected that the monetary union has a positive effect on foreign trade. The first research subject of this study is to show the monetary union has a positive effect on foreign trade. Thus, the first hypothesis of the thesis is as follows: "The European monetary union has a positive contribution on foreign trade volume".

The basis of establishing a monetary union for the countries by abandoning their monetary policy autonomy involves the expectation that the monetary union will provide a positive contribution to the welfare level as stated in economic integration theory. Frankel and Rose assume that the monetary union will affect income from several different channels. Therefore, the second research subject is to show the effect of monetary union on macroeconomic performance. The second hypothesis examined in order to investigate the welfare effects of the monetary union is as follows: "The European Monetary Union has a positive effect on income." Firstly, the data set will be described by giving literature studies and then empirical results will be discussed.

Literature Review

Under the title of literature, similar studies analyzing the effects of the monetary union on macroeconomic performance were tried to be gathered.

Rose and Rose et al., in their study, carried out panel gravity model estimation by using bilateral data. The estimation considered the data of 186 countries for 5 observations (five-year observations) during the period 1970-1990. As a result of the analysis it was put forward that the monetary union had a relatively high positive effect on international trade and a relatively small negative effect on exchange rate volatility. According to these statistically significant effects, trade was found to be three times more when the countries used the same currency not different currencies. Monetary unions like the European Monetary Union can cause great increases in foreign trade.[1]

Pakko and Wall, in their study, used the data set Rose used in his study. The results they obtained were poorer than those obtained by Rose. Additionally, the authors argue that the results obtained by Rose are not reliable since he used determinants that do not change depending on time. They estimated a generalized fixed effects model by using the data set of Rose in three different ways. As a result, it was concluded that common currency use had a decreasing effect on trade.[2]

Persson reconsiders the data set of Rose. If the countries included in the monetary union are systematically different from each other and the relationships between the observable determinants and trade are complex, the effect of common currency use on trade can be measured wrongly. Persson states that such negations can ruin the empirical results of Rose. Persson, in this context, estimates the effect of the monetary union on international trade by using the techniques designed in a reliable way. As a result, the effect of the monetary union obtains more moderate results than the study carried out by Rose. In addition, it is emphasized that the results are unclear.[3]

Tenreyro estimates with the help of the gravity model in the study in which annual data are used for 200 countries for the period 1978-1997. It is emphasized that the trade flows which are given zero value among the countries and making endogenous selection in the common currency area can lead to some econometric problems. Therefore, in the study, it is stated that because of obtaining statistically non-significant results, no big and reliable results were reached like previous studies. [4]

Bun and Klaassen try to obtain the effect of euro directly from the data of EMU observations. Double-sided trade figures include annually the period 1965-2001 for 15 European Union countries and G7 Countries out of Europe (Canada, Japan and the USA). In the study in which the dynamic panel technique was used, it was concluded that euro increased trade to an important extent. The size of increase is 4% for the first year and 40% for the long term. The authors argue that this calculation is useful for the countries which are included in the European Union and out of the monetary union like England.[5]

De Souza estimates the period 1980-2001 for 15 EU countries by using annual data. The purpose of the study is to calculate the earnings of economically developed and big countries

from the formation of monetary union. As a result of the study, it is put forward that EMU has no consistent and important effect.[6]

Edwards and Magendzo analyze per capita income, growth rate, growth volatility and inflation for the period 1970-1998 by using panel data analysis. The authors analyze the possible effects of joining the common currency by using treatment effects model. The authors express that monetary union decreases inflation rate but increases macroeconomic volatility.[7]

Frankel and Rose investigated the data of more than 200 countries with five-year observations between the years 1970 and 1995 by using panel data analysis. The authors conducted a two-stage analysis in their studies. In the first stage, the effect of the monetary union or board on trade volume was investigated with trade gravity model. As a result, it was seen that the monetary union positively affected foreign trade. In the second stage, the effect of the monetary union or currency board on per capita income was investigated and a positive contribution was seen on income.[8]

Kenen estimates by using the data set of Rose for 121 countries by means of the gravity model. It was concluded that the effect of monetary union was relatively smaller than the results put forward by Rose in his study. Nitsch concluded that the effect of monetary union on trade was zero by using the data set of Rose.[9]

Barr et al. estimated the gravity model of Rose for the European countries during the period between 1978Q1 and 2002Q1. Not only European countries but also EFTA countries (including Luxembourg and Lichtenstein) were included. Thus, 11 EMU countries and 6 non-member countries were included in the analysis. A panel data set of 13,192 observations was estimated for 17 countries and 136 different time series. The authors, in their studies, investigated the effects of monetary union when EMU countries were compared to those not included in the union. As a result, it cannot be said there is a clear effect of being an EMU member in terms of the performances of countries (inflation, unemployment and output).[10]

De Nardis and Vicarelli produced estimations for 11 exporting and 32 importing countries (Belgium and Luxembourg series were collected). The estimation period was 1980-2000. In the study, gravity equation was considered in a dynamic framework in order to catch the effects of trade. The main finding of the study is that the acceptance of euro has a moderate positive effect on bilateral trade of the European countries. Here, the effect is smaller than the effect that occurs when estimating with a bigger and heterogeneous country set.[11]

Micco et al, in their study, investigated the initial effect the European Monetary Union caused in the trade. They estimated double-sided trade of 22 developed countries by using the data belonging to the period 1992-2002 with panel data analysis. An analysis was conducted by selecting industrialized countries in a way to be homogenous with 12 European countries in the monetary union during the relevant period. After taking the effect of several other variables under control, the effect of euro on double-sided trade occurred between 5-10% when the member countries were compared to all countries. When the effect of union countries on trade was compared to the effect on the non-member countries, it was estimated to be between 9-20%. Additionally, no trade deviating effect was seen. As a result, it was concluded that euro had a trade increasing effect both for the countries in the area and the entire countries in the world.[12]

Faruqee estimated the data belonging to the period 1992-2002 for 22 industrialized countries by means of panel gravity model. He considered both import and export separately as a dependent variable for the gravity model. As a result, while euro caused an increasing effect in the area, it did not affect the trade out of the area.[13]

Haber and Neck examined EMU, USA and Central and Eastern European countries with annual data. In the analysis dynamic intertemporal general equilibrium model was used (MSGR44A). As a result of the analysis, when the welfare effect was considered, EMU's covering the Central and Eastern European countries (2004 expansion) was seen to be dependent on the shocks economies encountered. EMU expansion did not cause a welfare effect for the current union countries. On the other hand, there was no benefit for the Central and Eastern

European countries. As a result, it was seen that economic benefit was very small for all countries and harmful for the Central and Eastern European countries.[14]

Flam and Nordström investigated the effect of the European monetary union on the trade volume by means of the gravity model. When the period 1989-1997 and the period 1998-2002 were compared, trade increased in the rate of 15% for the countries in the euro area and 8% for the countries out of the euro area. This effect was estimated to increase over time.[15]

Mancini-Griffoli and Pauwels estimated the period 1980Q1-2004Q4 for EU 15 countries by using gravity model. Authors investigated whether a break occurred in the trade volume of the euro area with structural break test. As a result, a break was determined in the period 1999Q1. However, they stated that break was temporary. The reason for the break was shown to be deeper integration of the institutions in the euro area and a decrease in real interest rates.[16]

Traistaru-Siedschlag, in his study, examined the macroeconomic performance of EMU (European monetary Union) with annual data belonging to the period 1990-2005. In the study, he compared the periods 1992-1998 and 1999-2005 for the mean and standard deviation figures as well as the graph analysis of the related period. He found out as a result of the analysis that inflation differences decreased, real growth converged, trade in the area provided contribution to business cycles and concluded that EMU was successful. Additionally, he emphasized that financial integration formed an adaptation mechanism against individual shocks with portfolio differentiation.[17]

Barrell et al. investigated the effect of euro on macroeconomic performance for Austria, Belgium, Denmark, Finland, France, Germany, Holland, Sweden, England and the USA by using cointegration analysis, regression analysis and table and graph analysis. In the study it was stated that euro had an important effect on income volatility and increased income level by decreasing income volatility. In addition, it was seen that euro had a positive effect on exchange rate volatility.[18]

De Nardis et al. examined double-sided export figures of 23 OECD countries for the period 1988-2003 by means of dynamic panel data methodology. They concluded as a result of the gravity model estimation that the trade effect of euro was 4%.[19]

Elu and Price investigated the effect of euro on the economic growth of the Sub-Saharan African. As a result of the research, they found out that the participation of the sub-Saharan Africa in the monetary union would have a positive effect on the growth. Additionally, they stated that formation of a second euro area like the Central African Economic and Monetary Union would develop life standards.[20]

Gerlach and Hoffmann investigated income, consumption, inflation, short and long term interest rates by using regression equation and annual data for the periods of 1990-1998 and 1999-2006. In the study, it was seen with the transition to euro that industrialized countries had an important effect on nominal and real main macroeconomic variables (GDP, stocks, inflation, interest rates and consumption). In addition, they concluded that monetary union contributed to the stability of both the member countries and non-member countries.[21]

McGowan analyzed double-sided trade figures of 12 Euro area and 3 countries out of the area with 187 countries by using OLS, Panel OLS and Dynamic Panel Data Methods. In the study, it was stated that joining the euro area increased the trade of euro area countries in the rate of 11% for the period 1999-2004.[22]

Aghion, Bacchetta, Rancie` and Rogoff, in their study, conducted regression analysis with unbalanced panel data set by considering 47 countries and at least 10 sectors for each country for the period 1970-2000. As a result, they showed that flexibility of exchange rate or a decrease in the exchange rate volatility provided positive contribution to production efficiency.[23]

Davis and Pomerantz, in their study, investigated whether monetary union had an effect on real effective exchange rate for EU12 countries and England and Denmark with quarterly data for the period 1980Q2-2007Q2. As a result, they found out that monetary union provided positive

contribution to real exchange rate volatility of the EU and EMU countries. The authors emphasize that the result is controversial when factors that can affect exchange rate such as inflation, interest rate and balance of current accounts are considered. Finally, they state that exchange rate that is relatively low in the EU and particularly EMU countries has a positive contribution on economic growth and fixed investments.[24]

Berger and Nitsch, in their study, analyzed double sided balance of foreign trade belonging to the period 1948-2008 of 18 European countries by using regression method. With the transition to euro, balance of foreign trade of the member countries deteriorated more and deteriorations became permanent. As a result, irrevocable exchange rate hedging made the deteriorations in the balance of trade more permanent and less costly. However, the deviations in the balance of trade in the rate of fixed exchange rate and labor power and flexibility of commodity market are smaller and faster to eliminate. Similarly, structural reforms soften business cycles. The measures taken to improve financial unbalance will probably help to prevent big deficits in international trade.[25]

Santana-Gallego et al. carried out a study comprising three parts. Firstly, the effect of common currency on incoming tourism and trade flows was estimated by means of gravity model. Data set used for the gravity model includes the period 1995-2006 for 179 countries and 30 OECD countries as well. Secondly, the effect of trade and tourism on income was investigated by using the gravity model. Thirdly, in the light of the results, the effect of common currency on tourism, trade and income was investigated. The results indicated that monetary unit had a positive effect on income by means of both trade and tourism channels.[26]

Peersman, in his study, in which he considered the euro area as a single economy, estimated the period 1999M9-2009M12 by means of VAR methodology. 3 different deviations were tried to be determined for the supply side of the credit market. These are (i) developments in credit supply independent of monetary policy, (ii) the effect of a change in monetary policy (change in interest rates) in the credit supply, (iii) credit supply shocks arising from non-standard policy implementations. When compared with changes in interests, final results in the output and consumer prices occur more slowly. Ultimately, Euro system activates economy.[27]

When the literature is considered, the results obtained for different periods and different monetary unit examples vary. In most of the studies investigated, positive effects of the monetary unit are referred. These effects emphasize it increases trade flows, increases income and decreases inflation and also reduce exchange rate volatility, income volatility and inflation volatility. In this respect, in the studies in which the effects of the European Monetary Union are analyzed, they conclude that monetary union has positive contributions. On the other hand, Frankel and Rose obtained results showing that there was no effect on income; Kenen and Pakko and Wall and Berger and Nitsch found out that it had no positive contribution on trade. Edwards and Magendzo expressed that it increased macroeconomic volatility. Therefore, it is emphasized in literature that the effects of monetary unit are mostly positive.

In this study, the effects of the European Monetary Union will be empirically analyzed for the period to be examined. Firstly, the data set to be used in the analysis is described and then the models that are used are explained and the results of the empirical analysis are interpreted.

Data

The data gathered from IMF Direction of Trade Statistics (DOTS), The World Bank, ECB, Eurostat, CIA, Timeanddate websites. Annual data covers the period 1988-2009. The analysis period was chosen depending on the availability of data can be accessed in a healthy way. In the analysis there are 24 OECD countries including Turkey. 12 out of these countries are already in the monetary union. The other 12 countries are Canada, Japan, USA, Australia, Iceland, New Zealand, Netherlands, Norway, Sweden, Switzerland, Britain and Turkey. The variables used in the analysis are explained in the concerned models to avoid confusion.

Methodology

If the observations used in econometric analysis are in multiple individualistic units (households, firms, cities, countries, etc.) for a period of time, it will be appropriate to use methods that combine the data. Firms in an industry, households in a region or countries in a union can be examples of this type of data. Combining both horizontal and vertical cross-sectional data is called pooling.[28]

Equations in the pooled OLS method can be estimated with three different ways including common effects, fixed effects and random effects. However when panel data theory is analyzed for countries with similar characteristic or member or a union (OECD countries, U.S States, Middle-East Countries, etc.), fixed effects will be more appropriate. On the other hand, for samples selected randomly, would be better to prefer random effects model.[29] Therefore, in this study fixed effects model will be preferred to investigate the effects of monetary union.

Fixed Effects Model

Fixed effects model with one explanatory variable is as follows:

$$y_{it} = \beta_1 x_{it} + a_i + u_{it}, \quad t=1,2,3,...,T \tag{1}$$

As an average over time for equation (1) is;

$$\bar{y}_i = \beta_1 \bar{x}_i + a_i + \bar{u}_i \tag{2}$$

In equation (2) $\bar{y}_{it} = T^{-1}\sum_{t=1}^{T} y_{it}$. Here a_i is constant over time. By subtracting equation (1) from equation (2) we will get equation (3) as;

$$y_{it} - \bar{y}_i = \beta_1 (x_{it} - \bar{x}_i) + u_{it} - \bar{u}_i, \quad t=1,2,3,...,T \tag{3}$$

$$y_{it} - \bar{y}_i = \beta_1 (x_{it} - \bar{x}_i) + u_{it} - \bar{u}_i, \quad t=1,2,3,...,T \tag{4}$$

We can rewrite equation (4) as follows;

$$\ddot{y}_{it} = \beta_1 \ddot{x}_{it} + \ddot{u}_{it}, \quad t=1,2,3,...,T \tag{5}$$

In equation (5), $\ddot{y}_{it}$, $\ddot{x}_{it}$ and $\ddot{u}_{it}$ represents the time difference between the average and data, that is conversion of fixed effects. This conversion also called within transformation. The important point in equation 5, unobservable a_i effect has been ignored. Equation 5 is estimated by OLS method. The data obtained by time difference between averages is called pooled OLS estimator or fixed effects estimator.[30]

If there are more than one explanatory variable equations can be rewritten as follows;

$$y_{it} = \beta_1 x_{it1} + \beta_2 x_{it2} + ... + \beta_k x_{itk} + a_i + u_{it}, \ t=1,2,3,...,T \quad (6)$$

The transformation of fixed effects model;

$$\ddot{y}_{it} = \beta_1 \ddot{x}_{it1} + \beta_2 \ddot{x}_{it2} + ... + \beta_k \ddot{x}_{itk} + \ddot{u}_{it}, \ t=1,2,3,...,T \quad (7)$$

Equation (7) can be estimated by pooled OLS method.[31]

Gravity Model

According to the international trade gravity model, it is assumed that trade between two countries increases with size (GDP and population) and decreases with transportation costs (distance between two countries and having a common boundary). Gravity model can explain the bilateral trade flows between countries and periods in wide variety.[32] Gravity model was first used by Tinbergen in 1962 in economic literature.[33]

Gravity models use concept of gravitational force to explain the trade volume between countries, capital flows and migration movements. As an example, gravity models established for trade volume are explained by GDP, population and distance variables. Policy effects of trade flows can be measured by adding policy variable.[34]

A dummy variable can be added into the gravity model to represent regionalization effect (preferential trade agreements, monetary union, etc.).[35] Positive coefficient of the dummy variable included in the model shows –that the trade agreement each pair countries have done, has a trade enhancing effect. In other words, trade enhancing effect is larger than the trade diversion effect. A negative coefficient shows the trade diversion effect.[36] Annex 1 describes the Newton's Gravity model. This study will investigate the effect of monetary union on trade with the help of the gravity model. After that, with a new gravity model the effect of monetary union on output will be examined.

Trade Gravity Model

The model which is used by Faruqee, Micco etc. and McGowan will be followed here. On the other hand, when the literature for gravity model is examined, it can be seen that there are not so many differences between the models. The trade gravity model for this paper can be seen in Equation (7);

$$LnTrade_{ijt} = \beta_0 + \beta_1(GDP_{ijt}) + \beta_2(\text{LPPC\_GDP}_{ijt}) + \beta_3 FTA_{ijt} + \beta_4 EMU_{iji} + \beta_5 Z_i + u_i \quad (7)$$

In equation (7) the variables are as follows;

$LnTrade_{ijt}$: Export and import volume between country I and j (export and import are estimated separately in regressions)

GDP_{ijt} : GDP,

LnGDPPC : Per capita GDP of partner country,

FTA_{ijt} : Free Trade Agreement

EMU_{iji} : European Monetary Union

Z_i : Control variables (language, geographical distance, population)

u_i : Error term.

In the model export and import figures are denominated in U.S dollars. Two separate models will be estimated for imports and exports. GDP are nominal output. Per capita GDP figures are obtained by dividing annual GDP to mid-year population. FTA and ENMU are dummy variables. FTA is 1 if two countries have free trade agreement and 0 otherwise. And EMU is 1 if the countries are in monetary union and 0 otherwise. Language variable is 1 if the both countries are using the same language and 0 otherwise. Geographical distance is calculated by the crow flies in kilometers between capitals of the countries in trade. Population obtained from the mid-year population figures. Data series for examining bilateral trade covers the period 1987-2009.

As described in the analysis fixed effects model is suitable for homogeneous groups of countries. In this context, fixed effects model will be used for trade gravity model. Unobservable individual characteristics can be caught by fixed effects estimators. Before the estimation of gravity model, the stationarity of series will be tested. LLC test will be used for stationary test.

Output Gravity Model

The models that were used in Mankiw, Romer and Weil and Frankel and Rose will be estimated for gravity model. The growth model is as follows:[37]

$$Ln\text{GDPPC} = \beta_0 + \beta_1 NEXP_i + \beta_2 POP_i + \beta_3 INV_i + \beta_4 EMU_i + \beta_5 n_i + \beta_6 PS_i + \beta_7 SS_i + \beta_8 Z + u_i \quad (8)$$

In the equation;

LnGDPPC : Per capita GDP,

$NEXP_i$: Openness rate (net export/ reel GDP),

POP_i : Population,

INV_i : Investment rate (investment / real GDP),

EMU_i : Monetary union variable,

n_i : Population growth rate (annual),

PS_i : Number of students enrolled in primary school,

SS_i : Number of students enrolled in secondary school,

Z : Other control variables,

u_i : Error term.

Equation 8 has been expanded by adding other control variables. Control variables are area of the country (AREA), initial income level (IGDPPC), average inflation rate (INF) and GDP of the partner country (P_GDP). In the equation, same as trade gravity model, statistical significance and direction of the coefficient of EMU is investigated.

Before estimating the model, the stationarity of the series will be tested by LLC test.

LLC Unit Root Test

In order to examine the stationarity condition of panel data, many unit root tests can be used. These are Levin, Lin and Chu (LLC), Im, Peseran and Shin (IPS), Harris and Tzavalis, Maddala and Wu and Breitung. In all these tests, the basic hypothesis of the series is not stationary and alternative hypothesis is the series is stationary. However, Hadri has developed a test in which the basic hypothesis is that the series is stationary and the alternative hypothesis is that series is not stationary.[38]

When the literature of unit root analysis examined, it can be seen that generally Maddala and Wu (MW), Levin, Lin and Chu (LLC) tests are used. While IPS and LLC tests require a balanced panel, MW test can be also used for unbalanced panel. Also, MW test does not mandate the same lag length for individual ADF regressions. The weakness of MW test is that it is not parametric. On the other hand, LLC and IPS are parametric tests.[39] LLC test, gives an excellent estimate of t statistics empirical distribution for a panel data analysis with at least 10 cross-sectional and 25 time series data.[40] Therefore, in this study LLC test is preferred to investigate the stationarity conditions of the series.

The equations and hypothesis used for LLC test are as follows:[41]

$$\Delta y_{it} = \delta y_{it-1} + \sum_{L=1}^{P_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it}, \qquad \text{m=1,2,3,.}$$

The hypothesis are; $H_0 : \rho = 0$ and $H_1 : \rho \langle 0$.

Empirical Analysis

Frankel and Rose involved with the results of a country leaving its own independent currency and being included in a monetary board or union in their study. In this context, first they investigated the effect of monetary board or union on trade and secondly on output.[42] In this study we will follow method of Frankel and Rose.

The first hypothesis of the study is; monetary union has appositive effect on trade. For investigating this hypothesis, trade gravity model is estimated. In trade gravity model by using various control variables, bilateral trade relationship between countries can be estimated.

The second hypothesis is; monetary union has appositive effect on macroeconomic performance. For examining the effect of monetary union on macroeconomic performance, output gravity model will be estimated.

Test Results of Trade Gravity Model

LLC test results for level values of series can be seen in Table 1.

Table 1: LLC Test Results of Trade Gravity Model

Variables	NONE (Without Individual Intercept and Trend)	Prob.	Individual Intercept	Prob.	Individual Intercept and Trend	Prob.
LEXP	-1.602	0.054	-2.767	0.002	-4.588	0.000
LIMP	-1.296	0.097	-2.119	0.017	-3.252	0.000
LDIST	-1.001	0.158	-2.333	0.009	-2.905	0.001
LGDP	15.211	1.000	-18.672	0.000	-29.733	0.000
LPPC_GDP	0.421	0.663	0.142	0.556	0.213	0.584
LPOP	26.855	1.000	-41.088	0.000	-51.891	0.000
LPOP_PARTNER	0.0876	0.534	1.868	0.969	1.529	0.936

* The lags are determined according to Schwarz information criterion.

According to the results of LLC test in Table 1, PPC_GDP and POP_PARTNER are not stationary at level. Unit root test is repeated at first difference. The results are in Table 2.

Table 2: LLC Test Results at First Level of Trade Gravity Model *

Variables	Individual Intercept	Prob.	Individual Intercept and Trend	Prob.
DLPPC_GDP	-152.495	0.000	-218.210	0.000
DLPOP_PARTNER	-154.204	0.000	-215.779	0.000

* The lags are determined according to Schwarz information criterion.

From Table 2, PPC_GDP and POPPARTNER are stationary at first difference. After the unit root tests, the relationship between series can be estimated.

The Results of Trade Gravity Model Panel-Data Analysis of Trade Gravity Model

While estimating trade gravity model, both LEXP and LIHR will be taken as dependent variables. As described earlier for panel OLS, fixed effects model will be preferred, because all countries are OECD members.

Table 3: The Results of Trade Gravity Model *

Dependent Variable: LEXP				
Total pool observations: 11594				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.110782	0.265009	-0.418031	0.6759
EMU	***0.040971***	***0.010758***	***3.808458***	***0.0001***
LANG	0.081817	0.019335	4.231507	0.0000
LDIST	-0.071977	0.006905	-10.42358	0.0000
LGDP	-0.060970	0.015767	-3.866823	0.0001
DLPPC_GDP	1.679481	0.084132	19.96237	0.0000
LPOP	0.101460	0.024603	4.123811	0.0000
DLPOP_PARTNER	0.991049	0.051206	19.35400	0.0000
LEXP(-1)	0.944373	0.004627	204.1095	0.0000
R-squared	0.963915	Prob(F-statistic)		0.000000
Adjusted R-squared	0.963821	Akaike info criterion		1.138845
S.E. of regression	0.427051	Schwarz criterion		1.158520
Sum squared resid	2108.777	Hannan-Quinn criter.		1.145456
Log likelihood	-6570.886	Durbin-Watson stat		2.172104
F-statistic	10295.83			

* The model were reestimated by subtracting the variables which are statistically insignificant.

When the model with export as dependent variable is examined, it can be seen that the effect of monetary union is positive and significant. For coefficient of FTA is statistically insignificant, it is removed from the equation. According to the results, monetary union has an enhancing effect on union countries' export. After that, the model with import as a dependent variable will be estimated.

Table 4: The Results of Trade Gravity Model *

Dependent Variable: LIMP				
Total pool observations: 11585				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.379665	0.202484	1.875037	0.0608
EMU	***0.032371***	***0.009678***	***3.344715***	***0.0008***
LANG	0.079860	0.017447	4.577302	0.0000
LDIST	-0.075506	0.006115	-12.34811	0.0000
LGDP	-0.023751	0.012368	-1.920368	0.0548
DLPPC_GDP	1.877750	0.070063	26.80100	0.0000
LPOP	0.047223	0.018645	2.532760	0.0113
DLPOP_PARTNER	0.908507	0.052911	17.17058	0.0000
LIMP(-1)	0.950492	0.003934	241.5867	0.0000
R-squared	0.969629	Prob(F-statistic)		0.000000
Adjusted R-squared	0.969550	Akaike info criterion		0.931518
S.E. of regression	0.384999	Schwarz criterion		0.951205
Sum squared resid	1712.578	Hannan-Quinn criter.		0.938133
Log likelihood	-5364.816	Durbin-Watson stat		2.065410
F-statistic	12295.70			

* The model were reestimated by subtracting the variables which are statistically insignificant.

When the results of the model with imports as dependent variable are observed, it can be seen that, similarly, monetary union has statistically positive and significant effect on import. In other words, monetary union has an increasing effect both on export and import volume.

The positive effect of monetary union on trade proves our first hypothesis. In other words, monetary union affects foreign trade positively.

The effect of monetary union on macroeconomic performance will be explained by studying the second hypothesis. As explained in the theoretical chapter, monetary union may affect economic growth in many different channels. The effect of monetary union on output will be estimated with the gravity model.

Unit Root Test

The results of the stationary tests are in Table 5.

Table 5: LLC Test Results of Output Gravity Model

Variables	NONE (Without Individual Intercept and Trend)	Prob.	Individual Intercept	Prob.	Individual Intercept and Trend	Prob.
LGDPPC	-0.725	0.234	-18.173	0.000	-26.167	0.000
n	-19.244	0.000	-22.803	0.000	-32.960	0.000
LPOP	26.377	1.000	-45.002	0.000	-54.391	0.000
NEXP	-22.988	0.000	-7.720	0.000	-11.151	0.000
PS	-1.627	0.051	-2.558	0.005	-3.509	0.000
SS	-4.814	0.000	-1.526	0.063	-2.273	0.011
LAREA	-2.294	0.010	-0.002	0.498	-0.141	0.443
LP_GDP	-0.017	0.493	0.010	0.504	0.170	0.567
INV	-5.071	0.000	-2.998	0.001	-4.566	0.000
LIGDPPC	-4.961	0.000	-4.961	0.000	-18.474	0.000
INF	-27.639	0.000	-27.639	0.000	-20.007	0.000

* The lags are determined according to Schwarz information criterion.

According to the LLC test, LAREA and LP_GDP are not level stationary. The series will be tested again at first difference. Table 6 shows the results of LLC test.

Table 6: LLC Test Results at First Level of Output Gravity Model *

Variables	Individual Intercept	Prob.	Individual Intercept and Trend	Prob.
DLAREA	-129.737	0.000	-218.400	0.000
DLP_GDP	-149.802	0.000	-211.867	0.000

* The lags are determined according to Schwarz information criterion.

LAREA and LP_GDP are stationary at first difference. After the testing the stationary, equation can be estimated. Equation 8 will be estimated for output gravity model. Secondly, adding the dummy variables that are representing economic size, Equation 8 will be estimated again.

The Results of Output Gravity Model Panel-Data Analysis

Output gravity model is estimated under two headings. First equation 8 will be estimated. After that with additional variable that represents the economic size of member countries in monetary union.

Results From the Estimation without Economic Size of the Member Countries.

Here output gravity model in equation 8 will be estimated. The variables in gravity model are estimated in different combinations following Frankel and Rose. The results in Table 7 are obtained from the estimation with all control variables.

Table 7: GDP Gravity Model Test Results*

Dependent Variable: LGDPPC				
Total pool observations: 11637				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	2.793867	0.146884	19.02097	0.0000
INF	-0.003496	0.000127	-27.44758	0.0000
n	0.057333	0.003187	17.99176	0.0000
EMU	***-0.017780***	***0.002912***	***-6.106452***	***0.0000***
PS	0.000408	0.000237	1.719312	0.0856
SS	0.000816	5.78E-05	14.12473	0.0000
DLAREA	-0.018077	0.006126	-2.950822	0.0032
DLP_GDP	1.392825	0.039437	35.31737	0.0000
LIGDPPC	-0.222787	0.014040	-15.86803	0.0000
LGDPPC(-1)	0.916240	0.002772	330.5702	0.0000
R-squared	0.935834	Prob(F-statistic)		0.000000
Adjusted R-squared	0.935657	Akaike info criterion		-0.905278
S.E. of regression	0.153663	Schwarz criterion		-0.884402
Sum squared resid	273.9972	Hannan-Quinn criter.		-0.898265

Log likelihood	5300.363	Durbin-Watson stat	1.581044
F-statistic	5288.762		

* The model were reestimated by subtracting the variables which are statistically insignificant.

By examining the results in table 7, the coefficient of the dummy variable representing the monetary union appears to be statistically significant, but negative. Theoretically, the effect of monetary union is expected to be positive. There are costs of monetary union as well as benefits. Implementation of monetary policy is limited by transferring the policy practices of national authorities to a transnational institution. The effects of monetary union can not be put forward theoretically, because of the presence of benefits and costs of the monetary union.

Besides the positive effects of monetary union on foreign trade, it has a negative impact on growth. The current inadequacy of output gravity model may be not to add economic size of countries in monetary union as a control variable. Frankel and Rose are investigating whether monetary union affects output through other channels expect trade. For this, they added new dummy variables that represent the importance of the trade partners of monetary union countries into the output gravity model. The importance of trade partners is measured by size of countries and distance between countries.

The first variable is added to the equation is obtained by multiplying the monetary union dummy variable with output of partner country. Other dummy variable is obtained by multiplying monetary union dummy variable with the output/distance ratio. These two dummy variables were included in the model separately and the model is estimated again.

The Results from the Estimation with Economic Size of Member Countries

Under this heading new dummy variables will be added to the model that represents the importance of partner countries for monetary union members. The results can be seen from Table 8 and Table 9.

Table 8: GDP Gravity Model Test Results*

Dependent Variable: LGDPPC				
Total pool observations: 3380				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.250951	0.049659	5.053467	0.0000
EMU	***-0.004566***	***0.006507***	***-0.701647***	***0.4829***
n	0.052380	0.004762	10.99998	0.0000
DLP_GDP	1.668837	0.013421	124.3470	0.0000
LEDGDP	0.008699	0.001612	5.396377	0.0000
LGDPPC(-1)	0.957216	0.004763	200.9898	0.0000

R-squared	0.948765	Prob(F-statistic)	0.000000
Adjusted R-squared	0.948506	Akaike info criterion	-1.433180
S.E. of regression	0.117869	Schwarz criterion	-1.400558
Sum squared resid	46.70837	Hannan-Quinn criter.	-1.421517
Log likelihood	2440.074	Durbin-Watson stat	1.662912
F-statistic	3662.194		

* The model were reestimated by subtracting the variables which are statistically insignificant.

Table 9: GDP Gravity Model Test Results*

Dependent Variable: LGDPPC				
Total pool observations: 3381				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.130043	0.036612	3.551931	0.0004
EMU	***-0.008332***	***0.004564***	***-1.825557***	***0.0680***
n	0.054482	0.002295	23.73490	0.0000
DLP_GDP	1.669932	0.036232	46.08938	0.0000
LEMUGDP	0.010368	0.001130	9.173642	0.0000
LGDPPC(-1)	0.958754	0.002079	461.1482	0.0000
R-squared	0.946992	Prob(F-statistic)		0.000000
Adjusted R-squared	0.946724	Akaike info criterion		-1.399138
S.E. of regression	0.119892	Schwarz criterion		-1.366524
Sum squared resid	48.34023	Hannan-Quinn criter.		-1.387478
Log likelihood	2383.243	Durbin-Watson stat		1.673204
F-statistic	3534.128			

* The model were reestimated by subtracting the variables which are statistically insignificant.

According to the results from Table 8, the coefficient of the dummy variable that represents the monetary union is statistically insignificant. On the other hand, the results in Table 9 shows that coefficient of dummy variable is statistically significant and negative.

As a result, the effects of monetary union on trade are consistent with theoretical expectations. Monetary union has positive effect on both export and import. However, results of output gravity model are not consistent with theoretical expectations.

According to the results obtained from output gravity model, the effect of monetary union either does not exist or mainly is negative. This states that to be a member of monetary union has positive effect on trade and decreasing impact on output. There are many reasons for monetary union having negative effect on output. Among these reasons, there are budget deficits and fiscal pressure caused by 2008 crisis, inefficient fiscal and monetary policies, current account imbalances and productivity differences between countries.

Conclusion

The focus of this study is the effects of European Monetary Union on macroeconomic performance. Given that, European countries make one fifth of the world trade, its importance in global scale can be understood.

In this study, when the results of trade gravity model panel OLS estimated by using data of member and non-member countries are examined, it is seen that monetary union has positive effect on non-member countries' trade. The important point here is that positive coefficient of the dummy variable which represents monetary unions points the trade creating effect. In other word, positive coefficient shows that trade creating effect exceeds trade diversion effect. Empirical analysis of the union having a positive impact on foreign trade is consistent with theoretical expectations.

The aim of establishment of the monetary union is to increase the welfare of member countries by taking advantage of the benefits of the transition to a common currency. In theory, the main effect of the union on foreign trade is expected to be positive. Empirical analysis revealed the presence of positive effect on foreign trade. However, monetary union affects the level of prosperity in the country in many different channels particularly through trade. In this sense, to measure the welfare effects of monetary union, a new panel OLS analysis was performed. Thus, the effect of monetary union on output was investigated. The results of output gravity model show that, monetary union either has a negative effect or no effect on output.

There are many reasons for European Monetary Union's negative effect on output. First, EU countries, to get rid of the effects of the contraction as result of the global crisis of 2008, have preferred implication of expansionary policy. The implication of these policies has led to budget deficit problems. In other words, 2008 crisis turned to deficit crisis. Financial pressure as a result of budget deficit has a negative impact on countries' economic structure and growth.

Second, there are difference between euro-zone countries caused by lifestyle and traditions. These differences are basis of the labor productivity differences between countries. Southern countries have current account deficit with low productivity and high consumption (low savings). There is permanent current account surplus in Nordic countries. Devaluation of national currency is possible to some extent, to eliminate the current account deficit; such possibility is not available within the monetary union. Finally, the current account deficit in southern countries with low levels of savings is covered by foreign debt. External debt is carried out by high interest rates, and finally external debt and financial pressure are increasing. External debt crisis is caused in two ways. First is the balance of assets and liabilities as in Italy and Spain, as well as, the mismatch of current period interest – principal payments and cash. Secondly, it is the failure of payment that is resulting from debts exceeding assets like in Greece.

Another effect is due to the high debt stock, high debt stock causes financial pressure, financial pressure causes contraction of credit amount on one hand and corruption of effectiveness on monetary transmission channels on the other hand. The European Central Bank is committed to ensuring price stability by using interest rate. There is no financial institution active in the European Monetary Union. On the other hand, there is no fiscal transfer mechanism which will

share the cost of shock among countries against financial shocks (no bailout rule). So the only possibility for countries seeking to finance their debts is to borrow from market. In this case, government bonds with high interest rate disrupt the policy interest rates and finally break the efforts of central bank redirecting the economy by using transmission channels.

Faced with the crisis Spain and Italy borrowed at 6,5% and 7% interest rate respectively from the market. In this case, interest rates on debt exceed the annual growth rate. Market interest rates are exceeding the level of growth means that the debt output ratio increased from year to year. In this situation, for member countries experiencing debt crisis, is getting harder and harder to be able to provide finance at sustainable interest rates.

Inefficiency of monetary policy, providing finance with sustainable interest rates and hence growth of debt – output ratio, productivity differences between countries and hence current account imbalances; on the other hand lowering the credit rate of the countries in the region (Greece, Italy, Spain, Portugal and Malta) by rating agencies, due to current economic situation means that the capital perceived the countries in the region as risky. Credit rating agencies emphasized that if debt crisis continues, credit rates of the region countries will be cut of to not invest level.

On the other hand, European Monetary Union has effects on non-member countries through various channels. These effects are, primarily foreign trade impact, spill-over effect of high growth, high synchronization impact of business cycles, the effect of using euro for billing foreign trade transactions and disappearance of exchange rate differences within union. The empirical results combined with theoretical expectations, firstly, in foreign trade, trade creating effect exceeding trade diversion effect shows that foreign trade shifted from non-union countries to union countries. Other important result, euro has negative effect on union countries' output. This shows that non-member countries will not benefit form spillover effect of high growth rate. Another important result, business cycle synchronization was not achieved as a result of recent global financial crisis and recession and subsequent debt crisis. Therefore, it is not expected for non-member countries to benefit from this.

On the other hand, using euro in billing has increased relatively over time and exchange rate differences within the region have disappeared. These two cases affect export of non-member countries negatively by increasing the competitiveness of the firms in member countries. Finally over the analysis period, it is seen that there is a positive contribution of euro on non-member countries.

As a result of financial pressure, debt crisis and ineffectiveness of policy instruments, powerless EU against financial shocks does not have positive welfare effect on member countries and non-member countries that are trade partners. For candidate countries like Turkey and member of EU, but not European Monetary Union is not attractive to join the monetary union, it is clear that the re-evaluation of European Monetary Union performance effects after the provision of financial unity and full international risk-sharing is necessary.

Appendix

Gravity model began with Newton law. Newton gravity law is seen in equation (1).[43]

$$GF = \frac{M_i M_j}{D_{ij}} \quad i \neq j \tag{1}$$

In the equation gravity power is affected directly from M_i and M_j (body mass of i and j) and indirectly from D_{ij} (distance between objects). Gravity models are expressed as the natural logarithm. Equation (2) is the linear form of equation (1).

$$\ln GF = \ln M_i + \ln M_j - \ln D_{ij} \quad i \neq j$$

(2)

Equation (2) becomes equation (3) by rearranging international trade gravity models. In equation (3), gravity power replaced by trade flow (net export) or export variables. Instead of distance between objects, distance between countries is used. On the other hand, there are four possibilities for mass. Firstly mass can be replaced by GDP. In this case equation is:

$$\ln E_{ij} = \alpha_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln D_{ij}$$

(3)

In equation (3) generally $\beta_1, \beta_2 \rangle 0$ is expected. However, in Equations (3) GDP represent income and when model is applied to agricultural products in the target country (trading partner, the second country), Engel Law permits the GDP to be negative. So it can be $\beta_2 \langle 0$.[44]

The second alternative for replacement of mass is to evaluate the GDP and POP (population) variables at the same time:

$$\ln E_{ij} = \varphi_0 + \gamma_1 \ln GDP_i + \gamma_2 \ln GDP_j + \gamma_3 \ln POP_i + \gamma_4 \ln POP_j + \gamma_5 \ln D_{ij}$$

(4)

When we consider the expected sign of the variable population $(\gamma_3, \gamma_4 \rangle 0)$, these variables that represent the magnitude of the market are expected to be positive. On the other hand, like the effect of market size, there can also be import substitution effect. İf import substitution effect is greater than it is expected to be $\gamma_4 \rangle 0$.[45]

Third alternative is to replace GDP with per capita income. The fourth alternative is to evaluate both output and per capita income.[46]

$$\ln E_{ij} = \tau_0 + \delta_1 \ln\left(\frac{GDP_i}{POP_i}\right) + \delta_2 \ln\left(\frac{GDP_j}{POP_j}\right) + \delta_3 \ln D_{ij}$$

(5)

$$\ln E_{ij} = \mu_0 + \nu_1 \ln\left(\frac{GDP_i}{POP_i}\right) + \nu_2 \ln\left(\frac{GDP_j}{POP_j}\right) + \nu_3 \ln GDP_i + \nu_4 \ln GDP_j + \nu_5 \ln D_{ij}$$

(6)

Variables in equations are substitutes for each other. Therefore, the coefficients in the equations can be converted to each other: $\gamma_1 = \delta_1 = \nu_1 + \nu_2$; $\gamma_2 = -\delta_1 = -\nu_2$; $\gamma_3 = \delta_2 = \nu_3 + \nu_4$ and $\gamma_4 = -\delta_4 = -\nu_4$.[47]

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