THE TRADE AND FDI EFFECTS OF EMU ENLARGEMENT*

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Abstract

This paper considers the nature and the distribution of the trade and FDI effects of a potential enlargement of the European Monetary Union (EMU) to the ten countries that obtained EU membership in 2004. Intuitively, the implementation of a single currency for these countries means replacing several fluctuating currencies by a common currency. This gives rise to both "level" and "risk" effects of reduced currency movements on trade and investment. Another factor is the nature of the link between trade and FDI. This is also important not only because cross-border factor flows are becoming increasingly important, but also the international trade literature has long recognized that cross-border factor flows and trade in goods and services can be substitutes or complements. Given this background, we empirically examine for these theoretical expectations within a unique dataset of unbalanced panel data that combines bilateral trade flows among 29 countries and the distribution of outward FDI stocks among these countries (including the 10 new EU members). The data generally cover the period from 1980 to 2005. Our empirical results convincingly support: (i) a complementarity between trade and investment, (ii) a relationship between trade and exchange rate volatility that depends on the sign of bilateral trade balances, (iii) a positive effect of EU on trade and investment, and (iv) a positive effect of EMU on foreign investment. Estimates of the effects of EMU on FDI range between 19% for Poland and 30% for Hungary in our worst scenario.

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1. Introduction

The Accession Treaty of the European Union (EU) that entered into force on May 1, 2004 accredited the accession of ten new countries into the EU. This represented the biggest enlargement in European integration with more than 100 million citizens joining the EU[1]. Economic and political changes came dramatically fast in these countries as they, excepting Cyprus and Malta, adjusted from planned to market economies in 15 years. The next step in the integration process is to join the European Monetary Union (EMU) [2]. On the one hand, the prospect of euro membership helps stabilize these economies and the effective adoption of the euro as a common currency would generate the microeconomic benefits of a currency union. On the other hand, membership would imply the loss of the macroeconomic flexibility of running an independent monetary policy. Hence, the question of what constitutes the benefits of EMU accession for new members assumes considerable importance.

An important factor affecting firms' foreign trade and investment decisions is the volatility in the major currencies of the world as illustrated by the behavior of the U.S. dollar in the last two decades. Central to the issue is the popular conjecture that the floating exchange rate regime has led to a decrease in the volume of trade and in the investment flows by multinational firms. This view has been put forward repeatedly by governments and international organizations (see for example, UNCTAD, 1993, pp.224, Table XI.2). This paper examines the theoretical and empirical premises of such conjecture.

Foreign direct investments (FDI) have grown dramatically as a major form of international capital transfer over the last few decades. Between 1990 and 2005 world stocks of FDI have approximately quintupled. The emerging global economy is one increasingly dominated by multinational firms that contribute to the internationalization of production chains. Currently they account for about one-third of world trade, intra-firm trade constituting the major component of such trade flows. One of the important features of FDI is that it is prominent in industries where the classical competitive paradigm fits least well. Old style multinationals continue to dominate oligopolistic resource based industries such as oil, gas and electricity. Modern multinationals thrive in Schumpetarian sectors such as pharmaceutical, apparel and electronics (UNCTAD, 2006). A characteristic of the data is that the ten new EU members lag

[1] The ten new countries are: Estonia, Hungary, Slovenia, Malta, Cyprus, Poland, Czech Republic, Latvia, Lithuania and Slovakia.
[2] The European Monetary Union (EMU) exists since January 1, 1999 and comprises 12 countries. It substituted the euro for the national currencies of Austria, Belgium, France, Finland, Germany, Ireland, Italy, Luxembourg, The Netherlands, Portugal and Spain. Greece joined the EMU on January 1, 2001.

behind in attracting FDI as evidenced by UNCTAD's FDI performance index. The latter computes the ratio of a country's share in global FDI inflows to its share in global GDP. An index value of 1 implies the equality of both shares. In 2005, estimates range between 0.04 for Estonia to 0.92 for Slovenia (UNCTAD, 2006, Annex Table A.I.9). Therefore, the question of what can be the role of EMU in the trans-boundary investment behavior of enterprises becomes important for these countries.

The analysis of this paper considers variables such as trade and foreign direct investment, which are closely linked to the exchange rate. To that end, we estimate gravity models based on a unique dataset of unbalanced panel data that consists of bilateral trade flows among 29 countries and of the distribution of outward FDI stocks among these countries (including the ten new EU members). The data generally cover the period from 1980 to 2005, thus including the 2004 EU membership of the new countries. Whereas the existing literature aims at measuring the general effects of a common currency on trade or FDI, the contribution of the paper is to assess the implications of EMU enlargement for each individual country. These implications rest on the empirical tests of key propositions that are issued from the theoretical literature on the relationship between trade and FDI and on the role of exchange rate volatility on trade and investment. Our empirical results convincingly support: (i) a complementarity between trade and investment, (ii) a relationship between trade and exchange rate volatility that depends on the sign of bilateral trade balances, (iii) a positive effect of EU on trade and investment, and (iv) a positive effect of EMU on investment. Estimates of the effects of EMU on FDI range between 19% for Poland and 30% for Hungary in our worst scenario.

The remainder of this paper is as follows. Section 2 provides a discussion of the empirical literature on the effects of the early introduction of EMU. Section 3 outlines the hypotheses to be tested. This is followed by the empirical tests in Section 4. Section 5 uses this evidence to compute the trade and FDI effects of a country-by-country enlargement of EMU. Section 6 discusses the consequences of the empirical results together with the scores of the ten new EU countries on the basis of the Maastricht criteria. An Appendix describes the data methods and sources.

2. Related Literature

Rose (2000) initiated a new stream in the trade literature. He uses the gravity equation to estimate the separate effects of exchange rate volatility and currency unions on international

trade. He finds a significant effect on trade for both variables. More specifically, the conclusion is that countries with a common currency would trade three times as much as countries that do not share a common currency. Further, bringing down the exchange rate volatility hypothetically to zero increases trade by 13 percent. These results led to numerous reactions, most of them questioning the large common currency effects on trade.

In his interpretive survey of the literature, Baldwin (2006) mentions the following drawbacks. First, a selection bias may arise because the data set used by Rose contains currency unions that involve many small and/or developing nations. As the EMU is exclusively built on developed countries his findings may not be applicable to Europe's single currency. Second, an important endogeneity issue may arise as well. If it were the case that countries that trade more with each other tend to form currency unions, then the estimated trade effects of currency unions cannot be interpreted as a pure currency union effect. Third, Rose's hypothesis is whether countries with a common currency trade more than countries without. For the EMU, the question is different, namely, has the euro caused a structural break in the data? Finally, the estimated effects using the gravity equation could suffer from non-linearity and omitted variables.

Compared to the existing literature, Micco *et al* .(2003) contains three important contributions: (i) the authors use sufficiently long samples of relatively homogenous countries to obtain indifferently time-series, cross-section or panel data estimates; (ii) they find effects of currency union on trade that are smaller (and more realistic) than comparable empirical studies; (iii) their intensive use of robustness checks gives a reliable range of estimates. Their finding is that, by joining the EMU, any two participating countries increase their bilateral trade between 5 and 20 percent. In addition, there is no evidence of trade diversion with non-member countries.

While the theoretical foundations for the gravity equation for international trade flows are well developed (see, e.g., Anderson, 1979; Deardorff, 1995; Helpman and Krugman, 1985; Anderson and van Wincoop, 2003) there is hardly no formal theoretical foundation for the gravity equation for FDI flows. In spite of that, the gravity equation for FDI is commonly used and shows a high explanatory power. An exception is De Sousa and Lochard (2006) who derive a gravity model based on the tradeoff between the benefits of a foreign affiliate of a multinational enterprise and the cost of its remoteness. In the model's reduced form, FDI depends on an inward effect, an outward effect (both related to countries' GDP), a bilateral effect (linguistic ties, colonial, physical distance) and a multilateral effect that represents the

relative attractiveness of alternative locations. They show that the EMU increases FDI stocks among EMU countries by about 29 percent on average.

3. Model Specification

The objective of this section is to outline the functional forms of the models to be estimated and discuss the expected sign of the main regressors.

3.1 Functional Forms

In order to formally assess the effects of EMU on trade and FDI flows we use three different models that have been fairly used in the empirical literature. The first model is the so-called one-way error component model where a dependent variable y_{ijt} is explained by a set of explanatory variables X_{ijt}, time-invariant unobserved country effects α_i and α_j, and other time-variant unobserved variables ε_{ijt}. Formally, the model is written as:

$$(1) \qquad y_{ijt} = \alpha_i + \alpha_j + X'_{ijt}\beta + \varepsilon_{ijt}, \qquad i,j = 1,\ldots N;\ i \neq j;\ t = 1,\ldots T,$$

where N is the number of countries and T the number of yearly observations. In our framework, y_{ijt} stands for the natural logarithm of nominal exports of country i to country j in the trade equation and the natural logarithm of the outward stock of FDI of country i in country j in the FDI equation. This corresponds to the gravity model by Anderson and van Wincoop (2003) who include "multilateral resistance" terms capturing country i's and country j's resistance to trade with all regions and proxy them using exporter and importer fixed effects. In this specification, country i's and country j's gross domestic product are usually not part of the set of explanatory variables.

To assess the direct effects of EMU on trade and FDI we augment (1) with a number of binary variables:

$$(2) \qquad y_{ijt} = \alpha_i + \alpha_j + X'_{ijt}\beta + \phi_1 EMU2 + \phi_2 EMU1_{new} + \phi_3 EMU1_{ru} + \phi_4 EMU1_{rw} + \delta_1 EU1 + \delta_2 EU2 + \varepsilon_{ijt}, \qquad i,j = 1,\ldots N;\ i \neq j;\ t = 1,\ldots T,$$

where

EMU2= 1 when country i and j are EMU members at date t; = 0 otherwise;

$EMU1_{new}$ = 1 when country i is EMU member, country j is outside the EMU but belongs to the new "ten" at date t; = 0 otherwise;

$EMU1_{ru}$ = 1 when country i is EMU member, country *j* is either Denmark, Sweden, U.K at date t; = 0 otherwise*;*

$EMU1_{rw}$ = 1 when country i is EMU member, country *j* is outside EMU and EU at date t; = 0 otherwise*;*

EU2= 1 when country *i* and *j* are both EU members at date t; = 0 otherwise;

EU1= 1 when country *i* only is EU member at date t; = 0 otherwise;

In (2), the dummy variables EMU2 and EU2 are introduced separately as they represent two separate forms of economic integration: parameter ϕ_1 is an estimate of the marginal contribution of EMU for participating countries whereas δ_1 is an estimate of the marginal contribution of EU for member countries. All other dummies are introduced to estimate the extent of trade diversion and of FDI diversion for different country groupings.

The second model is the so-called random effects model that has the following form:

$$(3) \qquad y_{ijt} = \beta_0 + X'_{ijt}\beta + \phi_1 EMU2 + \phi_2 EMU1_{new} + \phi_3 EMU1_{ru} + \phi_4 EMU1_{rw} + \delta_1 EU1 + \delta_2 EU2 + \nu_{ijt}, \qquad i,j = 1,\ldots N;\ i \neq j;\ t = 1,\ldots T,$$

where β_0 is an intercept and $\nu_{ijt} = \alpha_i + \alpha_j + \varepsilon_{ijt}$ is the new error term. In (3), α_i and α_j are assumed random now and independently identically distributed over time and across countries. In contrast to (2) this functional form includes country *i*'s and country *j*'s gross domestic products. This is compatible with trade models of product varieties and increasing returns to scale like in Helpman and Krugman (1985) and Helpman (1987) where consumers demand all foreign varieties according to the share of the country's GDP relative to the world GDP.

Finally, another fairly well established model is the bilateral fixed effects model where α_i and α_j in (2) are replaced by time-invariant unobserved country pair effect α_{ij}:

$$(4) \qquad y_{ijt} = \alpha_{ij} + X'_{ijt}\beta + \phi_1 EMU2 + \phi_2 EMU1_{new} + \phi_3 EMU1_{ru} + \phi_4 EMU1_{rw} + \delta_1 EU1 + \delta_2 EU2 + \varepsilon_{ijt}, \qquad i,j = 1,\ldots N;\ i \neq j;\ t = 1,\ldots T.$$

The estimation of (4) involves estimating *N(N-1)* country pair parameters α_{ij}. Micco *et al.* (2003) and, Flam and Nordström (2003) have used such a specification.

3.2 Testable Hypotheses

The theoretical literature has derived a number of hypotheses regarding the relationship between trade and FDI and the role of exchange rate volatility on trade and investment. Tests of these key propositions are important as most effects of EMU enlargement rest on the sign and value of key estimates. These hypotheses are outlined below and expected signs are given in Table 1. Within parentheses we give the name of the explanatory variable that is associated to each hypothesis.

[Insert Table 1 about here]

Significance of EMU (EMU2)

Rose (2004) performs a meta-analysis of all studies that had investigated the effect of a currency union on trade till that date, thirty-four in total. He concludes that the hypothesis that there is no effect of currency unions on trade can be rejected at standard significant levels. It is therefore safe to assume that the EMU has increased trade. However, though such a study has not been done for FDI, most empirical studies show a positive effect.

But, what are the reasons for the positive effects? First, the elimination of currency exchange costs is an obvious benefit. Also, the increased transparency in the international comparison of prices facilitates the arbitrage of goods across national boundaries. Simultaneously, search engines of the internet have provided the technology to perform arbitrage more efficiently. Second, the emergence of the euro as a reserve currency qualifies it as a prime currency of invoice for trade with non-member countries. For the euro zone, this is an additional element of stability as it shifts the exchange rate risk to trade partners. Third, with the announcement and introduction of the euro, real returns to capital have converged almost completely among participating countries. For countries with historically high interest rates, this meant a boost to new investments, higher growth and trade.

Significance of EU (EU2)

Several empirical studies have examined the hypothesis that a free regional trade agreement (FTA) increases members' trade and share of FDI. In a recent study of trade, Baier and Bergstrand (2007) use a gravity model and show that an FTA approximately doubles two members' bilateral trade after 10 years. Regarding FDI, it is a matter of empirical research to characterize this relationship. Besides that, though there are a number of theoretical studies

that look at trade diversion (EU1), the empirical studies do not really support the hypothesis (see, Bowen *et al.*, 1998, chapter 12).

Trade and FDI: Substitutes or Complements (Ln FDI)

Mundell (1957) is credited with the first formal analysis of the interaction between the international flow of goods and factors. Adopting the neo-classical model of trade, but relaxing the assumption of international factor immobility, Mundell derived the result that an increase in trade impediments stimulates factor movements and an increase in restrictions to factor movements stimulates trade. More generally, the result states that goods trade and factor flows are substitutes. In contrast, some have searched for explanations for complementarity within the context of received trade models. Markusen's (1983) analysis offers one such attempt.

Since alternative theoretical models predict opposite results concerning the relationship between the international trade in goods and in factors, it is a matter of empirical research to characterize this relationship. Previous research efforts have dealt with this issue but most recent studies conclude on a positive correlation between the international flow of goods and factors. For example, Wong (1988) estimates the effects of the movements of capital and labor on the volume of trade and factor prices of the United States over the period 1948-83. His results suggest a strong complementarity result between factor supplies and international trade. This implies that any increase in US factor endowments causes an increase in the volume of US trade (exports and imports) with the rest of the world.

Trade and Conditional Volatility of Exchange Rates (TB* LnVolatility)

Fluctuations in the foreign currencies matter for foreign investment because of the forward-looking behavior of multinationals when they make decisions to locate abroad. They matter for trade because of the common practice in international trade to extent trade credits. Hence, there is a time gap between the delivery date of goods and the payment date. These fluctuations give rise to both "level" and "risk" effects.

Regarding risk, theory in this field is rather simple in the sense that there is one main result namely, the separation theorem: in the presence of forward markets, the volume of trade is independent of the distributions of the exchange rate and of the type of utility function of the exporter (Edor and Zilcha, 1991). The implication is that any two firms with the same cost function but with different attitudes toward risk, and with different probability beliefs about

the future exchange rate, will produce the same level of output. This is the important contribution of a forward market. If the separation result holds, the exporter avoids exchange risk altogether and is indifferent between the EMU or a flexible exchange rate regime.

Several empirical studies have examined the hypothesis that increases in the conditional volatility of exchange rates reduce trade. The results differ depending on whether the analysis assumes the existence of a well-developed forward market. Studies of developing countries in which forward markets are absent generally find a negative relationship between trade and exchange rate volatility (Coes, 1981). For countries with forward markets, no consistent link between volatility and trade has been found (Klaassen, 2004).

In an attempt to reconcile the theory with empirics, Viaene and de Vries (1992) relax the assumption of exogenous forward rates necessary to derive the separation theorem and show that since importers and exporters are on opposite sides of the forward market, so is their exposure towards conditional exchange rate volatility. Who gains or loses from exchange rate volatility depends on the net aggregate foreign currency exposure. As gravity models consider both bilateral exports and imports to a single country, they are the ideal background to test this relationship. To that end, we take the bilateral trade balance (TB) as a proxy for currency exposure and pre-multiply it by the natural logarithm of volatility (TB*Ln Volatility). Assume TB<0. An increase in volatility in this framework leads to a depreciation of the home currency, which in turn increases exports. In contrast, when TB>0, an increased volatility decreases exports. The expected sign is therefore negative.

FDI and Conditional Volatility of Exchange Rates (LnVolatility)

Though there are numerous theoretical studies that look at how the conditional volatility of exchange rates affects foreign investment, no separation theorem has been derived for this case. For example, Broll and Zilcha (1992) show that in a model of horizontal product differentiation the effects of volatility (more precisely, a second-order decrease in the distribution of the exchange rate) depend on the shape of the profit function. Another interesting result is that in models of vertical product differentiation the reduced form expected gain from investment is a *strictly convex* function of the uncertain exchange rate. Therefore, an increase in foreign exchange variability has a positive effect on vertical foreign direct investment (Roy and Viaene, 1998). To the extent that strategic control of vertical production is a important motive for foreign investment, this last result indicates there is a theoretical basis for increased volatility of exchange rates having a positive effect on FDI.

Exchange Rates and Trade (XR changes)

A robust result of models of trade and exchange rates is that the terms of trade effect has the correct sign and is significant. If the exchange rate is defined as the number of units of domestic currency per unit of foreign currency (an increase is a depreciation), the expected level of the exchange rate is positively correlated with exports. However, since gravity models consider both bilateral exports of country *i* to country *j* and of country *j* to *i* (imports of country *i*), the sign is expected to be null if trade balances are in equilibrium.

Exchange Rates and FDI: Hysteresis (XR depreciation, XR appreciation)

As for the effect of a change in the expected level of exchange rate on direct investment, the empirical literature has provided mixed answers. On the one hand, a depreciation of the domestic currency can decrease the relative wealth of domestic firms and therefore their relative ability to undertake mergers and acquisitions (see, Froot and Stein, 1991). In models of vertical integration, a depreciation of the investor's currency increases both the effective arms length price at which a unit of the intermediate good can be bought in the market *and* the unit cost of producing the good directly through a subsidiary: the net effect is always a reduction in the incentive to undertake FDI.

On the other hand, models on hysteresis like in Dixit (1992) look for possible asymmetries in the response to exchange rate movements: exchange rate depreciations are expected to lead to entry events in industries whereas exchange rate appreciations do not necessarily lead to exits. In order to test for asymmetry in exchange rate changes we split our observations into exchange rate appreciations (XR appreciation) and exchange rate depreciations (XR depreciation). For hysteresis to hold, the sign of depreciations is expected to be positive and significantly different in absolute value of that of appreciations.

4. Empirical Results

We use panel data to estimate equations (2), (3) and (4) of the preceding section. As in Flam and Nordström (2003), the dependent variable in the export equation is the log of bilateral export flows from country *i* to country *j*.[3] For FDI it is the log of the stock of outward FDI from country *i* in country *j*. Here, the concept of stocks is preferred to flows as they are more persistent through time.

[3] It is more common to take the average of the logs of export and import. However, using unilateral trade flows eases the interpretation of home and partner effects.

Our sample contains 29 countries (N =29): all 25 EU countries, Switzerland, Japan, Canada, and the United States. This gives 28 bilateral relationships per country over a period ranging from 1990 till 2004. Hence, theoretically, there are 12180 observations. Unilateral data on exports are obtained from the IMF Direction of Trade Statistics. For FDI we use the outward stocks as published by the OECD. The limited availability of FDI data is the constraining factor since it limits the time span to fifteen years (T=15). Moreover it has a missing rate of approximately fifty percent. The Appendix provides more details regarding data methods and sources.

The estimation results of equations (2), (3) and (4), using panel least squares, are reported in Tables 2, 3 and 4[4]. In each table the first column reports the results for export and the second column the results for FDI. Across the three model specifications, we have a number of robust and significant parameter estimates. For example, it is clear that EMU has a positive effect on FDI. Less robust is the effect on trade since EMU2 has a negative sign for exports in Table 3 where random effects are used. The sign of volatility on trade is consistently negative and significant. Regarding the EU2 dummy, the effects are systematically positive, which is indicative of the beneficial effects of EU for trade and investment. Another robust finding is the absence of trade and investment diversion for the ten new EU member states. This is seen from the estimates of the EMU1 (NEW) dummy, which is positive throughout. However, these coefficients probably also capture some of the transition effects of the new EU countries, as they moved from a closed to an open economy. Also, FDI is negatively related to exchange rate depreciations (though not always significant), a result which does not support the hysteresis hypothesis.

[Insert Tables 2, 3, 4 about here]

Finally, a crucial result of our empirical analysis is that the link between FDI and trade is positive and significant. This implies that the euro affects trade through two channels: (i) a direct effect due to the microeconomic benefits of a common currency and (ii) an indirect effect due to its stimulating effects on FDI.

5. EMU Enlargement

[4] Given the forward-looking behaviour of traders and investors, we estimate two separate versions of (2), (3) and (4), one with current volatilities, the other with expected volatilities. As a proxy for the latter, we use one-period ahead volatilities (at date t+1). It turns out that there is almost no difference in the outcomes, the reason being that volatilities constructed on a yearly basis show strong persistence through time. Hence, we only report results with current volatilities.

The effects of EMU enlargement for each individual country can be approximated in two steps. In the first step, we simulate our estimated models to obtain the value of trade and FDI that arises in absence of EMU enlargement. This is our base scenario. The second step is to compute the counterfactual, that is, to compute the amount of trade and FDI that would arise if each of the ten new EU members had joined the euro zone in 2004, one by one. This is the counterfactual scenario. The comparison of the base scenario and the counterfactual gives our estimates of EMU enlargement. These steps are reproduced for each of the ten possible entrants and for each of the three models in order to check for robustness. The results, expressed in percentage changes, are shown in Tables 5, 6 and 7.

[Insert Tables 5, 6 and 7 about here]

Intuitively, the implementation of EMU for a candidate country means replacing a (managed) floating exchange rate regime by a common currency. Hence, a counterfactual scenario consists of bringing three major changes in our data. First, the true significance of the euro is obtained by setting the binary variable EMU2 to 1. Second, the bilateral exchange rate volatility with the euro is now set to zero. Volatility with third countries becomes that of the euro. Third, the currency takes its central parity rate whereby exchange rate changes become null. For trade, a fourth effect is added which corresponds to the change in trade that is induced by its positive relationship with FDI. The column "Total" in each table is the arithmetic sum of the respective elements.

Results in Table 5 are based on estimates of Table 2, those of Table 6 on Table 3 and those of Table 7 on Table 4. The direct EMU effect on FDI in Table 5 can be approximated by $(e^{0.969}-1)*100$ which corresponds to about 163%. This number is large and dominates the rest of the table. Whereas the direct EMU effect is common to all potential entrants, cross-country variation in the results emerge from exchange rate movements in 2004. Since exchange rate volatility has a positive effect on FDI, bringing down to zero the exchange rate volatility with the euro has a depressing effect on FDI. The larger the observed volatility in 2004 is the larger is the response. This is the case for Hungary, Slovenia, the Czech Republic, and Slovakia. Changes in the level of the exchange rates are differentiated in both sign and absolute value. The direct EMU effect on exports is $(e^{0.114}-1)*100 \approx 12\,\%$ and is also common to all countries. Compared to FDI, the effects on trade differ in two respects. First, the volatility effect on trade depends also on the sign of the trade. Second, there is the indirect positive effect of FDI on exports. The total impact ranges from 33.59% for Hungary to

51.59% for Lithuania. Most of the positive gains of EMU on trade arise from the FDI channel.

The positive results on FDI of Table 6 are in line with those of Table 5 except that the numbers are smaller. In contrast most effects on trade are negative simply because of the negative EMU2 parameter in the estimated equation. Malta and Poland are the only ones to experience positive trade effects. Once again the FDI channel is major source of trade gains. It is important to note that this model with random effects had the least explanatory power in estimation.

The main difference between Table 7 and Table 5 is that the overall effects are much smaller. A reason might be that most cross-country variation is picked up by the country-pair binary variables. The main difference between Table 7 and Table 6 is that trade effects are now positive for all countries and the indirect of FDI on trade are weaker. In Table 7 Malta is the country that would benefit the most from the euro adoption when it comes to export, Lithuania the least.

6. Discussion

The above analysis has provided robust evidence that EMU enlargement to the ten new EU countries can generate positive effects on the amount of FDI they are expected to receive. The evidence on trade is less overwhelming and a great deal of the trade effects arises from higher FDI stocks. This is because our empirical results strongly support the hypothesis of a positive correlation between and FDI.

The results are consistent with the idea that firms in the same market tend to be *bunched* in their foreign investment decisions. Firms are observed to "imitate" decisions of their rival firms to set up production subsidiaries in a particular region. One of the important explanations offered for this has been strategic competition between non-collusive oligopolists: competing firms invest upstream because their rivals do. A typical outcome is that a small decrease in the fixed cost of investment brought about by the EMU (because of lower uncertainty, lower interest rates, more transparent markets, etc.) can trigger a big jump in the volume of foreign investment. Trade of these regions increase because of increased intra-firm trade.

Membership to EMU would imply the loss of the macroeconomic flexibility of running an independent monetary policy. For that reason, candidate EMU countries have to satisfy

Maastricht criteria in order to minimize the macroeconomic costs of a common monetary policy:

- an inflation no more than 1.5 percentage points above the average of the three countries with the lowest inflation rates;
- nominal long-term interest rates not exceeding by more than 2 percentage points those for the three countries with the lowest inflation rates;
- no exchange rate realignment for at least two years;
- a gross debt to GDP ratio that does not exceed 60 percent;
- a government budget deficit not in excess of 3 percent of each country's GDP.

The first three criteria are designed to cover the loss of an independent monetary policy. The last two restrictions on government budgets are in place to protect the EMU from threats of inflation and to avoid the displacement of economic activity through fiscal policies. Though the last criterion has been broken recently by a number of current EMU members, it remains a tight constraint for potential entrants.

[Insert Table 8 about here]

Table 8 shows how the 10 countries that joined the EU in 2004 perform on each of the five criteria. It is clear that, based on 2005 data, only Lithuania and Slovenia meet the euro-adoption criteria. Some small countries have high inflation rates as their economies expand and some bigger countries face fiscal problems.

In contrast to the Maastricht criteria, no country in our analysis emerges as a strong performer in terms of foreign trade and investment. The reason is that though exchange rates play an important role their effects are secondary compared to the true significance of EMU. For example, a country might want to devalue its currency to gain in competitiveness. However, we have shown that the effects of exchange rate changes are far smaller than the large EMU effect. Therefore, based on our analysis, several countries other than Lithuania and Slovenia that are close to the Masstricht criteria could be equally admitted to the EMU.

References

Anderson, J. (1979): "A Theoretical Foundation for the Gravity Equation," *American Economic Review*, 69, 106–116.

Anderson, J. and E. van Wincoop (2003): "Gravity with Gravitas: A Solution to the Border Puzzle," *American Economic Review*, 93, 170–192.

Baier, S.L. and J.L. Bergstrand (2007), "Do Free Trade Agreements Actually Increase Members' International Trade?" *Journal of International Economics*, forthcoming.

Baldwin, R. (2006): "The Euro's Trade Effects," *ECB* Working Paper, 549.

Bowen, H., A. Hollander, and J. Viaene (1998): *Applied International Trade Analysis*, (Basingstoke: The University of Michigan Press).

Broll, U. and I. Zilcha (1992), "Exchange Rate Uncertainty, Futures Markets and the Multinational Firm," *European Economic Review,* 36(4), 815-882.

Coes, D. (1981), "The Crawling Peg and Exchange Rate Uncertainty," in Williamson, J. (ed.), *Exchange Rate Rules: The Theory, Performance and Prospects of the Crawling Peg* (New York: St. Martin's Press), 113-136.

De Sousa, J. and J. Lochard (2006): "Does the single currency affect FDI? A gravity-like approach," Mimeo, University of Paris and University of Rennes, Unpublished.

Deardorff, A. (1995): "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?" The University of Michigan.

Dixit, A. (1992),"Investment and Hysteresis," *Journal of Economic Perspectives*, 6(1), 107-132.

Eldor, R. and I. Zilcha (1991), "Exporting Firm and Forward Markets: The Multi-period Case," *Journal of International Money and Finance*, 10, 108-117.

Flam, H. and H. Nordström (2003), "The Trade Volume Effects of the Euro: Aggregate and Sector Estimates," *Institute for International Economic Studies*, Paper 746.

Froot, K. and J.C. Stein (1991), "Exchange Rates and Foreign Direct Investment: An Imperfect Capital Markets Approach," *Quarterly Journal of Economics*, 106, 1191-1217.

Helpman, E. (1987): "Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries," *Journal of the Japanese and International Economies*, 1, 62–81.

Helpman, E. and P. Krugman (1985), *Market Structure and Foreign Trade*, Cambridge, Massachusetts: The MIT Press.

Klaassen, F.(2004),"Why is it so Difficult to find an Effect of Exchange Rate Risk on Trade?," *Journal of International Money and Finance*, 28, 817-839.

Markusen, J.R.(1983), "Factor Movements and Commodity Trade as Complements," *Journal of International Economics*, 14,341-356.

Micco, A., E. Stein, and G. Ordonez (2003): "The currency union effect on trade: early evidence from EMU," *Economic Policy*, 18, 315–356.

Mundell, R. (1957): "International Trade and Factor Mobility," *American Economic Review*, 47,321-335.

Rose, A. (2000): "One Money, One Market: Estimating the Effect of Common Currencies on Trade," *Economic Policy*, 30, 9–45.

——— (2004): "A Meta-analysis of the Effect of Common Currencies on International Trade," NBER Working Paper, 10373.

Roy, S. and J.-M. Viaene, (1998), "On Strategic Vertical Foreign Direct Investment ,"*Journal of International Economics*, 46(2),253-279.

UNCTAD (1993), *World Investment Report 1993*, (Geneva: UNCTAD).

UNCTAD (2006), *World Investment Report 2006: FDI from Developing and Transition Economies*, (Geneva: UNCTAD).

Viaene, J.-M. and C. de Vries (1992): "International Trade and Exchange Rate Volatility," *European Economic Review*, 36, 1311–1321.

Wong, K.-Y. (1988), "International Factor Mobility and the Volume of Trade: An Empirical Study," in Feenstra, R.C.(ed.), *Empirical Methods for International Trade* (Cambridge, Mass.: MIT Press), 231-250.

Table 1 Expected Signs

Explanatory variables	Export	Outward FDI Stock
Ln GDP country *i*	+	+
Ln GDP country *j*	+	+
Ln Distance	-	+/-
Contiguity	+	+/-
Language	+	+
Ln FDI (of *i* in *j*)	+/-	
TB*Ln volatility	-	
Ln volatility		+/-
XR change	0	
XR depreciation		-
XR appreciation		+
EU2	+	+
EU1	+/-	+/-
EMU2	+	+
EMU1 (NEW)	+/-	+/-
EMU1 (RU)	+/-	+/-
EMU1 (RW)	+/-	+/-

Table 2 Panel Least Squares and Country Effects

	Equation (2)			
	Ln Export		Ln FDI	
Ln Distance	-0.676	0	-0.908	0
Contiguity	0.398	0	0.331	-0.001
Language	0.202	0	0.337	-0.001
Ln FDI	0.184	0		
TB*Ln volatility	-0.082	0		
Ln volatility			0.064	-0.109
XR change	-0.011	-0.268		
XR appreciation			0.046	-0.251
XR depreciation			-0.051	-0.279
EU2	0.266	0	1.001	0
EU1	0.058	-0.214	0.325	-0.016
EMU2	0.114	-0.001	0.969	0
EMU1 (NEW)	0.196	0	0.966	0
EMU1 (RU)	0.093	-0.075	0.74	0
EMU1 (RW)	0.04	-0.382	0.666	0
R squared	0.93		0.81	
# of observations	4152		3542	
Country pair dummies	no		no	
Country dummies	yes		yes	

Note: p-values in parentheses

Table 3 Panel Least Squares and Random Effects

	Equation (3)			
	Ln Export		Ln FDI	
Ln GDP country *i*	0.811	(0.000)	1.437	(0.000)
Ln GDP country *j*	0.775	(0.000)	0.883	(0.000)
Ln Distance	-0.763	(0.000)	-1.129	(0.000)
Contiguity	0.584	(0.000)	-1.041	(0.000)
Language	-0.344	(0.000)	1.914	(0.000)
Ln FDI	0.073	(0.000)		
TB*Ln volatility	-0.102	(0.000)		
Ln volatility			0.062	(0.000)
XR change	0.023	(0.123)		
XR appreciation			0.433	(0.000)
XR depreciation			-0.458	(0.000)
EU2	0.061	(0.070)	0.485	(0.000)
EU1	-0.032	(0.360)	0.236	(0.020)
EMU2	-0.108	(0.016)	0.420	(0.001)
EMU1 (NEW)	0.141	(0.012)	0.319	(0.036)
EMU1 (RU)	0.042	(0.541)	-0.058	(0.763)
EMU1 (RW)	-0.283	(0.000)	0.231	(0.211)
Constant	3.061	(0.000)	1.089	(0.001)
R squared	0.85		0.61	
# of observations	4152		3542	
Country pair dummies	no		no	
Country dummies	no		no	

Note: p values in parentheses

Table 4 Panel Least Squares and Panel Fixed Effects

	Equation (4)			
	Ln Export		Ln FDI	
Ln GDP country *i*	0.522	0.000	1.193	0.000
Ln GDP country *j*	0.590	0.000	1.060	0.000
Ln FDI	0.020	0.000		
TB*Ln volatility	-0.063	0.000		
Ln volatility			-0.019	-0.437
XR change	0.016	0.000		
XR appreciation			0.100	-0.015
XR depreciation			-0.027	-0.388
EU2	0.127	0.000	0.252	-0.001
EU1	0.069	-0.001	-0.102	-0.228
EMU2	0.067	0.000	0.192	-0.003
EMU1 (NEW)	0.305	0.000	0.830	0.000
EMU1 (RU)	-0.032	-0.178	0.419	0.000
EMU1 (RW)	0.032	-0.130	0.037	-0.678
R squared	0.99		0.96	
# of observations	4152		3542	
Year dummies	yes		yes	
Country pair dummies	yes		yes	
Country dummies	no		no	

Note: p-value in parentheses

Table 5 Effects of EMU Enlargement: Model with Country Effects [a]

	FDI [b]				Export [c]				
	EMU	Exchange Rate			EMU	Exchange Rate		Indirect	
	Effect	Volatility	Change	Total	Effect	TB*V	Change	FDI	Total
Cyprus	163	-0.10	1.08	163.98	12	0.03	-0.19	33.13	44.97
Czech R.	163	-2.07	-0.89	160.04	12	-0.03	-0.65	32.33	43.65
Estonia	163	-0.29	0.02	162.73	12	0.07	-0.12	32.87	44.82
Hungary	163	-27.48	-0.54	134.99	12	-3.26	-2.42	27.27	33.59
Latvia	163	-0.13	-3.53	159.34	12	-0.02	-0.68	32.19	43.48
Lithuania	163	-0.07	0.45	163.38	12	0.00	6.58	33.01	51.59
Malta	163	-0.39	-4.38	158.24	12	0.03	-6.00	31.97	38.00
Poland	163	-0.95	-5.52	156.53	12	-0.05	-3.47	31.62	40.10
Slovakia	163	-1.99	0.91	161.91	12	0.24	-0.38	32.71	44.57
Slovenia	163	-4.07	-1.47	157.46	12	0.49	-0.13	31.81	44.17

Note: (a). All numbers are percentage changes with respect to the base scenario, that is, data obtained from the static simulation of estimated equations. We are considering a country by country enlargement; (b) For FDI the cells are obtained as follows: column EMU effect = setting EMU2 at 1; column volatility = setting volatility with the euro at zero and volatility with third countries is that of the euro; column Change = setting exchange rate changes with the euro at zero; total= sum of all previous columns; (c) Likewise for exports except: column Indirect FDI = product of column (4) times elasticity of FDI in export equation. .

Table 6 Effects of EMU Enlargement: Model with Random Effects [a]

	FDI [b]				Export [c]				
	EMU	Exchange Rate			EMU	Exchange Rate		Indirect	
	Effect	Volatility	Change	Total	Effect	TB*V	Change	FDI	Total
Cyprus	52	-0.10	-12.43	39.67	-10	0.04	0.19	3.00	-7.00
Czech R.	52	-2.01	5.48	55.67	-10	-0.03	0.68	4.22	-5.38
Estonia	52	-0.28	-0.82	51.09	-10	0.09	0.12	3.87	-6.16
Hungary	52	-26.52	-0.81	24.87	-10	-4.04	2.51	1.88	-9.88
Latvia	52	-0.12	26.10	78.17	-10	-0.03	0.71	5.92	-3.64
Lithuania	52	-0.07	-5.43	46.70	-10	0.00	-6.81	3.54	-13.50
Malta	52	-0.37	32.23	84.06	-10	0.04	6.21	6.37	2.37
Poland	52	-0.92	40.76	92.03	-10	-0.06	3.59	6.97	0.27
Slovakia	52	-1.93	-10.42	39.84	-10	0.30	0.39	3.02	-6.53
Slovenia	52	-3.94	10.85	59.10	-10	0.61	0.13	4.48	-5.02

Note: (a) All numbers are percentage changes with respect to the base scenario, that is, data obtained from the static simulation of estimated equations. We are considering a country by country enlargement; (b) For FDI the cells are obtained as follows: column EMU effect = setting EMU2 at 1; column volatility = setting volatility with the euro at zero and volatility with third countries is that of the euro; column Change = setting exchange rate changes with the euro at zero; total= sum of all previous columns; (c) Likewise for exports except: column Indirect FDI = product of column (4) times elasticity of FDI in export equation.

Table 7 Effects of EMU Enlargement: Model with Panel Fixed Effects [a]

	FDI [b]				Export [c]				
	EMU	Exchange rate			EMU	Exchange rate		Indirect	Total
	effect	Volatility	Change	Total	effect	TB*V	Change	FDI	impact
Cyprus	21	0.03	2.41	23.61	7	0.02	0.19	0.48	7.62
Czech R.	21	0.61	-0.04	21.74	7	-0.02	0.65	0.44	8.00
Estonia	21	0.09	0.29	21.54	7	0.05	0.12	0.44	7.54
Hungary	21	7.47	1.68	30.32	7	-2.51	2.41	0.61	7.44
Latvia	21	0.04	-1.89	19.31	7	-0.02	0.68	0.39	7.98
Lithuania	21	0.02	1.11	22.29	7	0.00	-6.55	0.45	0.84
Malta	21	0.11	-2.30	18.98	7	0.02	5.97	0.38	13.30
Poland	21	0.28	-2.95	18.49	7	-0.04	3.46	0.37	10.72
Slovakia	21	0.59	2.02	23.78	7	0.19	0.38	0.48	7.97
Slovenia	21	1.19	-0.79	21.57	7	0.37	0.13	0.44	7.87

Note: (a) All numbers are percentage changes with respect to the base scenario, that is, data obtained from the static simulation of estimated equations. We are considering a country by country enlargement; (b) For FDI the cells are obtained as follows: column EMU effect = setting EMU2 at 1; column volatility = setting volatility with the euro at zero and volatility with third countries is that of the euro; column Change = setting exchange rate changes with the euro at zero; total= sum of all previous columns; (c) Likewise for exports except: column Indirect FDI = product of column (4) times elasticity of FDI in export equation.

Table 8 Scores on the Maastricht Criteria

Criteria	Inflation (HICP)	Budget deficit to GDP	Government debt to GDP	Exchange rate	Long term interest rate	Satisfied criteria?
	2.9	**-3**	**60**	**ERM2** [a]	**5.4**	
Cyprus	**2.0**	**-2.3**	69.2	+	**5.2**	
Czech Republic	**1.6**	-3.6	**30.4**	-	**3.5**	
Estonia	4.1	**2.3**	**4.5**	+	**4.0**	
Hungary	3.5	-6.5	**57.7**	-	6.6	
Latvia	6.9	**0.1**	**12.1**	+	**3.9**	
Lithuania	**2.7**	**-0.5**	**18.7**	+	**3.7**	**yes**
Malta	**2.5**	-3.2	74.2	+	**4.6**	
Poland	**2.2**	**-2.5**	**42**	-	5.2	
Slovakia	**2.8**	-3.1	**34.5**	+	**3.5**	
Slovenia	**2.5**	**-1.4**	**28**	+	**3.8**	**yes**

Note: (a) "+" in the column ERM2 indicates participation to ERM2; "-"no participation to ERM2. Participation means that a central parity rate against the euro is set for the currency and the currency may then fluctuate by a certain percentage relative to the central parity rate.

Appendix

Data Sources and Methods

Unilateral data on export are obtained from the Direction of Trade Statistics (DOTS) published by the International Monetary Fund (IMF). Annual averages of FOB exports are used for the period 1980-2005. The values are measured in United States dollars (USD), conversion to USD is done by using year to year exchange rates.

FDI data are taken from the International Direct Investment by Country table (2005, release 01), which has been put together by the Organization for Economic Co-operation and Development (OECD). The data set contains annual averages of the outward FDI stock for the period 1990-2004. The values are measured in USD. In the regressions, the dependent variables are thus:

Ln Export = bilateral exports from country *i* to country *j* in USD;
Ln FDI = the outward FDI stock of country *i* in country *j* in USD.

Nominal GDP is obtained from the IMF, International Financial Statistics. In the regressions:

Ln GDP country i = nominal GDP in USD of country *i*;
Ln GDP country *j* = nominal GDP in USD of country *j*.

Exchange rates are defined as the number of units of domestic currency per unit of foreign currency. Hence, the bilateral exchange rate is expressed as the number of units of exporter's currency per unit of importer's currency. The real exchange rates are taken from the IMF's International Financial Statistics. Monthly averages are used for the period 1980.01 until 2006.11. Changes are expressed in percentage changes. Volatility is measured as the standard deviation of the monthly percentage changes within a year. In particular:

Ln volatility = natural logarithm of exchange rate volatility, where volatility is defined as the standard deviation of the monthly percentage changes in the real exchange rate within a year;

TB* Ln volatility = trade balance times Ln volatility;

XR change = exchange rate change, measured as the percentage change in the level of the exchange rate within a year;

XR depreciation = positive percentage changes in the level of the exchange rate;

XR appreciation = negative percentage changes in the level of the exchange rate.

The gravity variables distance, contiguity, and language are taken from Centre d'Etudes Prospectives et d'Informations Internationales (www.cepii.fr):

Distance = distance between capital cities of country *i* and *j* in kilometres;
Contiguity = 1 when countries *i* and *j* share a common border, 0 otherwise;
Language = 1 when countries *i* and *j* share a common language, 0 otherwise.

The marginal and diversion effects of EMU and EU are measured by the following binary variables:

EMU2= 1 when country *i* and *j* are EMU members at date t; = 0 otherwise;

$EMU1_{new}$ = 1 when country *i* is EMU member, country *j* is outside the EMU but belongs to the new "ten" at date t; = 0 otherwise;

$EMU1_{ru}$ = 1 when country i is EMU member, country *j* is either Denmark, Sweden, U.K at date t; = 0 otherwise*;*

$EMU1_{rw}$ = 1 when country i is EMU member, country *j* is outside EMU and EU at date t; = 0 otherwise*;*

EU2= 1 when country *i* and *j* are both EU members at date t; = 0 otherwise;

EU1= 1 when country *i* only is EU member at date t; = 0 otherwise;

The country groupings are as follows: EMU = Austria, Belgium, France, Finland, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal and Spain; NEW= Estonia, Hungary, Slovenia, Malta, Cyprus, Poland, Czech Republic, Latvia, Lithuania and Slovakia; RU = Denmark, Sweden, U.K.; RW = Canada, Japan, Switzerland and U.S. The EU currently consists of all countries in our sample except RW.