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Does monetary integration affect EU's trade?

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Our paper contributes to the discussion about economic effects of monetary integration and contains test of Rose effect for EU countries. The fundamental aim of our research is to investigate influence of different exchange rate regimes (especially monetary union) on bilateral trade between members of the European Monetary Union (EMU) and between EMU members and non-EMU countries. For an empirical test we use data set covering period of the years 1994-2008 and including as reporters EU countries and as partners all countries in the world. In modeling impact of exchange rate regimes on trade we use panel data analysis. We test standard factors of gravity models such as size of the markets of trade partners, GDP *per capita* of trade partners etc. To control for the effect of exchange rate regimes we add several dummy variables indicating pairs of countries on different stages of monetary cooperation. Our model includes a time effect dummy for the common shocks and a country pair dummy covering country-specific effects. We use loglinear specification of the gravity model. We expect positive effects of the growing GDP and GDP *pc*, as usual. We also suppose that participation in a monetary union does not enhance trade between countries and is not responsible for increasing exports and imports. To test for this hypothesis, and to control for additional factors, we use panel data estimation with Hausman-Taylor method. We start our analysis with a short presentation of theory of monetary integration and its impact on trade and with a short summarizing of gravity approach.

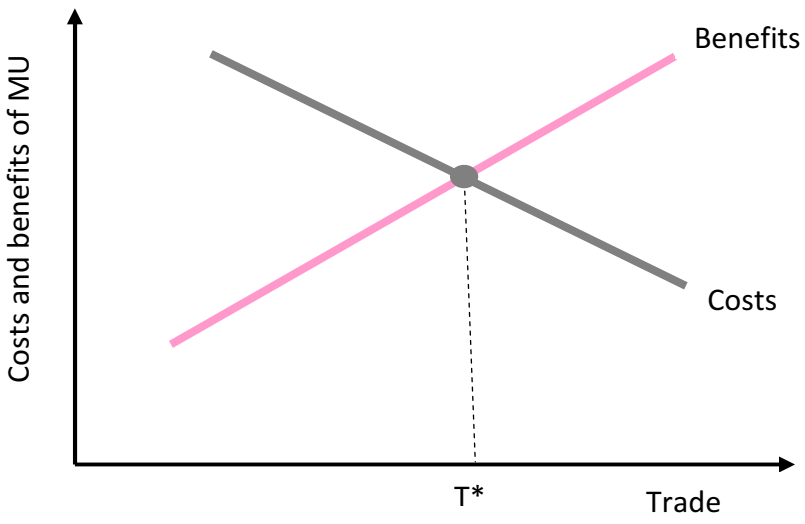
Impact of monetary integration on trade – theoretical background

Majority of economists represent the view that existence of different currencies is a constraint for trade. Bordo (2002) confirms this result presenting huge increase in international trade in the times of the gold standard. Mundell (1961) treat increase in trade as the most important microeconomic benefit of introduction of monetary union (MU).

De Grauwe (2007) proposes a presentation of impact of monetary union[1] (MU) on trade of participants of integration agreement. He divides effects of MU into costs and benefits. He presents costs and benefits of monetary union as well as trade as shares in GDP. He presents benefits of monetary union as an upward sloping line indicating gains growing with increase in level of openness of the economy, whereas costs are downward sloping and decreasing. De Grauwe makes his presentation separately for monetarist and Keynesian views. Costs are equal to benefits of monetary union (both lines in Figures 1 and 2 intersect) in a point determining the critical level of openness measured as the share of trade in GDP. The model allows to make some conclusions concerning comparison of costs and benefits of MU and their impact on net welfare of MU member countries.

In Keynesian view rigidities of the national economies (sticky prices, wages) result in governments' need to have an exchange rate as a instrument to eliminate disequilibria. In this view the equivalence of costs and benefits of monetary union can be achieved only if share of trade in GDP is considerable.

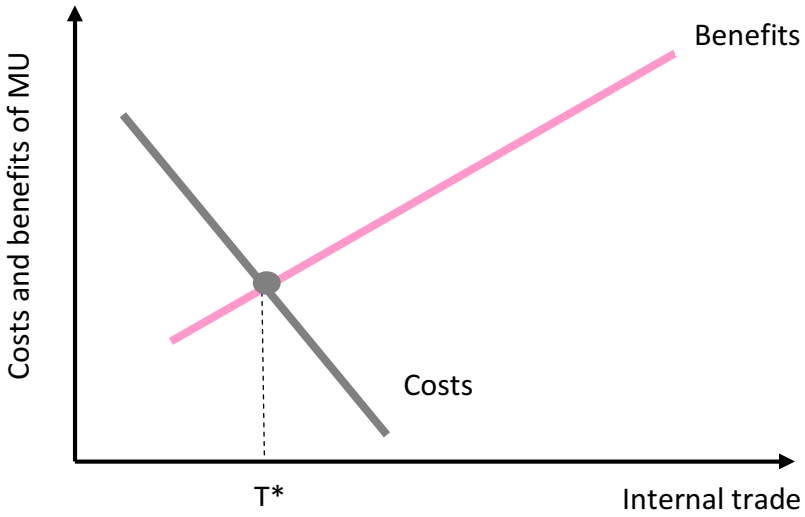
Figure 1. Costs and benefits of a monetary union and trade (all as % of GDP) in the Keynesian view



Source: P. De Grauwe, *Economics of Monetary Union*, 2007, p. 82

[1] The aim of this article is to analyze trade effects of monetary union in its practical form of European Monetary Union (EMU). However a lot of theoretical and empirical literature covers broader topics of monetary integration (including not only MU, but e.g. currency pegged to other currency – "dollarization", agreements to keep fixed exchange rates as well). We use the term MU only in theoretical context or by empirical tests of trade of EMU members. Other forms we generally see as monetary integration though we expect similar trade effects in case of forms of monetary integration other than MU.

Figure 2. Costs and benefits of a monetary union and trade (all as % of GDP) in the monetarist view



Source: P. De Grauwe, *Economics of Monetary Union*, 2007, p. 82

Figure 2 presents the monetarist view of costs and benefits of monetary union. The costs curve is relatively steep and drawn close to the origin. It represents the monetarist view that the exchange rate is ineffective as instrument of economic policy. This explains why countries gain from monetary integration even if their share of trade in GDP is relatively low.

As we pose the question whether monetary integration and the "cost-benefit" forces lead to trade intensification, we reverse the analysis and assume that trade is endogenous and depending on costs and benefits comparison.

Literature about monetary integration is full of arguments of its positive impact on bilateral trade of integrated countries. The most important benefit is that a common currency eliminates bilateral nominal exchange rate volatility. A common currency reduces exchange rate risk present in standard trade transactions and eliminates need to hedge it. It reduces transaction costs of international trade. De Grauwe (1988) estimated costs of keeping national currencies in EU countries on 0.5 % of their GDP. A common currency increases market transparency and enables producers/exporters/consumers to get more information about prices. It make them better predict demand. It strengthens competition between firms from member countries making it more direct. It can be expected that the more MU members trade the larger is positive effect of their monetary integration. Finally, it is also expected that the more countries join a MU the larger is its positive impact on trade.

Frankel and Rose (1997) made understanding of monetary integration more dynamic than the authors before did. In their opinion participation in a MU results in intensification of trade of member countries and deepening of their integration, what in turn leads to structural changes in their economies. As a consequence a synchronization of their business cycles follows and asymmetric shocks become less probable. Further consequence is less need to use national monetary policy.

Some authors question a negative impact of exchange rate volatility on trade volume. Ozturk (2006) provides a review of the literature on exchange rate volatility and trade, examining both the theory and empirical studies and concludes that the analyzed results are difficult to interpret and to compare because of differences in a.o. the samples used, periods of analysis, model specification and measures of risk. However he concludes that a dominating number of studies favors the intuitive assumption about a negative impact of exchange rate volatility on volume of trade.

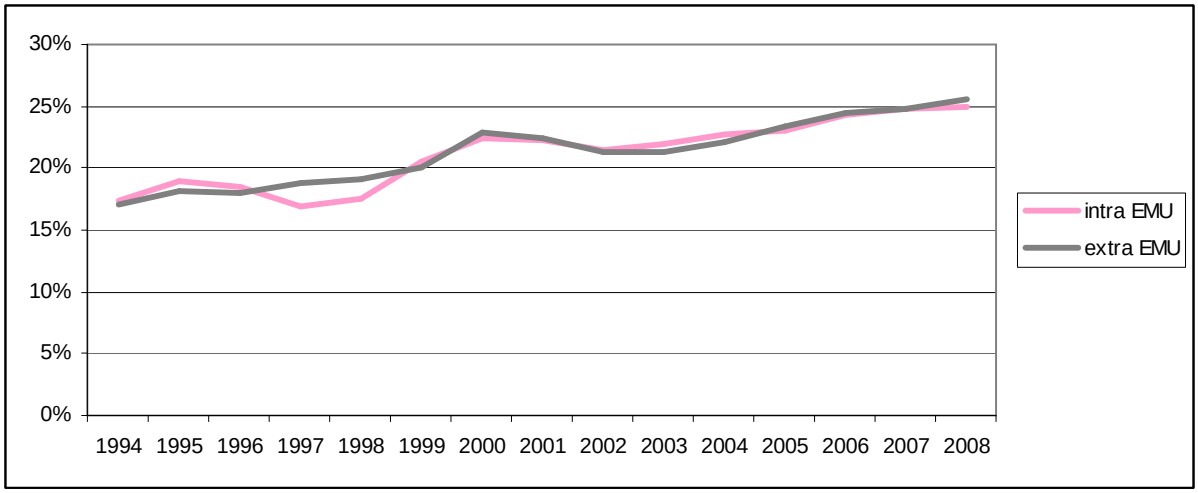
A first look at the data

One of the most intensively analyzed example of a MU is EMU. There are many analysis of this form of monetary integration. Moreover, with EMU creation problems of monetary integration experienced their revival in the economists' interest. Analysis of EMU is important for its member states as well as for potential accession candidates and for countries having main trade partners in EMU.

Before we start an analysis of the EMU's trade effects with advanced econometric tools we derive some facts from the analysis of statistical data (see Figures 3 and 4 and Table 1). This analysis brings a set of mixed results.

In Figure 3 we present internal and external trade of EMU countries as a per cent of GDP (in current prices and current exchange rates). We show that after introducing a common currency in the year 1999 there is almost no difference between the shares of internal and external trade. The statistics don't confirm positive impact of EMU on trade among its member countries. The only significant difference (in favor of external trade) is noticed during the period 1996-1998 (before creation of EMU).

Figure 3. External and internal trade of EMU members as a per cent of GDP in current prices and current exchange rates



Source: Authors' calculations with http://stats.unctad.org/Handbook

Data in Table 1 confirm that creation of EMU did not increase its member states shares in the world export. However, all developed countries (division of countries by UNCTAD) did much worse than the EMU countries did (the share of developed countries in the world export decreased in the analyzed period almost three times more than the respective share of the EMU countries). This can be proof of positive effects of EMU creation on trade as reported in the literature (see further discussion of literature). After the year 1997 yearly changes in the shares of EMU countries exports (measured in percentage points, p.p.) were smaller than the respective changes of all developed countries. The shares of EMU countries were more stable than these of all developed countries. In the literature analysis is often constrained to the EMU or OECD countries and increase in shares after introduction of the EMU are reported. If we take into consideration share of EMU countries in global exports the results are different.

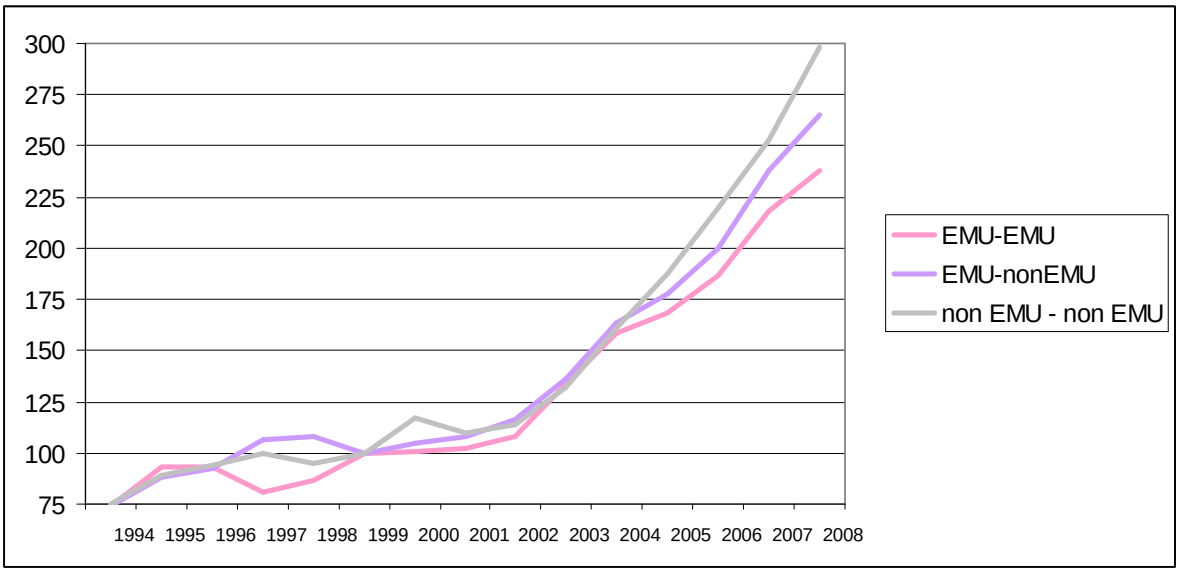
Table 1. Shares in world export in % and their percentage changes in the periods 1994-1999 and 1999-2008 in p.p.

	Developing economies	Transition economies	Developed economies	EMU
1994	28.0	2.1	69.9	32.1
1995	28.1	2.3	69.6	32.9
1996	29.1	2.3	68.5	32.1
1997	29.8	2.3	67.9	30.8
1998	28.2	2.0	69.8	32.9
1999	29.1	1.9	69.0	32.4
2000	31.9	2.4	65.8	29.6
2001	31.1	2.2	66.7	31.4
2002	31.5	2.5	66.0	32.0

2003	32.2	2.7	65.1	32.9
2004	33.6	2.9	63.5	32.4
2005	35.6	3.3	61.0	30.6
2006	37.1	3.6	59.3	29.6
2007	37.2	3.8	59.0	30.1
2008	39.0	4.3	56.7	28.7
2008/1999	**9.9**	**2.4**	**-12.3**	**-3.7**
1999/1994	1.1	-0.2	-0.9	0.3

Source: Authors' calculations with http://stats.unctad.org/Handbook
Note: Export shares as a percentage of total world exports.

Figure 4. Relative export index in the period 1994-2008, 1999=100



Source: Authors' calculations with http://stats.unctad.org/Handbook
EMU countries: Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain

In Figure 4. we present relative export indexes (introduced in Micco et. al., 2003 as export indexes), A relative export index is defined as:

$$x = \frac{X_1}{X_0} \cdot 100\%,$$

where:

x – relative export index,

X_1 – value of bilateral export in the year of analysis,

X_0 – value of bilateral export in the basic year (here: 1999 = 100).

We analyze relative export indexes in bilateral trade of all countries in the world and aggregate them into three groups of trade partners. In the first group both partners are EMU members. In the second one partner participates in EMU whereas the other is from the rest of the world. In the third group both partners are from out of the area. We take the year 1999 as the basic year because since then EMU is existing. Data in Figure 4 confirms that (especially

after the year 2000) trends of trade are similar no matter whether analyzed pairs of trading partners are members of EMU or not. Moreover, the highest relative export indexes note countries from out of area. Trade of EMU members with the rest of the world is as well growing more dynamically than the internal EMU trade. It is not surprising as the internal EU trade is growing dynamically since fifty years, but still it shows that after creation of EMU in didn't change a lot on costs of external trade (moreover, the opposite is true).

Willett (2003, 155) express opinion that looking at economic consequencies of EMU is not the right approach as EMU is dominantly political and not economic issue. Not fulfilling of optimal currency area (OCA) criteria by some EMU members is proof of his statement. This can also (at least partly explain) why criteria of EMU are different than general criteria of OCA.

Trade effects of EMU: a review of the literature

Research of trade effects of EMU can be divided into pre-EMU and post-EMU literature. The critical and synthetic review of the then stand of empirical works is presented in Baldwin (2006).

First expectations regarding the EMU trade effects are mainly based on a study by Rose (2000). His analysis covered 186 countries and contained more than 300 cases with pairs of trade partners sharing the same currency. In Rose's opinion after II WW the existence of currency unions led to increase in trade by 200%. Rose repeated his analysis (see a.o. Frankel, Rose, 2000 and Rose, Wincoop, 2001) confirming the general result obtained in the pioneering work though with smaller expected trade intensification. The most important reason was positive impact of elimination of exchange rates on bilateral trade (elimination of exchange rates volatility and decrease in transaction costs covered by trading firms). In the long run a common currency helps to deepen economic integration what is source of further benefits.

Rose's work started the discussion about the EMU impact on trade. It also provoked lots of critiques. The first one objecting against magnitude and measuring of Rose effect was Persson (2001). Baldwin (2006a) summarizes Rose's and follow-up papers and specifically points his critique at possible estimation biases related to omitted variables, endogeneity and sample selection.

After the EMU is created there is a large number of papers aimed at verification of the Rose effect of the EMU. The first study by Micco et al. (2003) estimates 6% increase in trade among EMU countries compared to trade among the other EU members. Other authors used different econometric methods (most of them are on panel datea with fixed and random effect

techniques) and received positive and significant impact of the EMU on trade. A relatively small impact (3%) is obtained by Bun and Klaassen (2007). Cieślik, Michałek, Mycielski (2008) confirmed that the positive effect of joining the EMU decreases over time.

Barr et all. (2003) tested a gravity model for European countries participating in EMU and out of area. They estimated that in the period 1978-2002 MU increased trade by 29 %. They estimate that exchange rate volatility leads to decrease in trade by 12 %. It means that impact of MU is larger than only resulting from exchange rate stability.

Empirical test

The data consisting of countries observed over several number of years are a typical set of panel data with pairs of countries (exporter and importer named – respectively – a reporter and partner) stand for units, while subsequent years constitute the time dimension. The panel itself is an unbalanced one due to some missing observations, especially on certain least developed and relatively closed economies (even their possible inclusion into the analysis wouldn't considerably change results). There is, however, no problem of nonrandom missing observations for the missing data are simply due to lacks in international databases rather than to not revealing the information. We can thus believe, that the results can be considered as general, representing the true relationship for the set of all the countries in the world. What needs to be considered is then the choice of variables, functional form of the model and the method of estimation.

We used bilateral export flows of almost 200 countries[2]. Our data covers the period 1994-2008 which gives us almost 250 thousand observations.

As dependent variable we take exports (*leksport*). We use bilateral trade data in the current US dollars obtained from Comtrade database.

We adopt following independent variables:

- sums (*lsumgdppc*) and differences (*lmdiffgdppc*) GDP *per capita* in purchasing power parity (PPP) of reporter and partner countries as a measure of the impact of factor proportions on bilateral trade. We agree with Cieślik (2010) that the impact of factor proportions is correctly measured when both capital-labor sums and differences are simultaneously included in the regression. We use data obtained from the IFS (International Financial Statistics) database.

[2] Not exact number of countries is a result of using of an unbalanced panel. Variations in the sample in different years are confirmed by the changing number of observations in the tables.

- sum of GDP in current US dollars of reporter and partner country (*lsumgdp*) representing the country size variable. Data are obtained from the IFS (International Financial Statistics) database.
- geographic distance (*ldist*) between trading country pairs as a measure of the impact of trade costs. Data are obtained from CEPII (Centre d'Etudes Prosepctives et d'Informations Internationales) database.
- *year* – the variable presenting a simple linear trend and controlling for the annual growth of exports.

Additionally we introduce a set of dummy variables responsible for country-pair specific factors:

- *k12EMU* - dummy variable indicating whether both trading countries are members of the EMU. This variable controls for the impact of EMU on intra EMU exports. We use data obtained from ECB.
- *k1v2EMU* - dummy variable indicating that one of both trading countries is a member of the EMU. This variable controls the impact of EMU on exports of EMU country to non-EMU country (or export of non-EMU country into one of the EMU members), it measures the impact on trade between EMU members and the rest of the world. We use data obtained from ECB,
- *k12ERMvEMU* - dummy variable indicating whether both trading countries are members of EMU or ERM. This variable controls for the impact of monetary integration on exports of EMU and ERM countries to other EMU or ERM members. In our opinion membership in ERM leads to fulfilling conditions of such advanced monetary integration that it can be seen as a form of MU. We use data obtained from ECB.
- *EMUkot* - dummy variable indicating whether one of the countries pegged its currency to the euro (fixed its exchange rate against the euro). This variable controls for the impact of other forms of monetary integration than the EMU and the ERM on exports (generally here we catch cases of "euroisation" of economies of different countries). We use data obtained from ECB.
- *FTA* - dummy variable indicating whether both trading countries are members of a free trade area (FTA). This variable controls for the impact of regional integration in form of creating a FTA on exports. We use data obtained from WTO database.

- *CU* - dummy variable indicating whether both trading countries are members of a customs union (CU). This variable controls for the impact of regional integration in form of creating a CU on exports. We use data obtained from WTO database.
- year dummy variables (*_Iyear_*) capturing deviations from trend ("seasonal" fluctuations).

The choice of functional form of the model is due to the literature and the aim of analysis. Most literature (see the review in Baldwin 2006) uses loglinear form with the natural logarithm of the outcome variable (export) modeled as a function of natural logarithms of respective regressors. Such an approach is motivated by two factors. Firstly, one could expect the elasticities rather than the marginal changes of export to be constant with respect to the changes of regressors as it is in the case of eg. typical Cobb-Douglass production function. Otherwise, we would conclude, that the expected change of dependent variable as expressed in monetary units will be the same if the independent variable changes by one absolute (*not realative*) unit, no matter whether the initial value of regressant was truly high or low. In the context of the discussed model, this would bring about that in any pair of countries (no matter what their economic potential and sizes are) the expected change of export from one to the other expressed in US dollars will be the same if, for example, GDP of the reporter expressed in PPP grows by one unit. It is much more likely, that the relation will be better approximated by assuming, that if the expected percentage change of the regressant will be the same if a particular regressor increases by 1%, which makes the model much more universal and releases the problem of incomparable sizes of regressants for different units. This is particularly important when the estimation sample consists of highly diversified countries, some of which are developed whereas the others are the developing ones, what makes their GDPs very different and thus absolute and relative changes gives very different information. Secondly, unless some interaction terms are deliberately introduced, linear model assumes that changes of the regressant caused by changes of one of the regressors do not depend on the values of the other regressors. We can expect the truth is far from that. For example, increase in GDP of a country is more likely to increase the value of export from this country to another developed one if the distance between the countries is small. This is not taken into account in the typical linear model, whereas the linear model in which all the quantitative variables are logarithmized is actually a Cobb-Douglass type of function, linearized only for the purpose of facilitating the estimation.

The choice of proper estimation method is the next issue. A natural choice is to adopt one of the typical panel data based estimators, such as fixed or random effects approach. However,

the main disadvantage of the fixed effects approach is the unavailability of parameter estimates on the variables that are constant over time for all observations. These simply cannot be computed, because the *within* transformation of the data, which is applied in the estimation process, eliminates all such variables from the model equation. An example of this kind of variables is a distance between a reporter and its trade partner. Since it most likely is a relevant variable and simultaneously, it might be correlated with the variables in the model, omitting it could cause an omitted variable error and in consequence, result in obtaining biased estimates of parameters. The necessity to eliminate such variable as the above mentioned *distance* and the fact that this would most likely cause the omitted variables problem, makes the use of fixed effects technique a bad idea. Another possibility is thus to use the random effects technique. Still in this case one of the assumptions that needs to be adopted is that of the zero correlation of the individual effects and the independent variables of the model. This assumption does not hold. If we assume that the functional form and the regressors of the model are valid, Hausman test is the way to verify it and the null hypothesis of no correlation between the individual effects and the regressors must be rejected on any reasonable significance level. There might be some doubts though, whether rejection of the null in the Hausman test is truly due to the problem of correlation between individual effects and independent variables. Another possible reason of rejecting the null in Hausman test is a general specification error of the model, which, in most cases, is due to endogeneity of the regressors, whereas in the mentioned techniques we assume a strong form of exogeneity. A theoretical way to check if this is not the true problem is to apply some form of instrumental variables approach. Although it is numerically feasible, the problem lies in the choice of instruments. Typical approach is to use lags of the endogeneous regressors as instruments. Unfortunately, if the variables in the model are not exogeneous, their lags themselves will not be proper instruments since themselves they will not be strictly exogeneous either. This is due to the fact, that most regressors cannot be viewed as white noise: it is actually quite the opposite. In most cases they are seriously autocorrelated. Possible correlation of some X's with error term might be due to the fact, that current value of the error term is influenced by some previous values of the same X's. Thus endogeneity of current value of a given X is likely to coexist with certain form of endogeneity of its lagged values. Also it is difficult to find any additional instruments, which would be strong in econometric sense and truly strictly exogeneous. Baldwin (2006a) discuss the invalidity of external instruments used in this type of models. We will then follow most authors and assume exogeneity of the regressors, without testing it with some particular test. In this situation there is still one solution to be

applied, which is the Hausman-Taylor estimation method. It allows for the use of both time-varying and time invariant variables, however it is allowed that some of them can be endogeneous in the sense of correlation with individual effects, but still exogeneous with respect to idiosyncratic error term. Most of the independent variables can even intuitively be viewed as truly exogeneous, treating distance between countries as an ideal example of a factor that cannot be influenced itself by any other variables. We thus assume, that those of the variables that can be endogeneous in the sense of correlation with individual effects, are those most "fragile" and prone to vary in result of economic phenomena taking place both inside the countries and in the international environment: the logarithmized GDPs of the countries and the logarithmized absolute difference between the GDPs per capita between the exporter and the importer, while the other variables remain purely exogeneous. It is important to note, that there is no endogeneous variable constant over time. Otherwise applying the Hausman-Taylor procedure would require that there are sufficiently strong instruments for the endogeneous variables in the set of the exogeneous variables, which usually is not the case.

Estimation results

The estimation results for the impact of selected variables on bilateral exports are reported in Table 2.

Table 2. Impact of selected variables on bilateral exports

TVexogenous			(0.0152)
k12EMU	**-0.147*** **	_Iyear_1998	-0.0318**
	(0.0508)		(0.0148)
k1v2EMU	**-0.166*** **	_Iyear_1999	-0.0921***
	(0.0135)		(0.0147)
k12ERMvEMU	0.152***	_Iyear_2000	-0.102***
	(0.0502)		(0.0143)
EMUkot	0.0387	_Iyear_2001	-0.109***
	(0.0354)		(0.0143)
FTA	0.117***	_Iyear_2002	-0.102***
	(0.0169)		(0.0143)
CU	0.344***	_Iyear_2003	-0.108***
	(0.0291)		(0.0139)
Year	0.0196***	_Iyear_2004	-0.0556***
	(0.00174)		(0.0140)
_Iyear_1995	0.0220	_Iyear_2005	-0.0480***
	(0.0167)		(0.0143)
_Iyear_1996	-0.0247	_Iyear_2006	-0.0536***
	(0.0159)		(0.0146)
_Iyear_1997	-0.00904	_Iyear_2007	-0.0247

	(0.0152)
_Iyear_2008	0.0622***
	(0.0160)
TVendogenous	
Lsumgdp	0.638***
	(0.0167)
Lmdiffgdppc	-0.0487***
	(0.00757)
Lsumgdppc	0.851***
	(0.0356)

TIexogenous	
Ldist	-1.548***
	(0.0363)
Constant	-23.05***
	(3.340)
Observations	238215
Number of k12	23485

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
TV refers to time varying; TI refers to time invariant

The estimated parameters on variables derived from the theory of gravity approach are statistically significant and have expected signs. As expected distance (*Ldist*) has negative impact on exports, GDP and GDP *pc* of both partners positive, difference in GDP *pc* negative. Also, as expected, the impact of membership in both analyzed forms of regional agreements (FTA and CU) is strong, positive and significant with almost three times stronger positive impact of participation in a CU than in a FTA).

In contradiction to Rose effect our analysis confirms strong negative and significantly large impact of EMU both on intra and extra EMU exports is confirmed. We prove positive and significant impact for exports when countries are member of ERM or one of the country is member of ERM and the other of EMU. We got statistically significant results (exception is the dummy of a partner currency pegged on the euro)

While the assumptions of the model are valid, the distribution of the estimator is asymptotically normal. That means that in the case of such sample size we can use t statistic to draw conclusions that refer to variables significance. This justifies omitting the variability of reers on the basis of t test for the variable denoting it. Considering the relevance of time dummies, t test cannot be used since the test should be carried out for all the time dummies as a group. This brings about the idea of applying Wald's test for common significance of the time dummies. Under the null none of the time effects is significant, yet this hipothesis is rejected on any significance level with chi^2 (14) = 420,6 and p-value practically equal to zero.

One thing that one could consider is skipping the individual effects and applying the usual ordinary least squares instead of panel data techniques. However the variance of individual effects constitutes more than 90% of the total variance of the sum of individual

effects and the idiosyncratic error, which makes it clear that omitting the individual effects is not reasonable.

Conclusions

In our analysis we confirm strong negative and significant impact of EMU both on intra- and extra-EMU exports. We also prove positive and significant impact for exports when countries are member of ERM or one of the analyzed countries constituting a single pair is member of ERM and the other is member of EMU.

Our results differ from these analyzing only EMU or OECD countries giving a broader perspective of almost all countries in the world.

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