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ORIGINAL PAPER

Enlarging the EMU to the east: what effects on trade?

Ansgar Belke · Julia Spies

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Abstract The purpose of this article is to assess the implications of the Economic and Monetary Union (EMU) accession of eight Central and Eastern European Countries (CEECs) on their share of EMU-12 imports. Overcoming biases related to endogeneity, omitted variables and sample selection, our results indicate that the common currency has boosted intra-EMU imports by 7%. Under the assumption that the same relationship between the explanatory variables and imports will hold for EMU-CEEC trade, we intend to predict the future impact of the Euro. Our findings suggest that except for the least integrated countries, Poland, Latvia and Lithuania, all CEECs can expect increases in the EMU-12 import share.

Keywords Central and Eastern European countries · Euro Area enlargement · Gravity model · Panel estimation

JEL Classification F15 · F41

1 Motivation

As a result of the European Commission's convergence report in May 2006, Slovenia was the first of the new European Union (EU) member states to adopt the Euro. Other countries will follow in years to come. While research into exchange rate regimes traditionally focused on consequences for the macroeconomic performance of countries (see Ghosh et al. 2002 for an exhaustive overview), a

A. Belke (✉)
University of Duisburg-Essen, 45141 Essen, Germany
e-mail: ansgar.belke@uni-due.de

J. Spies (✉)
Institute for Applied Economic Research (IAW), 72074 Tübingen, Germany
e-mail: julia.spies@iaw.edu

more recent line of research draws attention to the real impacts of exchange rate issues (e.g. Bayoumi and Eichengreen 1992 and 1998 and Frankel and Rose 1998 for the effects on business cycle synchronization, and Belke and Gros 2002 and Belke and Setzer 2003 for labour market effects). In a controversial but highly influential paper, Rose (2000) assessed the contribution of currency unions in promoting international trade. His point estimate of a 3.35 times higher trade volume with a common currency compared to the baseline scenario without a common currency has been subject to much critique. In a recent paper, Baldwin (2006a) summarizes follow-up studies and specifically points his critique at possible estimation biases related to omitted variables, endogeneity and sample selection.

Among the numerous papers trying to reduce the "Rose effect", a few dealt explicitly with the Euro Area. The first studies by Micco et al. (2003) and Flam and Nordstrom (2006) respectively estimate 6% and 9% more trade among Economic and Monetary Union (EMU) members compared to other EU member states.[1] Controlling for the general trend of greater economic integration among the Euro Area countries over the past five decades, Berger and Nitsch (2005) even find that the EMU effect disappears completely. In the most recent study, Bun and Klaassen (2007) introduce a time trend and estimate a Euro effect of only 3%.

However, very few authors point to the trade effects of the forthcoming EMU enlargement.[2] While trade barriers between the old and new EU member states were already removed during the 1990 s,[3] sharing a common currency may further deepen real economic integration—directly through reduced trade costs and indirectly through intensified competition due to enhanced price transparency. The question as to whether these changes have indeed led to an additional geographical restructuring of trade flows, involving trade creation and trade diversion, is, however, an empirical one. Empirical findings on intra-EMU trade effects due to the introduction of the Euro by the Central and Eastern European Countries (CEECs)[4] are of great interest for politicians and for researchers in the field of Optimum Currency Areas (OCAs) at least for two reasons: first, they may have important policy implications. If a common currency boosts trade even among highly integrated regions, currency unions become more attractive, and hence, the European Central Bank (ECB) and government authorities may encourage applicants to execute all necessary steps for an early adoption of the Euro.[5] Second, any increase in the Euro Area trade resulting from an EMU enlargement

[1] In this study, we use the terms EMU and Euro Area as substitutes and refer throughout the paper to the twelve EMU member states that introduced the common currency in 1999 and 2001.

[2] We are only aware of the studies by Maliszewska (2004) and Brouwer, Paap and Viaene (2007) dealing with this issue empirically.

[3] Trade and trade-related measures became effective by means of the Interim Agreements (IAs), ratified between 1992 and 1995. The asymmetric tariff policy implied that the EU's import tariffs against the CEECs were eliminated by 1997, whereas the CEECs had to follow only in 2002.

[4] In this paper, we conceive the CEECs as the group formed by the Baltic States (Estonia, Latvia and Lithuania), the Czech Republic, Hungary, Poland, Slovakia and Slovenia.

[5] Breuss, Fink and Haiss (2004) discuss the desirability of enlarging the EMU to the East in the context of different interpretations of the OCA theory.

provides empirical support for Rose's finding that establishing a common currency stimulates trade among union members substantially.

We start this study by applying a specification that accounts for recent insights into the theoretical foundation as well as the appropriate econometric set-up of gravity models. While earlier studies only use time-invariant country pair fixed effects to address the price terms, as emphasized by Anderson and van Wincoop (2003), we correct for the remaining omitted variable bias by also incorporating time-variant multilateral resistance to trade. As suggested by Egger (2002) and Carrère (2006), we apply the Hausman-Taylor (HT) instrumental variables estimator to account for any possible endogeneity of Right Hand Side (RHS) variables, and specifically the EMU dummy. Further, we use the Fixed Effects Vector Decomposition (FEVD) estimator developed by Plümper and Troeger (2007), which has—to our knowledge—hardly been applied before in the context of gravity modelling. Both techniques have the great advantage of allowing for an estimation of the traditional time-invariant gravity variables, such as distance and language while controlling for the unobserved individual effects in an efficient way.

Based on our estimates of the early impact of the Euro on intra-EMU imports, we aim to assess the implications of the EMU accession of eight CEECs on their share in the twelve Euro Area member states' imports as of end-of-year 2004. Assuming that the same relationship between income, distance, common borders and other country characteristics and bilateral trade will hold for future EMU member states, we calculate the potential import increases following the accession of the CEECs to the Euro Area. Our predictions based on the parameters estimated out-of-sample suggest that except for the least integrated countries, Poland, Latvia and Lithuania, all CEECs can expect further gains in the EMU-12 import share once they adopt the Euro.

After developing some stylized facts and linking them to the predictions of the OCA theory in Sect. 2, we continue with the specification of the gravity equation we are going to test (Sect. 3). The description of the applied econometric methods and the data set (Sect. 4) is followed by the interpretation of the estimation results in Sect. 5.1. The trade predictions for an enlargement of the Euro Area are assessed in Sect. 5.2. Section 6 contains a summary as well as policy implications of the obtained results.

2 Development of trade flows and the role of monetary integration

2.1 Stylized facts

We start with some stylized facts concerning trade flows between the Euro Area and the Central and Eastern European EU member countries. For this purpose, Fig. 1 plots the EMU-12 and the EU-15 imports from the CEECs between 1991 and 2004. The figure conveys initial empirical evidence of a parallel increase in the import values of the EU-15 and the EMU-12 from the CEECs over the past 15 years.[6]

[6] Clearly, the EMU-12 is much more important for the CEECs than the other way around. Due to restrictions concerning the availability of trade data, we are constrained to look at EMU-12 imports from the CEECs.

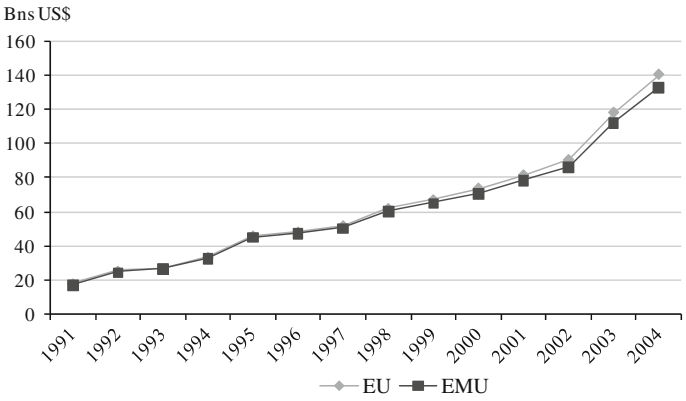

Fig. 1 EU and Euro Area imports from the CEECs. Source: authors' own calculations, data from OECD

While there has been a steady increase in the import value over the 1990 s, one can observe a higher growth rate imminently prior to the EU accession of the eight CEECs.

Even though most obstacles to free trade have been fully removed, sharing a single currency may stimulate real integration further through various channels (see Sect. 2.2). A simple calculation helps to portray the relative change in intra-EMU trade and intra-EU trade. To render the sizes of the two geographical regions comparable, the respective yearly import values have been normalized with regard to the base year (1997). Taking the quotient then allows us to assess relative changes. To be precise, the development of intra-EMU imports (M_{EMU}) and intra-EU imports (M_{EU}) since 1997 has been calculated as follows:

$$\frac{M_{EMUt}/M_{EMU97}}{M_{EUt}/M_{EU97}} \tag{1}$$

Figure 2 clearly shows that the increase in intra-EMU imports was over 5% higher than the rise in intra-EU imports during the same period. After an initial slowdown in 1999, the EMU experienced an especially strong relative increment in 2001, when Greece entered the currency union, and in 2003. The graph also suggests an announcement effect, since intra-EMU imports already increased relative to intra-EU imports in the two years before the common currency was formally adopted.

The crude figure seems to roughly confirm prior studies which provide estimates mostly in the range of 5 to 10% (Baldwin 2006a). However, the graph also shows that it is crucial to include the most recent year available, since much of the increase in imports has only occurred since 2002.

Seen on the whole, the stylized facts match our a priori expectations well. While the imports of the EU-15 and the Euro Area from the CEECs have developed synchronously up to now, those EU member states that share a common currency seem to trade relatively more with each other than with Denmark, Sweden and the UK. This result at the outset argues in favour of a similar development in the case of the EMU accession of the CEECs, thus calling for a more formal investigation.

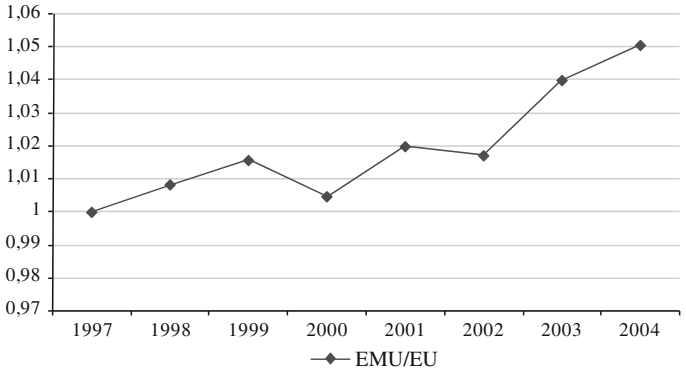

Fig. 2 Increase in intra-EMU imports relative to intra-EU imports. Source: authors' own calculations, data from OECD

2.2 Optimum currency areas and trade

The theoretical question as to whether a single currency is beneficial for the participating countries dates back to Mundell (1961).[7] On the one hand, he proposed that a single medium of exchange should reduce transaction costs and thereby facilitate international trade. On the other hand, he also stated that a single currency may be problematic in the case of coexisting asymmetric shocks and nominal rigidities. He therefore suggested perfect labour mobility as an indispensable condition to lowering the stability losses associated with giving up monetary independence. Mundell himself challenged his early proposal of a small currency union by introducing the foreign exchange market and international risk sharing (Mundell 1973). In his later model this means that the greater the number of countries involved, the better they can mitigate shocks by reserve pooling and portfolio diversification. There are, consequently, theoretical arguments speaking in favour of an enlargement of the Euro Area.[8] McKinnon (1963) specifically suggested small open economies as being suitable candidates for currency unions.

Based on the ratio of Euro Area imports over the CEECs' GDPs, Fig. 3 gives a visual impression of the degree of Euro Area openness of the CEECs in the year 2004. In accordance with the traditional OCA theory arguments mentioned above, the Czech Republic, Slovakia and Hungary should benefit most from their individual EMU accession since the Euro Area displays a high trade exposure towards them. However, the seminal study by Frankel and Rose (1998) challenged the OCA textbook view by stressing the possibility of endogenous currency unions. They argue that two countries would move even closer to matching the OCA criteria once they share a common currency. There are several transmission mechanisms that can spur this effect: in addition to the traditional trade cost reduction, the

[7] For a comprehensive discussion, see Breuss, Fink and Haiss (2004) and Gros and Thygesen (1998).

[8] Another strand of arguments points towards the importance of institutional quality. Alesina and Barro (2002) show that countries opt into currency unions in order to facilitate trade when participation allows them to upgrade the quality of their monetary institutions.

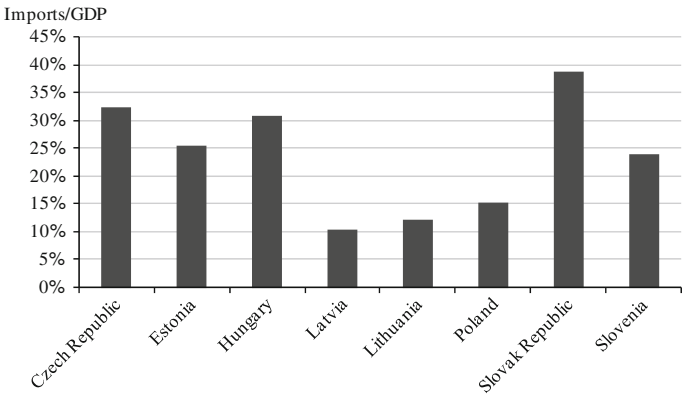

Fig. 3 EMU openness of the CEECs in 2004. Source: authors' own calculations, data from OECD and UN

efficiency gains studied within the OCA framework also include higher price transparency, which stimulates competition and eventually leads to higher trade volumes. Finally, one may argue that the EMU and its pro-competitive effects have served as a catalyst for structural reforms.[9] The cost savings related to monetary integration can be viewed like any other reduction of bilateral non-tariff trade barriers. Changes in intra- and extra-EMU trade should therefore be interpreted against the background of trade creation and trade diversion. Trade creation implies that lower cost suppliers inside the currency union substitute higher cost domestic producers as a result of diminished trade costs. Trade diversion takes place when low cost suppliers outside the currency union are replaced by higher cost Euro Area producers (Viner 1950).

In accordance with the possible ex-post trade effects of currency unions, it seems equally apt to argue a priori that the rise of imports due to adoption of the Euro is expected to be higher for countries that have not yet exploited their full trade potential with the current EMU member states. Based on this different variant of OCA theory, Fig. 3 indicates that Latvia, Lithuania and Poland were, in 2004, relatively less open towards trading with the EMU-12 and may therefore expect a bigger trade effect from the Euro. Which view is correct is above all an empirical question. We leave the answer to our econometric investigation.

3 Empirical specifications

To disentangle the effects of a single currency from other factors influencing trade flows, we estimate a log-linearised reduced-form gravity equation for country i's imports from country j (M_{ijt}) of the form

[9] Although there is no obvious link between monetary and institutional integration, one may argue that the commitment shown by adopting a common currency may have signaling effects towards greater harmonization in other areas as well.

$$\ln M_{ijt} = \alpha + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln re_{ijt} + \beta_4 \ln d_{ij} + \beta_5 Z_{ij} + \beta_6 EMU_{ijt} + \beta_7 \ln avre_{ijt} + \beta_8 \ln avd_{ij} + \beta_9 avZ_{ij} + \beta_{10} avEMU_{ijt} + \varepsilon_{ijt} \quad (2)$$

where Y_{it} is the importer's GDP influencing its import demand and Y_{jt} is the exporter's GDP influencing its export supply.[10] re_{ijt} stands for the real exchange rate and allows us to control for changes in the value of the currency which induce expenditure shifts not directly attributable to the EMU.[11] d_{ij}, the great-circle distance between the importing and the exporting country, is generally used as a proxy for transportation costs. Z_{ij} represents a set of dummy variables serving as proxies for additional trade costs. To be precise, we consider whether country i or j is landlocked (ll) and whether they share a common border (border) or language (cl) as factors hampering or facilitating trade. By including dummies for EU and Europe Agreement (EA) participation, we additionally control for integration efforts other than monetary integration.[12]

Finally, EMU_{ijt} represents a dummy variable measuring the intra-EMU trade effects of the single currency. Specifically, the variable captures all transaction cost savings due to the eliminated exchange rate uncertainty, namely the absence of exchange controls, foreign exchange transactions and currency hedging. It additionally picks up the lower mark-ups suppliers are expected to set because of increased competition and higher price transparency. As in the trade liberalisation literature, these savings may lead to trade creation inside the currency union. Therefore, EMU_{ijt} is defined to take the value of 1 for both countries of a trading pair being EMU members and 0 otherwise. We set this variable equal to 1 in the first set of regressions (Table 1)—also accounting for a possible announcement effect—over the period 1998–2004. In the second set of regressions (Table 2), we introduce yearly EMU dummies to see in which years the common currency impact was strongest.

As stated by Anderson and van Wincoop (2003), bilateral trade does not solely depend on bilateral trade costs, but also on the average resistance to trade with the Rest of the World (ROW). To account for this finding, we introduce the correspondent multilateral term to all variables that facilitate or hamper bilateral trade. To be precise, multilateral resistance (MR) is given by the sum of average bilateral resistances (BR) of countries i (j) towards all trading partners except for the specific trading partner j (i).

$$MR_{ij(t)} = \frac{1}{N-1} \sum_{k=1,k\neq j}^{N} BR_{ij(t)} + \frac{1}{M-1} \sum_{l=1,l\neq i}^{M} BR_{ji(t)} \quad (3)$$

Since the $avEMU_{ijt}$ variable is supposed to capture the trade effects of the common currency on outside countries, it is set to 0 for all EMU member states. If one interprets the saved transaction of the single currency costs as a discriminatory liberalisation of trade, it involves a trade-diverting switch of supply sources—like in any other Preferential Trade Arrangement (PTA).

[10] See Table A1 for variable definitions and sources.

[11] A rise in the real exchange rate implies a depreciation of country i's currency against country j's currency and therefore lowers its import demand.

[12] The multilateral counterparts of these two variables are defined in the same way as the average EMU dummy.

The parameter coefficients of the multilateral trade cost variables are expected to take the opposite sign of their bilateral counterparts. Hence, the bigger a trading pair's joint resistance to trading with the ROW, the lower the bilateral trade costs relative to the multilateral trade costs and the larger country i's imports from country j.

Example, for the $avre_{ijt}$ this means that, holding the bilateral real exchange rate between country i and country j constant, a depreciation of country i's currency with respect to all other currencies in the sample, leads country i to import more from country j.[13] Since a part of the multilateral variables does not only change from a cross-sectional perspective but also over time (e.g. the average exchange rate), we are able to remove those biases which are present in studies that only include country (pair) fixed effects to describe Anderson and van Wincoop's (2003) price terms. To summarize, the expected coefficient signs are

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 < 0, \beta_5 = \sum_{z=1}^{Z} \tau_1 < 0, \tau_2 > 0, \tau_3 > 0, \beta_6 > 0, \beta_7 > 0, \beta_8 > 0,$$

$$\beta_9 = \sum_{avZ=1}^{avZ} \tau_4 > 0, \tau_5 < 0, \tau_6 < 0, \beta_{10} < 0.$$

Finally, we overcome a possible selection bias by including three variables that approximate the Heckman correction term: *HC1* is a variable containing the number of years of a trading pair in the sample while *HC2* and *HC3* are dummies taking the value of 1 if the trading pair is observed over the entire period 1991–2004 and if the trading pair is present in the sample in $t - 1$, respectively (and 0 otherwise).

4 Estimation methodology and data

The estimations are based on a panel data set containing all countries which were members of the Organisation for Economic Co-operation and Development (OECD) over the period 1991 to 2004—also including those CEECs which have already joined (Hungary, Poland, the Czech Republic and Slovakia)—plus Romania and Bulgaria and the four CEECs (Estonia, Latvia, Lithuania and Slovenia) that have not yet become full OECD members.

The advantages of using panel data in the context of this study are straightforward. They allow us to capture relevant relationships between variables over time and to monitor unobservable country pair individual effects. In column 1, Tables 1 and 2, the POLS estimation of Eq. 2 is displayed as a starting point. Cheng and Wall (2004) demonstrate that not controlling for country pair heterogeneity yields biased estimates. In our further estimations, the country pair fixed effects are then treated as fixed, since the Random Effects (RE) model only yields consistent estimates when the unobservable bilateral effects are not correlated with the error term. The conducted Hausman test, however, rejected the null-hypothesis of no correlation.

[13] Since taking the sum of the average exchange rates of both trading partners would have offsetting effects, we consider in this case simply the average exchange rate of country i towards all trading partners except the particular trading partner j.

The relevant Fixed Effects (FE) regression thus gives unbiased estimates of the coefficients of the time-varying variables (reported in column 2 of Tables 1 and 2). The first drawback of this procedure is well known: since the within-groups estimator ignores the between-groups variance, estimates for the coefficients of the time-invariant explanatory variables cannot be provided. Only very recently, researchers have started discussing a second drawback: although coefficients are provided for variables that hardly change over time, the FE absorbs most of their explanatory power and estimates of these variables become inefficient (Plümper and Troeger 2007). A third problem is related to the possible endogeneity of preferential arrangements. Thinking in terms of the traditional OCA theory, this way of reasoning may hold for monetary arrangements even too a larger extent than for trade arrangements. Fearing the loss of the exchange rate and an autonomous monetary policy as tools to respond to external shocks, policy makers might only opt into a currency union when the level of integration (here reflected by the level of imports) is already high beforehand. We address these problems via two estimation techniques we apply in addition to the FE estimator. Both the FEVD estimator and the HT estimator (reported in columns 3 and 4 of both tables, respectively) allow for an estimation of time-invariant (e.g. distance) and almost time-invariant variables (e.g. the EMU dummy).[14] Furthermore the FEVD estimator explicitly addresses the problem of inefficiency. The HT estimator is an instrumental variable panel estimator capable of correcting for any bias caused by the mentioned reverse causality. To provide comparability to earlier studies, we also report the results of the Pooled Ordinary Least Squares (POLS) regression in column 1 of both tables. We corrected for heteroskedasticity and serial correlation in all regressions.

5 Results

5.1 Trade effects of the Euro

The outputs from the regressions on the full country sample are displayed in Table 1. The estimates in columns (3) and (4) are consistent and efficient, so we refer to them when interpreting the results. In the FEVD estimation all coefficients, except for the bilateral real exchange rate and the multilateral landlocked and border variable, show the expected sign and are highly significant. Once the correlation between the regressors and the unobservable country pair effects is properly accommodated, the HT estimator turns the coefficients of some of the time-invariant variables (specifically, the bilateral border, landlocked, common language, EU and the multilateral common language and EA variable) insignificant.[15]

The estimates of the traditional gravity variables GDP and distance lie within the usual range.[16] While a 10% rise in bilateral distance lowers imports by 14.1%

[14] Cf. a detailed description of the estimators in Appendix A.2.

[15] Among others, Egger (2002) finds a similar effect when applying the HT estimator.

[16] As stated by Anderson (1979), GDP estimates may slightly differ from the theoretically predicted unitary elasticity due to the existence of non-tradeable goods.

Table 1 Estimation results with EMU dummy for the entire period (1998–2004)

	(1) POLS	(2) FE	(3) FEVD	(4) HT
Lngdpim	0.88***	0.68***	0.68***	0.68***
	(0.04)	(0.11)	(0.00)	(0.10)
Lngdpex	0.89***	0.71***	0.71***	0.71***
	(0.03)	(0.07)	(0.00)	(0.07)
Lrer	−0.01	0.13**	0.13***	0.13***
	(0.01)	(0.06)	(0.00)	(0.04)
Ldist	−1.27***		−1.41***	−1.75***
	(0.11)		(0.00)	(0.16)
Border	−0.00		0.00***	−0.00
	(0.00)		(0.00)	(0.00)
Ll	−0.16*		−0.23***	−0.15
	(0.10)		(0.00)	(0.13)
Cl	0.23*		0.13***	0.01
	(0.12)		(0.00)	(0.15)
Eu	0.08	0.03	0.03***	0.03
	(0.09)	(0.05)	(0.00)	(0.05)
Ea	0.16*	0.22***	0.22***	0.22***
	(0.10)	(0.06)	(0.00)	(0.05)
Emu	0.13**	0.07**	0.07***	0.07**
	(0.05)	(0.03)	(0.00)	(0.03)
Lavrer	1.22***	0.45**	0.45***	0.45**
	(0.41)	(0.23)	(0.01)	(0.22)
Lavdist	0.55***		0.93***	1.45***
	(0.15)		(0.00)	(0.23)
Avborder	0.00***		0.01***	0.01***
	(0.00)		(0.00)	(0.00)
Avll	−0.10***		−0.14***	−0.18***
	(0.03)		(0.00)	(0.05)
Avcl	−0.02		−0.40***	−0.45
	(0.26)		(0.00)	(0.34)
Aveu	−0.74***	−0.22*	−0.22***	−0.22*
	(0.21)	(0.12)	(0.01)	(0.12)
Avea	0.34	−0.07	−0.07***	−0.07
	(0.23)	(0.11)	(0.01)	(0.10)
Avemu	0.22*	0.69***	0.69***	0.69***
	(0.12)	(0.09)	(0.01)	(0.08)
hc1	0.09***		0.10***	0.09*
	(0.03)		(0.00)	(0.05)
hc2	0.00			
	(0.00)			

Table 1 continued

	(1) POLS	(2) FE	(3) FEVD	(4) HT
hc3	−0.18***	−0.03	−0.03***	−0.03
	(0.04)	(0.03)	(0.00)	(0.03)
Observations	5262	5262	5262	5262
R-squared	0.89	0.98	0.98	0.83

Robust standard errors in parentheses

* Significant at 10%; ** significant at 5%; *** significant at 1%

Source: authors' own calculations

(17.5% in the HT estimation), the same increase in multilateral distance (or remoteness) induces country *i* to import 9.3% more from a certain trading partner *j* (14.5% in the HT estimation). The unexpected positive sign of the bilateral real exchange rate may be due to temporarily irreversible import contracts and reflect a J-curve effect. This effect does not seem to be important on a multilateral basis. A 10% depreciation of country *i*'s currency against all but country *j*'s currency pushes it to import 4.5% more from country *j*. The other multilateral counterparts of the bilateral variables are also significant at the 1%-level in the FEVD regression and thus indicate their relevance for the gravity estimation. Our consistent EMU estimate indicates 7% more imports attributable to savings in transaction costs and lower mark-ups. The result is well in line with our preliminary analysis (compare Fig. 2) and amidst the range of estimates found in other post-Rose studies. Bun and Klaasen's (2007) preferred estimate suggests a Euro effect of only 3%. However, their use of time-varying trading pair dummies makes it "impossible to estimate factors that affect bilateral trade costs even if they are time varying" (Baldwin and Taglioni 2006, p. 23). Indeed, the Euro estimate jumps up to 6% when the authors employ country-specific time-varying dummies, suggesting that the pair dummies absorb at least some of the variation of the EMU variable. We also believe our result to be reliable with an eye on the fact that the inclusion of multilateral variables enables us to remove not only the time-invariant part of the omitted variable bias, but to address additionally the time-varying character of Anderson and van Wincoop's (2003) relative price terms. Interestingly enough, the significantly positive multilateral EMU estimate indicates that the common currency did not divert trade from non-members—on the contrary, outside countries profited highly from trading with the currency bloc. This result does not come unexpectedly. Many of the empirical studies, including Baldwin and Di Nino (2006) and Baldwin (2006b), also find significant pro-trade effects of a unilateral Euro usage. The empirical evidence therefore suggests that the EMU has so far acted like a unilateral rather than a preferential liberalisation.[17] This finding contradicts the OCA theory

[17] Transitory factors, like the appreciation of the Euro since 2002 or the relative strength of the US and some of the Eastern and Asian economies help explain why imports from outside the Euro Area have even grown faster than intra-EMU imports over the underlying timeframe, but should already be captured by the exchange rate and GDP variables.

Table 2 Estimation results with yearly EMU dummies

	(1) POLS	(2) FE	(3) FEVD	(4) HT
Lngdpim	0.88***	0.75***	0.75***	0.75***
	(0.04)	(0.12)	(0.00)	(0.11)
Lngdpex	0.90***	0.75***	0.75***	0.76***
	(0.03)	(0.07)	(0.00)	(0.07)
Lrer	−0.01	0.13**	0.13***	0.12***
	(0.01)	(0.06)	(0.00)	(0.04)
Ldist	−1.27***		−1.38***	−1.68***
	(0.11)		(0.00)	(0.16)
Border	−0.00		0.00***	−0.00
	(0.00)		(0.00)	(0.00)
Ll	−0.16		−0.20***	−0.15
	(0.10)		(0.00)	(0.12)
Cl	0.23*		0.15***	0.05
	(0.12)		(0.00)	(0.15)
Eu	0.06	−0.01	−0.01***	−0.01
	(0.09)	(0.05)	(0.00)	(0.05)
Ea	0.15	0.23***	0.23***	0.23***
	(0.10)	(0.06)	(0.00)	(0.05)
emu1998	0.24***	0.07***	0.07***	0.07***
	(0.05)	(0.02)	(0.00)	(0.02)
emu1999	0.24***	0.05*	0.05***	0.05*
	(0.06)	(0.03)	(0.00)	(0.03)
emu2000	0.33***	0.15***	0.15***	0.15***
	(0.06)	(0.03)	(0.00)	(0.03)
emu2001	0.25***	0.16***	0.16***	0.16***
	(0.06)	(0.03)	(0.00)	(0.03)
emu2002	0.14**	0.07*	0.07***	0.07**
	(0.06)	(0.04)	(0.00)	(0.03)
emu2003	0.01	−0.02	−0.02***	−0.02
	(0.05)	(0.04)	(0.00)	(0.04)
emu2004	−0.06	−0.07	−0.07***	−0.07
	(0.06)	(0.06)	(0.00)	(0.05)
Lavrer	1.14***	0.47**	0.47***	0.48**
	(0.41)	(0.23)	(0.01)	(0.22)
Lavdist	0.54***		0.82***	1.29***
	(0.15)		(0.00)	(0.23)
Avborder	0.00**		0.00***	0.01***
	(0.00)		(0.00)	(0.00)
Avll	−0.10***		−0.13***	−0.17***
	(0.03)		(0.00)	(0.05)

Table 2 continued

	(1) POLS	(2) FE	(3) FEVD	(4) HT
Avcl	−0.01		−0.41***	−0.40
	(0.26)		(0.00)	(0.33)
Avemu	0.24**	0.63***	0.63***	0.63***
	(0.12)	(0.09)	(0.01)	(0.08)
Aveu	−0.75***	−0.28**	−0.28***	−0.27**
	(0.21)	(0.13)	(0.01)	(0.12)
Avea	0.30	−0.04	−0.04***	−0.04
	(0.23)	(0.11)	(0.01)	(0.10)
hc1	0.09***		0.09***	0.08*
	(0.03)		(0.00)	(0.05)
hc2	0.00			
	(0.00)			
hc3	−0.17***	−0.05	−0.05***	−0.05*
	(0.04)	(0.03)	(0.00)	(0.03)
Observations	5262	5,262	5,262	5,262
R-squared	0.89	0.98	0.98	0.85

Robust standard errors in parentheses

* Significant at 10%; ** significant at 5%; *** significant at 1%

Source: authors' own calculations

insofar as the latter asks a country to give up its monetary autonomy to be able to benefit from the efficiency gains in a currency union (see Sect. 2.2). If countries can, however, get better market access without sacrificing their main macroeconomic tool then the UK and Denmark took the right decision in voting against EMU membership. This may have important policy implications for the CEECs as well, even though they do not have the possibility to opt-out.

Turning to the regression results with yearly EMU dummies (Table 2), conducted again for the full country sample, one can readily become acquainted with the robustness of the coefficient estimates.

Both the FEVD and the HT estimator confirm the presumption of an announcement effect. In 1998, the prospect of a common currency had already boosted intra-EMU-12 imports by 8%. The results further suggest a positive impact of the Euro across all years until 2002, with the strongest effect on trade in 2001, the year Greece entered the currency union and one year before the physical notes and coins were introduced. In contrast to the descriptive statistics illustrated in Fig. 2, our formal econometric analysis shows that the Euro has not stimulated trade significantly further since 2003. On the contrary, the FEVD estimator even yields significant coefficients indicating a negative impact of the Euro in last two sample periods. The observation of no further gains for member countries in 2003 and 2004 suggests that the Euro's trade-creating potential has

already been fully exploited.[18] Further efficiency gains may be realised with the accession of new member states.

5.2 Trade effects of the Euro Area enlargement

When calculating predictions, two approaches of simulation can be distinguished: in in-sample predictions the countries under consideration, i.e. the CEECs, are included in the regression. This approach is appropriate when the parameters of the CEECs do not differ substantially from those of the other OECD member states. The method has, however, been subject to critique by Egger (2002) who states that systematic differences between predicted and observed trade flows are likely due to a misspecification of the model. An alternative is out-of-sample predictions, where the countries under consideration are left out when fitting the model. This approach seems justified when the parameters of the two country samples differ and was, for that reason, frequently used in the early stages of transition. Methods using FE bear limitations when it comes to the calculation of out-of-sample trade flow predictions. Much information needed to predict accurately EMU imports from the CEECs is contained in the country pair specific terms. The determination of this term for the countries not included in the sample when fitting the model is arbitrary. This problem can be circumvented by applying the HT estimator. In order to predict the impact of EMU accession for the CEECs based on the full sample as well as out-of-sample, two scenarios are constructed and investigated over the time frame 1991–2004. In the baseline scenario we predict the EMU-12 imports from the CEECs in a world without the Euro while in the counterfactual scenario, we base our import predictions on the estimated model controlling for the EMU. In order to measure the EMU impact correctly, a few adjustments have to be made: in the counterfactual scenario, the bilateral and the multilateral EMU variables take the value of 1 and 0, respectively. In addition to this, we adjust the real exchange rate variable, such that from the time of the Euro adoption only real changes are allowed whereas the nominal exchange rate is held constant. Under the assumption that the same relation between the explanatory variables and imports will also hold for future EMU members, we take the coefficients from the fitted model and apply these to the CEEC dataset. To be precise, by using the saved parameter estimates from the estimates based on the full country sample (columns one and two in Table 3) and from the estimates based on the country sample excluding the CEECs (columns three and four in Table 3) and combining these with the observations on the CEECs, we obtain the corresponding values for the import variable. Comparing the 2004 simulations on EMU-12 imports of the baseline (without the Euro) with the counterfactual scenario (with the Euro), we obtain a prediction of the extent to which a future EMU accession of the CEECs will further stimulate trade.

[18] Despite the correspondence with the appreciation of the Euro, it would be incorrect to interrelate this period with the non-positive 2003 and 2004 EMU estimates. The real exchange rate controls for any expenditure shift attributable to exchange rate movements. As an additional robustness check we also included different lags to account for a possible J-curve effect—without any change to the overall picture. For the impact of the Euro appreciation on trade, see also the report by the European Commission (2007).

Table 3 Overall EMU impact for the CEECs in 2004[a]

	Estimations based on the full country sample		Estimations based on non-CEEC country sample (out-of-sample)	
	In %	In bns US$[b]	In %	In bns US$[b]
Czech Republic	1.34	0.38	10.91	1.37
Estonia	18.54	0.30	20.16	0.75
Hungary	17.75	2.14	40.75	2.04
Latvia	−21.59	−0.60	−19.93	−1.29
Lithuania	−15.26	−0.57	−8.78	−0.65
Poland	−34.24	−13.74	−19.00	−8.13
Slovak Republic	−4.39	−0.31	11.21	0.43
Slovenia	52.12	4.23	66.51	8.34

[a] Table entries display the cumulated imports of the Euro Area from a specific CEEC

[b] Differences = counterfactual scenario with Euro minus baseline scenario without Euro

Source: authors' own calculations

Table 3 shows the results of the calculation of the impact of introducing the Euro in eight CEECs. The figures represent the additional cumulative EMU-12 imports from them. The full sample estimation indicates that EMU membership will boost EMU-12 imports from four CEECs beyond the level attained through their EU accession—however, Poland, Latvia, Lithuania and Slovakia cannot expect further gains when adopting the Euro.[19] Given the results for the multilateral EMU dummy variable of Table 1 and 2, the relatively low or even negative impact of some countries adopting the Euro does not come as a surprise. Since trade is not diverted from third countries—on the contrary, they benefited even more from the common currency area—the passage to full EMU membership may, in this setting, have a negative effect on their performance.

Although the discussed points of critique on in-sample and out-of-sample approaches limit the detail of the conclusions, the out-of-sample results (i.e. those based on parameter estimates gained from a country sample which does not include the CEECs) head in the same direction as the full sample estimation. Only Slovakia is additionally found to benefit from adopting the Euro through an 11% gain in EMU-12 imports. The overall performance of the CEECs is also slightly better: while the simple average of the out-of-sample estimates yields a gain in EMU-12 imports of 12.7%, the full sample calculation predicts only a 1.8% increase on average.[20] The trade-weighted averages report a slightly lower Euro effect of 12.4% and -2.8% for the out-of-sample and the full sample calculations, respectively.[21] The results for Austria broadly confirm the aggregate findings (Table A2). The finding that countries with a higher

[19] This result is in contrast to a study by Maliszewska (2004), who finds—based on a POLS model—positive impacts of the Euro throughout.

[20] Note that the growth effects due to the introduction of the Euro are long-run equilibrium effects and not annual growth rates.

[21] We used the 2004 share of each CEEC in total EMU-12 imports from all CEECs as weights.

Table 4 Spearman rank correlation between openness and EMU effect

	Full sample	Full sample excl. CEECs (out-of-sample)
2004	0.45	0.55
1991– 2004	0.54***	0.54***

* Significant at 10%; ** significant at 5%; *** significant at 1%

Source: authors' own calculations

share in EMU-12 imports have to settle for a lower Euro effect may, at first sight, contradict the old OCA theory; however, one has to keep in mind that trade integration should be related to country size as done in Fig. 2.

Table 3 gives some intuition with respect to the hypothesis that the EMU impact is higher for well-integrated economies. The negative prediction for the less-open Polish, Latvian and Lithuanian economies in both regressions clearly speaks in favour of the validity of the classical OCA theory. In contrast, the simulation results for the Czech Republic and Slovakia, the countries with the highest imports-over-GDP ratios reveal a relatively low EMU impact and strengthen, therefore, the validity of the OCA endogeneity hypothesis (compare Fig. 3). To elucidate this further, we also investigated the issue on a more formal level. For this purpose, we conducted a statistical Spearman rank correlation analysis of the relation between the rank order of the CEECs concerning trade openness in 2004 and the rank order of these countries with respect to their fictitious gains from adopting the Euro in 2004 (Table 4).

For both the full country sample and the out-of-sample scenario, we do not find any significant relationship. Only by calculating the rank correlation coefficient over the entire time span (1991–2004) do we find a significantly positive relation between the CEECs' openness and their gain in the EMU's import share. Hence, there is some evidence that a high degree of openness beforehand determines a positive trade impact of EMU membership. This result does not only give support to the traditional OCA theory, but also has important implications for the timing of the CEECs' accession to the Euro Area. While the open economies should opt for an early introduction of the single currency, Poland, Latvia and Lithuania may prefer to concentrate first on stronger real integration.

6 Conclusions

This paper's motivation has been twofold: first, we attempted to address all the commonly accepted mistakes in gravity estimation to obtain unbiased currency effects on trade. Using the HT estimator we took into account the possibility of reverse causality between membership in a currency bloc and the import value. By including multilateral time-variant variables we corrected for the omitted variable bias present in earlier studies that only rely on country pair fixed effects. Finally, with the proxies for the Heckman correction term, we addressed the possibility of selection bias. With this specification, we obtained a point estimate for the EMU dummy of 0.07, much lower than Rose's result but well in line with Micco, Stein

and Ordoñez (2003) and Flam and Nordstrom (2006). Second, we would like to argue that our procedure allows us to derive some policy implications. As the yearly EMU estimates for 2003 and 2004 indicate that the Euro did not contribute to any increase in imports in these years, it seems that the EMU-12 has already exhausted its trade-creating potential. The important announcement effects seem to have been consumed to a large extent by now without many further gains to be expected. For the EMU candidates, it might be worthwhile noting that these announcement effects could also be reversed again if EMU membership were suddenly not to be implemented. On the one hand, this fact may deliver an argument for current members to opt for a quick entry of the CEECs, once they have fulfilled the Maastricht criteria, although their importance for the EMU-12 is much lower than the other way around. On the other hand, the Spearman rank correlation suggests that gains from EMU membership are larger if openness towards the Euro Area was substantial beforehand. The predictions finally indicate that the Czech Republic, Estonia, Slovenia and Hungary (as well as Slovakia in the out-of-sample estimation) can expect further gains in the EMU-12 import share once they adopt the Euro. Therefore, these countries, too, may put efforts into fulfilling the accession criteria in the near future. The fact that outside countries even benefit more from trading with a currency union suggests that the less-open economies, Poland, Latvia and Lithuania, may do better not to enter the EMU in the near future.

One task that we have left open for further investigation is the role of exchange rate volatility in this kind of model. By implementing a variable measuring exchange rate volatility one could control for the exchange rate regimes the CEECs had during the sample period. We leave this task for future research.

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Appendix

A.1: Variable definitions and sources

Table A1 List of variables

Variable	Definition	Source
M_{ijt}	Yearly imports of country i from country j	OECD ITCS
$Y_{i(j)t}$	Importer and exporter GDP (in current US$)	UN NAMAD
re_{ijt}	Bilateral real exchange rate	UN NAMAD (nom. exchange rates), IMF IFS (producer price index)
D_{ij}	Great circle distance between the two countries of a trading pair	CIA World Factbook (latitudes and longitudes), the authors' own calculations based on the harvesine formula

Table A1 Appendix continued

Variable	Definition	Source
LL_{ij}	Dummy = 1 for one country and = 2 for both countries of the trading pair being landlocked	CIA World Factbook
B_{ij}	Dummy controlling for the length of a common border	CIA World Factbook
CL_{ij}	Dummy controlling for the number of common official languages	CEPII
EMU_{ijt}, EM_{ijt}, EA_{ijt}	Dummy = 1 for both countries of a trading pair being EMU, EU or EA members	

A.2 Econometric methods

A.2.2 The fixed effects vector decomposition estimator

In the first stage the FEVD procedure estimates a standard FE model by conducting a within-groups transformation,

$$\tilde{M}_{ijt} = \delta \tilde{X}_{ijt} + \tilde{\varepsilon}_{ijt} \tag{A1}$$

which removes the bilateral effects μ_{ij} and the time-invariant variables T_{ij}. From this, one obtains the estimated unit effects $\hat{\mu}_{ij}$, including all time-invariant variables, the overall constant term and the mean effects of the time-varying variables. In the second stage, $\hat{\mu}_{ij}$ is decomposed into an explained part (by the observed time-invariant and rarely changing variables) and an unexplained part h_{ij},

$$\hat{\mu}_{ij} = \lambda T_{ij} + h_{ij}. \tag{A2}$$

In the last stage, the full model, including the residual h_{ij} from stage two but leaving out μ_{ij}, is re-estimated using POLS.[22]

$$M_{ijt} = \alpha + \delta X_{ijt} + \lambda T_{ij} + \upsilon \hat{h}_{ij} + \varepsilon_{ijt} \tag{A3}$$

Hence, if the orthogonality assumption between the time-invariant variables and the unobserved bilateral effects is correct, the estimator is consistent.

A.2.3 The Hausman and Taylor estimator

By using instrumental variables to address the problem of correlation of the unobservable bilateral effects with some of the explanatory variables (as detected by the Hausman test), the estimator additionally allows us to control for potential endogeneity biases caused by RHS variables. In an RE model of the form

[22] Also, at this third stage, a robust variance-covariance matrix is applied to eliminate panel heteroskedasticity.

$$M_{ijt} = \delta_1 X_{1ijt} + \delta_2 X_{2ijt} + \lambda_1 T_{1ij} + \lambda_2 T_{2ij} + \mu_{ij} + \varepsilon_{ijt}, \quad \text{(A4)}$$

X_{1ijt} and T_{1ij} are $1 \times k_1$ and $1 \times g_1$ vectors of observations on exogenous variables and X_{2ijt} and T_{2ij} are $1 \times k_2$ and $1 \times g_2$ vectors of observations on endogenous variables, causing a bias in the standard RE estimation. Hausman and Taylor (1981) therefore propose the use of information already contained in the model to instrument the endogenous variables. In the first step, the consistent δ_1 and δ_2 are used to obtain the within residuals. Regressing these on T_{1ij} and T_{2ij}, using X_{1ijt} and T_{1ij} as instruments, yields intermediate, even though consistent estimates of λ_1 and λ_2. With the two sets of residuals (within and overall) it is possible to estimate the variance components, which are used to perform the General Least Squares (GLS) transform. The model is identified as long as $k_1 \geq g_2$. Since the estimator is consistent but not efficient, we correct the variance-covariance matrix at this stage by using standard errors that are robust to arbitrary autocorrelation and heteroskedasticity. The HT estimator is then obtained by

$$\breve{M}_{ijt} = \delta_1 \breve{X}_{1ijt} + \delta_2 \breve{X}_{2ijt} + \lambda_1 \breve{T}_{1ij} + \lambda_2 \breve{T}_{2ij} + \breve{\mu}_{ij} + \breve{\varepsilon}_{ijt}, \quad \text{(A5)}$$

using $\tilde{X}_{1ijt}$, $\tilde{X}_{2ijt}$, $\bar{X}_{1ijt}$, $\bar{X}_{2ijt}$ and T_{1ij} as instruments, where $\breve{\omega}$ represents the GLS transform of a variable, $\bar{\omega}$ stands for the within-groups mean and $\tilde{\omega}$ for the within transform of a variable ω.

The selection of variables included in X_{2ijt} and T_{2ij} is not straightforward. We follow the proposition by Hausman and Taylor (1981) and use economic intuition.[23] First, and in response to the critique by Baldwin (2006a), we treat the dummy variables for membership in a preferential arrangement as endogenous, including the variable reflecting EMU membership. In reference to the possibility of export-led growth, a second source of endogeneity bias may stem from the exporter's GDP variable. Its simultaneous instrumentation with the bilateral exchange rate variable improves the model so much that the over-identification test can no longer reject the null of a non-systematic difference between the FE and the HT estimator ($\chi^2_{(11)} = 1.56$). However, we find that instrumenting the importer's GDP variable improves the model further and fully eliminates the endogeneity bias.[24]

[23] The validity of the instruments can be tested. When the null of $p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} \bar{X}_{1ijt}, \mu_{ij} = 0$ and $p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} T_{1ij}, \mu_{ij} = 0$ cannot be rejected, $\bar{X}_{1ijt}$ and T_{1ij} are uncorrelated with the random effect μ_{ij} and no further instrumentation is needed.

[24] Since the instrumentation of the trade cost variables could not further improve the model, we treat the time-invariant HC1 variable as endogenous.

A.3 EMU impact on Austrian imports from the CEECs in 2004

Table A2 EMU impact on Austrian imports from the CEECs in 2004

	Estimations based on the full country sample		Estimations based on non-CEEC country sample (out-of-sample)	
	In %	In mns US$[a]	In %	In mns US$[a]
Czech Republic	3.64	5.72	25.74	159.83
Estonia	12.00	4.01	26.04	22.23
Hungary	15.93	87.57	52.91	115.33
Latvia	−24.15	−16.41	−14.40	−23.28
Lithuania	−17.57	−17.01	−1.85	−3.57
Poland	−32.12	−562.81	−8.36	−125.29
Slovac Republic	−2.95	−11.87	24.78	44.10
Slovenia	60.56	612.05	91.60	1026.56

[a] Differences = counterfactual scenario with Euro minus baseline scenario without Euro

Source: authors' own calculations

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