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THE EFFECT OF THE EURO ON FOREIGN DIRECT INVESTMENT

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ABSTRACT

In this paper the recent effect of the European Monetary Union on inward FDI-flows is examined. We use a difference-in-differences approach for both a gravity based- as well as a general equilibrium approach. The estimated results show that the introduction of the euro raises inward FDI by 14 to 16 percent within the euro area by 11 to 13 percent from non-member and weakly by 8 percent to non-member countries. Moreover the geographical effects of the euro are explored. The results show partial agglomeration tendencies for the euro area. There are also some indications of increased importance of vertical specialization in the sample.

Keywords: Foreign Direct Investment, EMU, Panel Data
JEL Classification: F21, F0, C23

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1 Introduction

A large body of empirical literature on the effects of EMU on trade is now forming, following the seminal paper by Rose (2000). These include Bun and Klaasen (2002), Barr et al. (2003), Micco et al. (2003) and Flam and Nordström (2003). Their results show that EMU has increased trade volume by a magnitude ranging between 15 and 38 percent. Moreover, this increase in trade has not been confined to member states only, but has extended to non-member countries as well.

This paper will address an interrelated issue, namely whether EMU has had any effects on foreign direct investment (FDI) flows. FDI flows can be considered to be interrelated with trade since, at least at the theoretical level, such flows are often viewed either as a substitute for trade (*horizontal FDI*) or as a complement to trade (*vertical FDI*). In addition, it can give an indication of whether EMU creates better conditions for firms making long-term investment decisions. One argument against floating currencies is that higher exchange rate variability creates uncertainty that discourages international investment and trade. Fixing the exchange rate eliminates this risk, hence encouraging international investment and trade, as well as making firms cost calculations and pricing decisions easier. Adopting a single currency is a very credible commitment to exchange rate stability and has the advantage of reducing transaction costs that would otherwise occur, irrespective of the degree of volatility. Both effects should promote international investment, i.e. FDI flows.

In spite of the intuitive appeal of the argument that lower exchange rate volatility will increase FDI flows, empirical evidence regarding the effects of EMU on FDI flows, is currently absent.[1] The approach of this paper is novel since little or no research, to my knowledge, has been devoted to appraising the effects of EMU on *FDI flows*. From a broader perspective, the recent economic and policy debate, concerning the economic effects of EMU on its member states, has been based on an increasing body of empirical evidence and this paper is an attempt to investigate yet another aspect of EMU.

We use a new dataset on FDI flows, a panel of unilateral FDI flows between 18 developed countries for the years 1992 to 2001 is gathered. Since we are trying to uncover potential effects of an institutional reform, a difference-in-differences approach suitable for identifying such structural changes, is used to gauge the effects of EMU on inward FDI. The estimations are carried out both within a partial as well as a general equilibrium approach to FDI. The results of this study show that

[1] A partial exception is Barr et al. (2003) that present some stylized facts concerning European FDI flows.

EMU increases inward FDI flows within the euro area by approximately 14 to 16 percent, inward FDI from member countries to non-members by 11 to 13 percent and a weak increase in inward FDI from non-member countries to member countries of around 8 percent.

The remainder of this paper is organized as follows. In Section 2 some stylized facts and basic concepts concerning FDI are presented. Section 3 discusses the data, and Section 4 considers the empirical methodology. Section 5 presents the main results, whereas Section 6 deals with the robustness of these results. Section 7 combines trade and FDI data in order to examine potential economic geography effects of the euro. Section 8 concludes the paper.

2 Basic concepts and stylized facts

An FDI is a cross-border investment made by an investor with the intent of obtaining a lasting interest in an enterprise resident in another country.[2] In principle, when a firm wishes to make sales abroad it has a variety of methods that can be employed, such as exporting, licensing, appointing agents or engaging in direct investment. FDIs are an equivalent to producing directly in the country one wishes to serve.

In latter years, FDI has become an increasingly important factor in the global economic activity, with growth rates for world FDI flows that, by far, exceed those of GDP or trade (*Table 1*). This is true even in spite of the large drop that world FDI flows experienced at the turn of the millennium.

Another interesting feature of the FDI flows is that they have been primarily concentrated to developed economies (*Table 2*), which received about 70 percent of world inflows during the '90s, and which, after several recent financial crises in developing countries, subsequently increased their share to more than 80 percent.[3]

[2] According to Eurostat, who follow the OECD benchmark definition of FDI (third edition), an international investment is classed as FDI when an investor owns ten percent or more of ordinary shares or voting rights in an incorporated or unincorporated enterprise abroad.

[3] With the majority of FDI inflows, 40 percent, to developing countries going to China. The developed countries share of world outflows is of course even higher, ranging between 85 to 95 percent. See Markusen 2002, Ch. 1.

Table 1

World Growth in FDI, Trade and GDP

	Period growth rates %, current US$			
	1992-96	1996-2001	1992-2001	1992-2000
FDI, Inflows	78.7	70.5	154.7	236.4
Exports and Imports	34.6	14.2	48.9	52.6
GDP per capita	5.4	6.8	12.2	12.3
GDP PPP, current	0.2	0.22	0.42	0.4

Source: World Bank, World Development Indicators

Table 2

FDI Inflows, percent of world inflows

	High Income	*Middle Income*	*Low Income*
	Inflows	Inflows	Inflows
1992-97	67.4	30.5	2.1
1998-02	80.4	18.2	1.4
2003-04	69.5	28.9	2.6

Source: World Bank, World Development Indicators

The existence of FDI has several major explanations. One type is market oriented, where FDI gives companies access to foreign markets thus acting as a substitute for trade; this is the so called *horizontal* FDI. Another rationale for FDI is production oriented and driven by cost minimizing objectives, where global companies gain strategic advantage by shifting low paid jobs abroad while keeping high value added research at home thereby producing either parts of or the entire final product in low-cost areas; this is the so called *vertical* FDI. Finally, a third rationale implies that the mode of outsourcing depends on the market structure, where oligopolistic or monopolistic markets have profits, while competitive markets have lower costs. The distinction between horizontal and vertical FDI is a theoretical construct.[4] A firm engaging in horizontal FDI is said to sell its products solely in the foreign market, while a vertical FDI serves the home market. It is a construct insofar as no FDI acts solely as either and the debate about whether most FDI act as if they were horizontal or vertical is not settled.

From a theoretical perspective two main areas are at the forefront of the literature on FDI. The first explores the rationale behind the existence and consequences of multinational activity within a general equilibrium framework.[5] This consists,

[4] See Ekholm, Forslid and Markusen (2003).

[5] See Brainard (1997), Carr et al. (2001), Bloningen et al. (2003), Ekholm et al. (2003), Baltagi et al. (2005) for specific models and Bloningen (2005) for an overview.

mainly, of attempts to incorporate FDI into the new trade theory of economic geography and the models focus primarily on real factors of production. Questions concerning capital flows, i.e. the financing decisions of the firms are believed to be largely separable from decisions regarding the location of production and the direction of trade. The second focuses on ideas stemming from industrial organization theory, where FDI are studied with endogenous firm organizations and general equilibrium models of industrial structures.[6]

From the perspective of empirical analysis, there are again two main areas of research. The first concerns the determinants of FDI and can be derived either from a specific model or created in a more ad hoc manner,[7] and the second concerns the consequences of FDI on the economic environment.[8] Another bifurcation in the empirical literature occurs in the choice of FDI data, with researchers either using plant-level panel microdata or FDI flows from the balance of payments (BoP). The former data is subject to smaller measurement errors, though its international availability is strictly limited. This forces us to turn to the latter data which is subject to larger measurement errors but is more readily available. Since the question to be addressed here is whether the European currency union has had an effect on FDI flows, a panel data approach is used. We utilize a coherent dataset of BoP FDI flows from Eurostat that covers 18 countries for the years 1992-2001.

3 Data

Eurostat provides satisfactory data for bilateral and unilateral FDI for the eighteen reporting economies. Total FDI flows are divided into three general subcategories, namely: *Equity, Other Capital* and *Reinvested Earnings*, with the third part showing gaps in availability due to misreporting. Hence in this paper the FDI flows refer to *Equity and Other Capital.* All FDI flows are net flows, where *net* does not imply a net between a country pair ($FDI_{ij} - FDI_{ji}$) but implies rather, *net of disinvestment.*

Following the FDI and trade literature, these kind of regressions are usually conducted on bilateral data, but in order to increase the observations to two for each country pair in the empirical specification one-way FDI flows will be used, defined as *inward FDI flows*, where an investment in country i from country j is represented as FDI_{ij} and is viewed as an *inward FDI* from country $i's$ perspective. The inves-

[6] Grossman and Helpman (2002 a, b), Puga and Trefler (2002).
[7] See Braunerhjelm and Ekholm (1998), Chakrabarti (2001), Markusen (2002) and Bloningen (2005).
[8] See Keller 2001 for an overview.

tigation in this paper entails a panel of 18 OECD countries, hence $(18 * 17) = 306$ country pairs, with yearly data spanning the period 1992-2001. However, country $i's$ *inward FDI* can of course, be measured in two different ways. That is, either the recipient country, i, reports an inflow from country j or the investing country, j, reports an outflow to country i. In an ideal world it would be an identity, but in practise there often is a difference in reported values, even at aggregate world level, between inflows and outflows and there are no indications that one is "better" reported than the other. It is thus prudent to try and ameliorate any effects stemming from this difference.

Two attempts to correct this measurement error are made in this paper. First, if the 'true' value of FDI flows lie somewhere between country $i's$ reported inflows and country $j's$ reported outflows, it is possible to improve the estimation by taking an average of the two series, we call this *Average*. Moreover, in order not to lose many observations, since inflows and outflows have different missing values, it has to be done stepwise by firstly approximating missing data on inflows by their outflow counterpart, if available.[9] This approximation is done by dividing the sample into three major entities, Europe, USA, Japan, calculating an average asymmetry between these and correcting each of the missing points by their average asymmetry. The new variables that are created are *Inflows Corr* and *Outflows Corr*. The results obtained from these "corrected" series mirror those obtained from the raw data series which allows us to move on to the second step and take an average of the two new series, hence creating a new variable called *Average Corr*. In the second approach we use outflows (inflows) to instrument for inflows_{ij} (outflows), which will give us consistent estimates even if measurement errors are present. The drawback of instrumenting is as usual the loss of efficiency in the estimations.[10]

Another issue with the data is caused by the erratic nature of FDI flows between any country pair. In our case where FDI flows are reported in millions of current US dollars, many flows can be, and are, negative due to disinvestment. The negative values in the dependent variable precludes a conversion of the data set into a logarithmic scale. However, it is still possible to obtain elasticities for the point estimates, since the predicted means are positive values, by using the chain rule. This enables us to obtain a clear picture of the magnitude of the effect due to the introduction of the euro.[11]

[9] See Appendix I and Appendix III Table A for methodological issues on asymmetries.

[10] The results of and discussion conserning these attempts are found in Appendix III.

[11] Logs of FDI are used many times in the litterature, usually when sales of multinational enterprises are used as a proxy for FDI. Here log form estimations are conducted both by simply converting the series into logs as well as by using a Heckman two-step approach. The results are presented in Appendix III Tables C1 and C2. Even if logging

4 Empirical specification

The introduction of the Euro can be viewed as a sharp change in the economic environment of the affected countries. This change makes it appropriate for us to use a difference-in-differences strategy. The idea behind this estimation strategy is to assess the effect of the introduction of the euro on inward FDI for the euro-countries, while keeping the effects for all other time-invariant variables, as well as common and country specific time-varying effects constant, whether these are observables or unobservables.[12] A general specification of this model can be expressed as:

$$FDI_{ij,t} = \alpha_{ij} + \beta_t + \beta_0 X_{ij,t} + \delta EMU_{ij,t} + \varepsilon_{ij,t}$$

where the dependent variable is $FDI_{ij,t}$ in millions of current US dollars. On the right hand side the explanatory variables include dummies to control for unobservable effects, specifically a country pair effect that is fixed over time (α_{ij}), in order to control for time-invariant unobservables, and a time effect that is common to all countries (β_t), in order to control for time-specific unobservables. The set of explanatory variables ($X_{ij,t}$) comprises a constant and a subset of variables that have been found, in one way or another, to be significant in explaining FDI flows in prior empirical investigations.[13]

In the *gravity regression approach* these variables include measures of market size for each country Y_{it} and Y_{jt} that are represented by GDP in current millions of US dollars. Other variables in the set include a measure of capital- or financing ability for country j measured as country j's stockmarket value of listed companies, $Stock_{jt}$ and, in the hope that we might capture potential forward looking elements, a measure of payoff for investing in country i that is measured as the percentage change in country i's stockmarket value of listed companies, $\Delta Stock_{it}$. Since the dependent variable is "one-way" FDI, a real exchange rate index is needed for country i and j, denoted by REX_{it} and REX_{jt}. The close link between trade and FDI suggests a measure of trade costs, defined as the inverse of trade openness from Penn World Tables, for both country i and country j, $Tradec_i$ and $Tradec_j$ to be used.

In the *general equilibrium approach*, the derived empirical specification of Carr, Markusen and Maskus (2001), henceforth (CMM), as well as the corrections proposed by Bloningen, Davies and Head (2003), henceforth (BDH), is used. The

the series reduces both the skewness and kurtosis of the estimated errors, see Bloningen and Davies (2004), some of the results obtained are improbable casting doubt on the log specification.

[12] See Angrist and Krueger (1999).

[13] See Brainard (1997) and Bloningen (2005). See also Chakrabarti (2001) for an overview and an extreme boundary analysis of the determinants.

explanatory variables capturing the long-run determinants of FDI are: the sum of the country-pair's current GDP, Y_{sum}, the squared difference of GDP, Yd^2, the skill difference of labor, skd, which is measured as the difference in average number of years in school, the interaction term of skill difference and GDP difference, $skd*Yd$, country i's investment cost, $Invc_i$ which is approximated by a composite index of bureaucracy, corruption and rule of law from the International Country Risk Guide, the trade cost for country i and j, as above, $Tradec_i$ and $Tradec_j$, and finally the interaction between trade costs and the square of skill difference, $Tradec_j * skd^2$.[14]

Finally, we have our variables of interest, $EMU_{ij,t}$, with the accompanying vector of estimates (δ) that capture the effect of the euro for the euro-area countries. The ($EMU_{ij,t}$) are time-varying dummies which take the value of zero prior to the introduction of the euro in 1999 or in the case of non-membership in the euro-area and one otherwise. There are three such dummy variables of primary interest here: one for inward FDI flows from a euro countries to other euro countries (*EMU11*), one for inward FDI flows to euro countries from non-euro countries (*EMU12*) and one for inward FDI flows from euro countries to non-euro countries (*EMU21*). Hence we have three groups of countries and the point estimates of these variables represent the average effect of the introduction of the euro. The control group is in this case represented by *EMU(22)* which is inward FDI flows from non-euro countries to other non-euro countries and as such, *EMU(22)* is a vector of zeros and does not appear in the specification.[15]

All our specification also include dummy variables that capture the EU's common market effect, both for EU12 ($EU12in$, $EU12out$) as well as for Austria, Sweden and Finland ($ASFin$, $ASFout$). The EU12 dummy is zero in 1992 and one thereafter, while the ASF dummy takes a value of one after 1995. Hence the full model to be estimated is, in the gravity approach case:

$$\begin{aligned} FDI_{ij,t} = {} & \alpha_{ij} + \beta_t + \beta_0 + \beta_1 Y_{i,t} + \beta_2 Y_{jt} + \beta_3 Stock_{j,t} + \beta_4 \Delta Stock_{j,t} \\ & + \beta_5 Tradec_{i,t} + \beta_6 Tradec_{j,t} + \beta_7 REX_{i,t} + \beta_8 REX_{j,t} + \beta_9 EMU11_{ij,t} \\ & + \beta_{10} EMU12_{ij,t} + \beta_{11} EMU21_{ij,t} + \beta_{12} EU12in_{ij,t} + \beta_{13} EU12out_{ij,t} \\ & + \beta_{14} ASFin_{ij,t} + \beta_{15} ASFout_{ij,t} + \varepsilon_{ij,t} \end{aligned}$$

in the general equilibrium case:[16]

[14] The difference between CMM and BDH is that some variables appear in absolute difference.

[15] A more precise description of the variables used in the regressions along with sources and construction, can be found in Appendices I and II.

[16] The difference between CMM's general equilibrium case and BDH's is that the latter has the skill variables in

$$
\begin{aligned}
FDI_{ij,t} = \alpha_{ij} + \beta_t + \beta_0 + \beta_1 Y_{sum,t} + \beta_2 Yd_t^2 + \beta_3 skd_t + \beta_4 skd_t * Yd_t \\
+ \beta_5 Tradec_{i,t} + \beta_6 Tradec_{j,t} + \beta_7 Invc_{i,t} + \beta_8 Tradec_{j,t} * skd_t^2 \\
+ \beta_9 EMU11_{ij,t} + \beta_{10} EMU12_{ij,t} + \beta_{11} EMU21_{ij,t} + \beta_{12} EU12in_{ij,t} \\
+ \beta_{13} EU12out_{ij,t} + \beta_{14} ASFin_{ij,t} + \beta_{15} ASFout_{ij,t} + \varepsilon_{ij,t}
\end{aligned}
$$

Lastly we come to the specification issue of controlling for common unobservable time effects. The most flexible specification, albeit not always efficient, is yearly dummy variables. However, in order to increase efficiency but maintain maximum flexibility we can restrict our regression by imposing a parametric specification in the form of *spline function*, which is a kinked time trend, to control for common unobservable time effects. We will see that inward FDI for our groups of interest as well as our control group have a very similar time evolution at an aggregate level. This leads us to believe that common time effects can be captured by a spline specification and thereby increase the efficiency of our regressions.[17]

5 Results

Before we enter the world of regressions, it is of interest to see if there are any indications of a euro effect in the raw data. The sample of 18 OECD countries is divided into the four previously mentioned groups: inward FDI flows between euro countries (EMU 11) , inward FDI flows to euro countries from non-euro countries (EMU 12), inward FDI flows to non-euro countries from euro countries (EMU 21) and inward FDI flows between non-euro countries (EMU 22).

In *Figure 1*, where the *Aver Corr* series is used to measure *FDI flows* in millions of US dollars, we see that all categories evolve almost at the same rate until 1999, when inward FDI drops for non-euro area countries, but continues upward for the rest.[18] It is clear from *Figure 1* that *inward FDI*, for all the groups, follows a non-linear development over time. Actually, a simple fitted exponential trendline is able to explain 50-90 percent of the different groups, while a linear trend line has consistently 10 to 20 percent lower explanatory power. *Figures 2* and *3* show the relative development of our groups of interest (EMU 11, EMU 12 and EMU 21) in

absolute form. To wit, $|skd|$ and $|skd| * |Yd|$.

[17] See Greene Ch. 8. For estimations and a discussion of the time controls in our case, see Appendix II.

[18] This increase occurs irrespective of the currency in which flows are denominated and irrespective of who reports the flows, i.e. if we use inflows or outflows to measure inward FDI. The same is true when it comes to the empirical estimations.

terms of our control group (EMU 22) for different time periods. It is clear that the three euro-categories exhibit a sharp relative increase around 1998-1999. Also, the spike exhibited in Figure 2, for 1996, is not due to any large increase in the three groups of interest but rather due to large disinvestment in countries that belong in group EMU 22. More precisely it is due to US disinvestment in Sweden and the UK and due to Japanese disinvestment in the USA.[19]

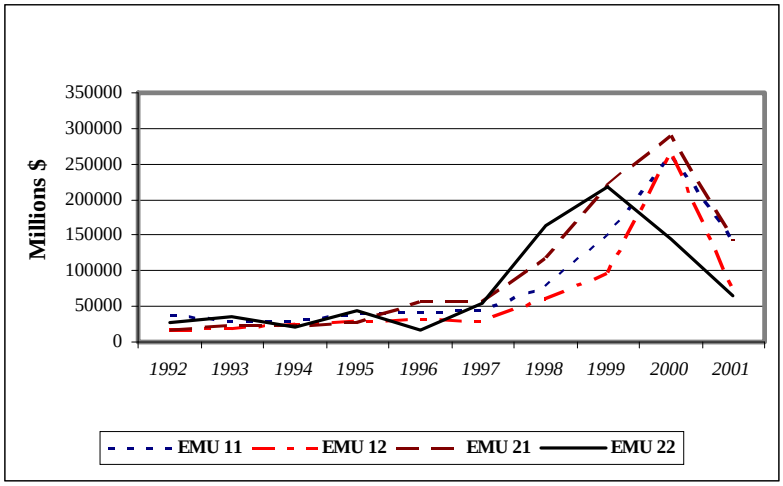

Figure 1: *Inward FDI, Average Corrected Flows, by Country Group. Millions of US $.*

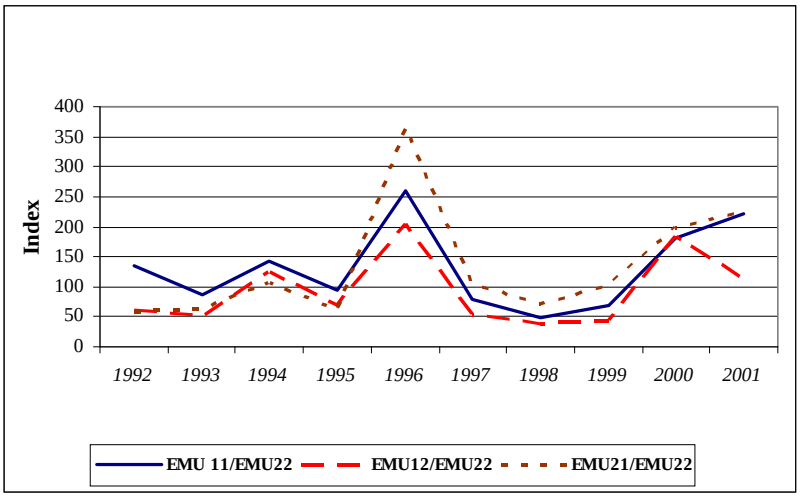

Figure 2: *Relative Inward FDI, of EMU-area groups Average Corrected Flows.*

[19] Figures for absolute and relative development for the other measures of inward FDI are found in Appendix II Figures A2-A5.

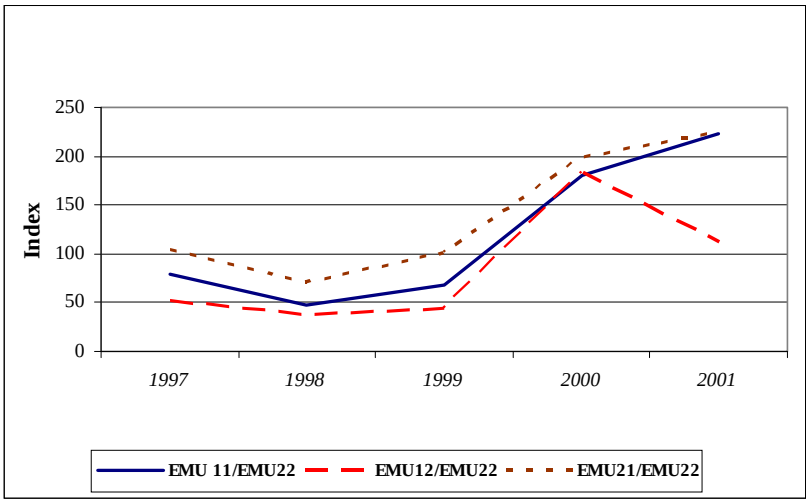

Figure 3: *Relative Inward FDI of EMU-area groups, Average Corrected Flows.*

These figures demonstrate two important facts. Firstly, the development of inward FDI for the different groups is very similar and, secondly, countries belonging to the EMU area have experienced a large relative increase in inward FDI after the introduction of the euro. However, even if this relative increase is clear in the raw data we still have to examine the determinants of FDI in a multivariate context that enables us to draw conclusions about partial effects of the euro.

5.1 Regressions

Table 3 contains the main results. Inward FDI is measured as the average of inflows and outflows in millions of current US dollars. *Panel I* shows the results from the gravity approach while *Panel II* presents the general equilibrium approach. The raw results are expressed in millions of dollars and give as such not a sense of magnitude but rather one of direction. However, since all estimated means are positive we can obtain elasticities for the point estimates from the original estimation by using the chain rule and gain hence a sense of magnitude as well. The fact that the elasticity point estimates have a higher t-value, can be attributed to the fact that the logarithmic form has a better "fit". Three models are estimated, both in order to gauge the different approaches of the gravity-, the more ad hoc, and the general equilibrium specification in general, but also in order to see whether specification issues will affect our results concerning the effect of the euro on FDI in particular. From the results below we see that the euro dummies are highly significant across the spectrum of specifications.

Concentrating on the *Gravity* regression we see that, by far, the most important determinant both in magnitude and significance is the variable for market size Y_i.[20] This is not a surprising result, since both at an empirical as well as a theoretical level the variable of market size is considered *the* determinant for FDI.[21] What is a surprising feature in the regression though, is that the measure of the investing country's market size, Y_j, is insignificant. This is a result of the inclusion of the measure for capital- or financing ability for the investing country, $Stock_j$. This is probably because size is acting as a proxy, albeit an imprecise one, for financing ability.[22]

Our general equilibrium approach give somewhat similar results to those obtained by CMM and BDH. Both the sum of GDP, as well as the squared difference of GDP, variables capturing horizontal FDI, have the theoretically predicted signs and are highly significant. The skill difference variables, skd and $skd{*}Yd$, give support to the vertical integration motivation within the theoretical framework of the knowledge capital model. The interaction term of, $Tradec_j * skd^2$, has the opposite sign of the predicted but as CMM puts it, "does not have a theoretically sharp hypothesis and, indeed, empirical support for this term is weak" (pp. 699). Lastly, the regressors measuring trade costs are both positive, which in light of their definition, is the expected sign.[23]

The most interesting result though, for our purpose here, is the impact of the euro on FDI. Table 3 shows that *inward FDI* increases by $14-16$ percent approximately, depending on model estimation, in the *intra- EMU* area (EMU 11). The increase is certainly not trivial and is of equal magnitude to the increase in trade volume found by Micco et al. (2003) as well as Flam and Nordström (2003). As with the findings on trade, the regressions show that there is evidence concerning positive spillovers from EMU on partner countries, represented by *EMU12* and *EMU21*. The magnitudes of *EMU12* and *EMU21* are also non-trivial with an increase in FDI in the former group of 8 percent, albeit significant only at the 10% level, and the latter group by around $11-13$ percent.

[20] The investing countries' real exchange rate is of equal magnitude but is not always significant, as shown in Appendix III. Since it is not a variable of primary interest in this paper, we do not dwell on it here.

[21] See Chakrabarti (2001).

[22] Another interesting feature, though not reported, are the dummy variables for the creation of the European common market in the regression that are negative and significant. It can be assumed that the creation of the EU made some investment non-profitable due to the removal of trade barriers, since a similar investment somewhere in the EU could service the entire market. These results are consistent with some results obtained by Flam and Nordström (2003) where dummies for the creation of the EU tend to have a positive effect on exports from non-EU countries to EU countries.

[23] Openess is defined as exports+imports/GDP and proxy hence trade costs going both ways.

Table 3: Panel I-Gravity Regressions

Dependent Variable: Inward FDI measured as:						
	Aver Corr		*Inflows*		*Outflows*	
	Millions US dollars	*Elasticities*	*Millions US dollars*	*Elasticities*	*Millions US dollars*	*Elasticities*
Y_i	0.006^{***}	6.54^{***}	0.006^{***}	4.94^{***}	0.006^{***}	6.62^{***}
	(4.34)	(4.60)	(3.56)	(3.77)	(3.46)	(3.66)
Y_j	-0.003	-2.90	-0.002	-2.08	-0.005	-4.15
	(1.46)	(1.50)	(0.95)	(0.97)	(1.17)	(1.22)
$Stock_j$	0.0006^{**}	0.52^{**}	0.0005^{*}	0.43^{*}	0.001^{*}	0.76^{*}
	(2.25)	(2.30)	(1.90)	(1.95)	(1.75)	(1.84)
$\Delta Stock_i$	$-0,82$	-0.01	-2.12	-0.02	-1.73	-0.02
	$(0,49)$	(0.49)	(0.46)	(0.46)	(0.92)	(0.92)
$Tradec_i$	24.55^{***}	3.83^{***}	29.06^{*}	3.55^{**}	18.13	2.77
	(2.60)	(2.62)	(1.74)	(1.77)	(1.55)	(1.54)
$Tradec_j$	-4.47	-0.69	-7.09	-0.95	-1.08	-0.15
	(0.43)	(0.43)	(0.49)	(0.49)	(0.05)	(0.05)
REX_i	-22.57	-1.86	-49.48	-3.45	-18.61	-1.47
	(0.90)	(0.91)	(1.30)	(1.32)	(0.51)	(0.51)
REX_j	72.88^{*}	1.87^{*}	90.44	6.24^{*}	64.85	5.17
	(1.75)	(1.83)	(1.62)	(1.67)	(0.85)	(0.89)
EMU 11	1616^{***}	0.146^{***}	2034.8^{***}	0.173^{***}	1795.9^{***}	0.176^{***}
	(3.17)	(3.40)	(2.82)	(2.96)	(2.71)	(2.91)
EMU 12	1081^{*}	0.075^{*}	1687.6^{**}	0.115^{**}	1345.9	0.07
	(1.74)	(1.81)	(2.09)	(2.18)	(1.05)	(1.10)
EMU21	1503^{**}	0.106^{**}	1931.0^{**}	0.09^{**}	2051.9^{**}	0.16^{**}
	(2.44)	(2.52)	(2.03)	(2.04)	(2.32)	(2.41)
Obs	2722		2092		2177	
R^2	0.35		0.39		0.28	

Notes: Robust |t-values| in parenthesis, Fixed effects and EU entry dummies not reported. Splines are used to control for time as year effects. *,** ,*** denote significance at the 10-, 5- and 1 % level respectively.

Table 3: Panel II-General Equilibrium Regressions

Dependent Variable: Inward FDI measured as Aver Corr:				
	CMM		*BDH*	
	Millions US dollars	*Elasticities*	*Millions US dollars*	*Elasticities*
Y_{sum}	0.01^{***}	20.40^{***}	0.01^{***}	20.67^{***}
	(4.33)	(4.79)	(4.36)	(4.84)
Yd^2	$-4e^{-16***}$	-2.88^{***}	$-4e^{-16***}$	-2.87^{***}
	(2.95)	(3.14)	(2.93)	(3.12)
skd	676.7^{***}	0.01^{***}		
	(2.88)	(3.02)		
$\|skd\|$			529.5^{*}	0.95^{*}
			(1.80)	(1.85)
$skd * Yd$	-0.0001	-0.24		
	(0.94)	(0.94)		
$\|skd\| * \|Yd\|$			-0.0002^{*}	-0.70^{*}
			(1.83)	(1.88)
$Tradec_i$	9.75	1.55	12.23	1.94
	(1.23)	(1.21)	(1.57)	(1.54)
$Tradec_j$	40.03^{***}	6.37^{***}	37.68^{***}	5.99^{***}
	(4.63)	(5.34)	(4.59)	(5.29)
$Invc_i$	-204.8	-0.28	-9.10	-0.01
	(0.34)	(0.34)	(0.01)	(0.01)
$Tradec_j * skd^2$	0.56^{**}	0.65^{**}	0.39	0.45
	(2.33)	(2.47)	(1.49)	(1.52)
EMU 11	1489^{***}	0.134^{***}	1488^{***}	0.134^{***}
	(2.90)	(3.03)	(2.85)	(2.98)
EMU 12	1158^{*}	0.08^{*}	1101^{*}	0.076^{*}
	(1.72)	(1.80)	(1.65)	(1.72)
EMU21	1752^{***}	0.123^{***}	1811^{***}	0.128^{***}
	(2.82)	(2.91)	(2.94)	(3.04)
Obs	2802		2802	
R^2	0.35		0.35	

Notes: Robust |t-values| in parenthesis, Fixed effects and EU entry dummies not reported. Splines are used to control for time as year effects. *,** ,*** denote significance at the 10-, 5- and 1 % level respectively.

The results indicate that we can be fairly confident of the positive effects the creation of the EMU had on *inward FDI*. These positive effects are not only within

the designated EMU area but also affects its partners. The results also suggest that positive spillovers exist and that they go in both directions. The remainder of the paper will use the Gravity regression and the Average Corrected FDI series as a reference and if any of the other estimation specification have a significantly different effect on the results it will be duly noted.

6 Robustness check

In this section the robustness of the obtained results is checked to changes in country and time sample.[24] The first important issue is the question of whether the results truly capture a euro effect or if it is something else. As mentioned earlier, the euro can affect international investment through several channels. Some of these channels can have a long transmission period and not have a direct impact, while other effects could be anticipated in advance. The easiest way to do this is to replace our EMU group variables with yearly dummies by group and plot their point estimates. If it is a euro effect we capture it should be obvious through some form of break in the values of the point estimates in 1999.

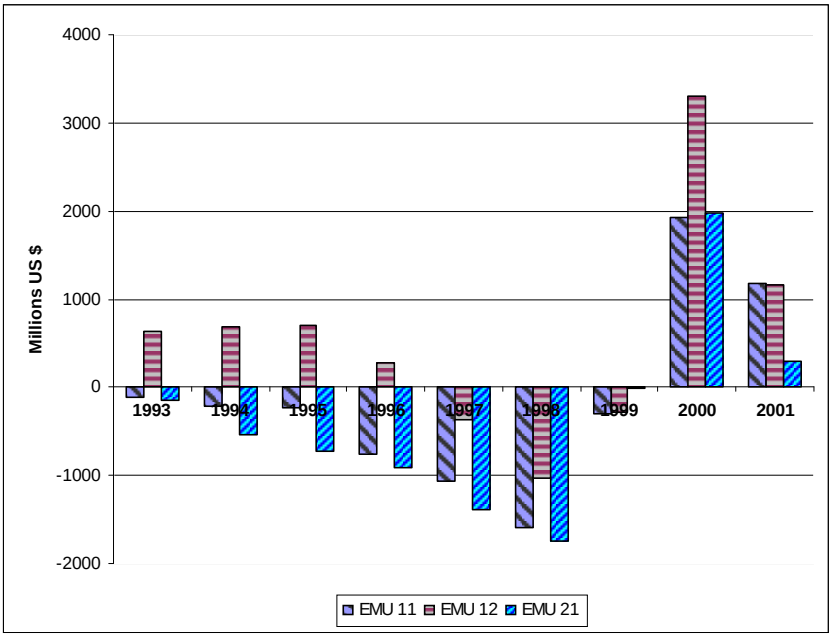

Figure 4: *Estimated Effects of Yearly Euro Group Dummies.*

Figure 4 depicts the estimated yearly effects of the various country groups. As we

[24] For space considerations only the results of the EMU variables will be presented in the tables. At a general level the remaining explanatory variables sustain their significance throughout the robustness check.

can see a sharp change occurs in 1999. From where the estimated yearly effects are increasingly negative they are close to zero in 1999 and positive for the rest of the years. Moreover we can clearly see that *EMU12*, exhibits a more cyclical behavior for the period, which explains the low significance in the estimations. The figure also makes it clear that there is a jump in 1999 and not any other year, which makes us confident that what we are capturing in our estimations is a euro effect.[25]

Continuing the sensitivity analysis, we now check whether the EMU results are driven by any particular country/countries, or whether they are more widespread.[26] Countries are excluded both as receivers of investment and investors (i and j respectively). The results presented in the table are the post estimation elasticities of the EMU variables.

Table 4: Country sensitivity, single country exclusion
Dependent variable: Inward FDI

	Independent variables					
	EMU 11		*EMU 12*		*EMU 21*	
Country dropped						
None	0.146***	(3.40)	0.075*	(1.81)	0.106**	(2.52)
Austria	0.148***	(3.62)	0.079*	(1.91)	0.115***	(2.76)
BeLux*	0.06*	(1.77)	0.05	(0.98)	0.08*	(1.77)
Finland	0.156***	(3.78)	0.084**	(2.01)	0.117***	(2.75)
France	0.117***	(2.53)	0.084*	(1.68)	0.08*	(1.72)
Germany	0.085**	(2.50)	0.04	(1.06)	0.093*	(1.88)
Greece	0.145***	(3.45)	0.075*	(1.75)	0.102**	(2.37)
Ireland	0.138***	(3.43)	0.076*	(7.84)	0.11***	(2.62)
Italy	0.163***	(3.89)	0.088**	(2.07)	0.125***	(2.92)
Netherlands	0.135***	(2.85)	0.088*	(1.84)	0.103**	(2.13)
Portugal	0.153***	(3.71)	0.083**	(1.99)	0.119***	(2.85)
Spain	0.144***	(3.29)	0.078*	(1.76)	0.12***	(2.78)

Notes: Robust |t-values| in parenthesis. *,** ,*** denote significance at the 10-, 5- and 1 % level respectively.* Economic entity of Belgium-Luxembourg

We see clearly from *Table 4* that the exclusion of Belgium-Luxembourg (BeLux) or Germany weakens the results. Further examination reveals that when both countries are excluded simultaneously the regressions do not show any euro effects, which is perhaps not so surprising since we have removed the most central locations in the euro area. Continuing however with this investigation we notice an important fea-

[25] The results concering time sensitivity are confirmed by more estimations in Appendix III Tables D1 and D2.
[26] The methodology of this experiment follows Micco et al. (2003), Table 6 and 7.

ture, namely, that if BeLux and Germany are excluded only as receivers (country i), or only as investors (country j) the results showing a positive effect for the introduction of the euro remain significant. These results are important for two reasons. Firstly, the aim of this paper is to investigate unidirectional FDI, hence the importance of examining the exclusion of FDI flows in only one direction, and secondly these results clearly illuminate the fact that Belgium-Luxembourg and Germany act as a hub for the EMU-area *inward FDI* but they are not the sole driving receivers of FDI nor are they the sole driving investors. *Table 5* presents some chosen results on the EMU dummies that clarify the previously made point.

Table 5: Excluding Germany and BeLux
Dependent variable: Inward FDI

Excluded as country:	(i) *and* (j)	(i)	(j)
EMU 11	0.03	0.06*	0.09**
	(0.94)	(1.76)	(2.41)
EMU 12	−0.02	0.001	0.087
	(0.47)	(0.02)	(1.59)
EMU 21	0.04	0.117**	0.05
	(0.80)	(2.12)	(1.23)

Notes: Robust |t-values| in parenthesis.

*,** ,*** denote significance at the 10-, 5- and 1 % level respectively.

Firstly, in all cases the intra-EMU (EMU 11) values decrease when Germany and BeLux are excluded either as receivers or as investors. Secondly, they seem to be a driving force of both attracting FDI from non-EMU countries, as well as investing outside the euro area, since *EMU 12* and *EMU 21* become in turn insignificant. Hence what can be said about Germany and BeLux is that while they play a vital role in the euro area for inward FDI (EMU 11) as well as for spillovers (EMU 12 and EMU 21) they do not explain the entire story. However, the results suggest the need to take a closer look at these two entities.

From *Table 6*, we see that a large part of European FDI circle around Germany and Belgium-Luxembourg. While the role of Germany is understandable, the entity of BeLux raises some concerns. Closer investigation shows that the majority of FDI to BeLux goes to Luxembourg and are special entity purposes (SPE's) flows, i.e. flows used for financial intermediation and not production. Unfortunately there is

no way to distinguish the intended end destinations in order to construct correct country pairs. What is interesting though is that the large majority of FDI both to and from BeLux concern "large" economies.

Table 6: The role of Germany and BeLux.

They	Receive, % of Group.	Invest, % of Group.
EMU 11	0.41	0.39
EMU 12	0.36	
EMU21		0.45

FDI flows from and to BeLux. Million US $ 1999-2001.

	From BeLux			
	To			
	Small	*Switzerl.*	*Big non Euro*	*Big Euro*
Total 1999-2001.	56552	54820	107281	169392
average per year	1571	13700	8940	10587
and country.				
	To BeLux			
	From			
	Small	*Switzerl.*	*Big non Euro*	*Big Euro*
Total 1999-2001.	47444	3707	137703	117492
average per year	1317	794	11475	7343
and country.				

To conclude this section, we may reemphasize the fact that intra-EMU effects retain their significance even when Germany and BeLux are excluded either as receivers of FDI or as investors. This provides more evidence that the positive effects of the introduction of the euro in attracting FDI are widespread across the members rather than more concentrated in some areas. This is a topic which will be further investigated subsequently.[27]

7 On the Economic Geography of the Euro

In this section groups of countries will be excluded as receivers (country i) of FDI or investors (country j) in order to check for any potential concentration of inward FDI. The results obtained will be compared to similar regressions on unilateral trade, measuring exports, where $Export_{ij}$ denotes exports from country i to country

[27] As we have seen, the magnitude varies of course, but the question is whether all members have had some effect to a varying degree or if all effects are concentrated in some countries.

j.[28] The purpose here is twofold. Firstly, it will give an indication of whether the introduction of the euro has induced any agglomeration effects on economic activity. Agglomeration tendencies, or the lack thereof, are possibly important for policy in any future EMU-members. Moreover, the direction of trade in conjunction with the direction of FDI might be able to reveal something of the character of FDI. That is, if the directions correspond to the notion of vertical or horizontal FDI or neither of the above, keeping in mind that a significant percentage of world trade, is intrafirm.[29] Secondly, this section can also be seen as being a continuation of the robustness checks performed previously.

In the new trade literature, the focus is on the geographic distribution of economic activity, where models display both forces of agglomeration as well as forces of dispersion. One key factor encouraging agglomeration is the "market access effect". It states that firms tend to locate their production in the big market and export to small markets.[30] As we have seen from the CMM and BDH estimations the variables capturing market size and symmetry ($Ysum$ and Yd^2) are significant determinants of FDI.

As mentioned above, the "new economic geography" models feature forces of both agglomeration as well as forces of dispersion. Their relative strengths are determined by trade costs. Mostly these models show how lower trade costs may lead to increased agglomeration of economic production. However, agglomeration forces are, as a rule, hump shaped in their relation to trade costs and depending on the starting point dispersion forces may dominate when trade 'feeness' is increased.[31] The introduction of the euro has had a significantly positive effect on trade volumes and it can be seen as a step towards reducing such trade costs. Yet, since we are not quite sure about our position on the hump prior to the introduction of the euro we can not make any a priori assumptions about agglomeration effects.

Another way to look at is through strategies of MNE's concerning locational decisions. Indication exists that MNE's have neither pure horizontal nor pure vertical motivations for investment. They employ rather, so-called, complex strategies regarding their locational decisions. From a theoretical as well as an intuitive perspective we should expect that, for large economies the decision to locate an FDI

[28] The dataset on exports is from the paper by Flam and Nordström (2003).

[29] According to Markusen (2002, Ch.1 pp. 5-6) about 30 to 40 percent of trade is intrafirm, while in Blonigen (2005) it is mentioned that as much as 47 percent of the U.S.'s trade with other countries was intrafirm in 1999, (pp. 1, footnote 1).

[30] See Baldwin et al. (2003).

[31] See Baldwin et al. (2003).

there should be dominated by horizontal motivations, while the decision to locate to a small economy should be dominated by vertical motivations. If this supposition is true, we should observe that the euro effect for FDI is, at least, more significant for the large economies, while the euro effect of trade is, at least, more significant for the small economies.

Moving on to empirical considerations we can note that in order to compare our results from exports and inward FDI, the datasets have to cover the same time period and country sample.[32] The division of the sample into "big" and "small" economies is based on market size. The "big" sample of euro countries contains Germany, France, Italy and Spain, while the remaining countries are found in the "small" sample.[33] The regressions are run by excluding the "big" or "small" group firstly as country i, i.e. as receivers of FDI and as exporters *(Table 7.1)* and subsequently as country j, i.e. as investors and as receivers of exports *(Table 7.2)*. Comparison of the elasticities obtained in the case of exports is straightforward: we can compare the group elasticities with their full sample counterparts and be able to discern some pattern in the direction of trade. In the case of the FDI regressions it is not so straightforward, since the elasticities obtained are calculated using the chain rule and are applied to the predicted mean of the respective variable. They will however give us an indication of direction concerning FDI.

Starting with the first three columns in *Table 7.1* it is not clear, at first glance, when comparing the estimates in regressions (1), (2) and (3) that "big" countries receive more FDI flows. Both subsamples experience a seemingly equiproportional increase. Remembering however the statistics concerning BeLux from *Table 6* it is not clear that the entity belongs in reality to the "small" sample. The large majority of FDI come from and go to large economies, we simply can not match the exact country pairs. Hence if BeLux acts only as a haven for financial intermediation, it should for all practical reasons belong to the "big" sample. Regressions (4) and (5) shows the results when BeLux switches sample. The results now indicate that a large part of the inward FDI increase due to the EMU is concentrated in a few large economies.[34]

[32] Exports for years other than 1992-2001 are dropped as well as FDI concerning Greece. Lastly, the euro dummies have 1999 as their starting date.

[33] The baseline regressions for this exercise are: for *inward FDI*, as previously the gravity specification in *Table 3* and for *Exports*, regression (6) in *Table 4*, in Flam's and Nordström's (2003) paper.

[34] We say a *large* part because not all FDI to and from BeLux concern "big" economies.

Table 7.1: EMU elasticities of inward FDI and Exports, country (i)

Dependent variable: Inward FDI

	Receivers of FDI				
	(1)	(2)	(3)	(4)	(5)
	All	$\text{Small}^{a}_{i-Euro}$	Big^{b}_{i-Euro}	$\text{Small}^{c}_{i-BeLux}$	$\text{Big}^{d}_{i+BeLux}$
EMU 11	0.146***	0.08***	0.11***	0.04	0.14***
	(3.40)	(2.59)	(2.68)	(2.14)	(3.78)
EMU 12	0.075*	0.05	0.05	0.01	0.09**
	(1.81)	(1.39)	(1.17)	(0.56)	(2.14)
$\hat{y}$	1301.9	1310.4	1558.7	1216.4	1626.5
Dependent variable: Exports,					
	Exporters				
	All	$\text{Small}^{a}_{i-Euro}$	Big^{c}_{i-Euro}	$\text{Small}^{b}_{i-BeLux}$	$\text{Big}^{d}_{i+Belux}$
EMU 11	0.14***	0.16***	0.13***	0.16***	0.13***
	(6.14)	(5.50)	(4.97)	(4.51)	(5.32)
EMU 12	0.07***	0.06**	0.09***	0.06**	0.09***
	(3.29)	(2.51)	(4.20)	(2.11)	(4.31)

Notes: Robust $|t|$-values in parenthesis.*,** ,*** denote significance at the 10-, 5- and 1 % level respectively.

[a] Excluding Germany, France, Italy and Spain

[b] Excluding Ireland, Portugal, Finland, Austria, Netherlands and BeLux

[c] Excluding Germany, France, Italy, Spain and BeLux

[d] Excluding Ireland, Portugal, Finland, Austria and Netherlands

The results concerning exports in *Table 7.1* differ markedly from their FDI counterparts. Firstly, we see that regressions (2) and (4) are virtually identical for exports, which implies that BeLux does not drive any results when exports are concerned. Secondly, for the intra- EMU area (*EMU 11*) the coefficient rises considerably, compared to the base regression, when the "big" sample is dropped as an exporter, but falls when the "small" sample is dropped. Hence, the export increase is larger for the "small" countries. For *EMU 12* the opposite holds and the increase is dominated by the big countries' exports to non-EMU members.

We now turn our attention to the opposite side of this equation, namely where do the FDI come from and to whom do the countries export to. In *Table 7.2* we see that when, BeLux changes sample, regressions (4) and (5), it is clear that the "big" economies are the ones that spawn most of the FDI, both within the EMU-area (*EMU 11*) as well as outside the same (*EMU 21*). On the other hand the regressions dealing with the export side of this experiment show an equal clear tendency where

the "large" economies receive larger part of the increase in exports both for *EMU 11* as well as *EMU 21*.

Table 7.2: EMU elasticities of inward FDI and Exports, country (j)

Dependent variable: Inward FDI

	Source of FDI				
	(1)	(2)	(3)	(4)	(5)
	All	$\text{Small}^{a}_{j-Euro}$	Big^{c}_{j-Euro}	$\text{Small}^{b}_{j-BeLux}$	$\text{Big}^{d}_{j+BeLux}$
EMU 11	0.146***	0.129***	0.08***	0.06*	0.144***
	(3.40)	(2.83)	(2.66)	(1.97)	(3.21)
EMU 21	0.106**	0.08*	0.07*	0.01	0.114***
	(2.52)	(1.76)	(1.93)	(0.48)	(2.75)
$\hat{y}$	1301.9	1236.4	1444.7	1097.9	1558.8

Dependent variable: Exports

	Receivers of Exports				
	All	$\text{Small}^{a}_{j-Euro}$	Big^{c}_{j-Euro}	$\text{Small}^{b}_{j-BeLux}$	$\text{Big}^{e}_{j+BeLux}$
EMU 11	0.14***	0.11***	0.21***	0.09***	0.21***
	(6.14)	(3.89)	(8.97)	(3.07)	(8.93)
EMU 21	0.08***	0.04	0.13***	0.03	0.13***
	(3.63)	(1.62)	(5.85)	(0.91)	(5.78)

Notes: Robust |t-values| in parenthesis. *,** ,*** denote significance at the 10-, 5- and 1 % level respectively.

[a] Excluding Germany, France, Italy and Spain

[b] Excluding Ireland, Portugal, Finland, Austria, Netherlands and BeLux

[c] Excluding Germany, France, Italy, Spain and BeLux

[d] Excluding Ireland, Portugal, Finland, Austria and Netherlands.

Overall, the results from *Tables 7.1* and *7.2* indicate that FDI flows concentrate in the "big" economies. However, within the euro-area FDI also originate mostly from the same countries. Exports, on the other hand, tend to increase more for "small" countries and are directed towards "big" countries, with the exception of euro-area exports to non-members, where the "big" members increase their exports more to "big" non members.

So, are any agglomeration tendencies apparent from this exercise? The answer to this is: only partially. It is a partial yes, since "big" economies attract a larger share of the total increase in inward FDI, after controlling for a host of factors including market size. Hence we observe an increase in the concentration of production and

the sample displays agglomeration tendencies. However, exports tend to increase slightly more for small countries, which may indicate an increase in production and, in terms of economic geography, increased dispersion.

An interesting feature of the results is, however, the direction patterns of exports in conjuction with those of the FDI. These create two caveats. Firstly, it may be that perhaps intrafirm trade and vertical FDI increased in importance with the introduction of the euro.[35] Secondly, it may also be that the location decision of FDI is characterized by "third" country considerations and more attention should be given to models such as Export-Platform FDI or complex versions of the knowledge-capital model.[36] These suspicions are supported by findings from Flam and Nordström (2003) where they use regressions of one-digit SITC sector exports and find that export increases are concentrated on differentiated and processed input goods. Flam and Nordström note that the estimated increase for trade can be explained by increasing vertical specialization along the lines suggested by Yi (2003).

8 Conclusions

Several theoretical arguments exist as to why the introduction of the euro should increase international investment. In this paper a difference-in-difference approach has been used in order to gauge the impact of the introduction of the euro on *inward FDI* for the EMU members. After attempting to correct potential measurement problems and for various time effects in the data we estimate that the introduction of the euro has increased *inward FDI* by $14-16$ percent within the euro area. Moreover, the euro has had significant positive spillover effects on *inward FDI* both to and from the euro area by around 8 and $11-13$ percent, respectively. The results are robust to changes in time and country sample with one exception. If the central locations of Germany and Belgium-Luxembourg are excluded simultaneously as both receivers of FDI and investors most of the euro effects disappear. However, if they are excluded either as receivers or investors the euro effects reappear indicating that the two countries act as a hub for FDI flows in the euro area. Finally, an investigation of the economic geography of the euro is conducted by combining the inward FDI results with results obtained from export regressions. The findings indicate that the increase in FDI is concentrated to large economies, while the increase in exports is

[35] That vertical motivations play a part in the loacation of FDI is partly vindicated by the signs and significance of the skill variables in the CMM and BDH specifications.

[36] For the former see Ekholm et al. (2003) and for the latter see Baltagi et al. (2005) and Bloningen et al (2004).

larger for small economies. From this exercise there is an indication of an increase in vertical specialization or "third" country considerations in the sample.

However, we do not feel that any specific model does an excellent job at explaining the location of FDI, which raises some questions of relevance for future research. The first is directed to the question of whether alternative general equilibrium models such as Export-Platform FDI are more informative. Second, for policy issues, there will be a need to investigate whether "small" economies are increasingly acting as suppliers of input goods to multinational enterprises that, in turn, are increasingly located in "big" economies? If this is the case, it would be a natural step to investigate whether "small" economies are going to encounter a more volatile future in their production when exogenous shocks hit the EMU area due to this vertical specialization and the implied supplier status. Moreover, the question arises of whether such a development will impede further on the possibilities of "small" economies to pursue independent policies?

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APPENDIX I: Data description

Variable description	
	Source: Eurostat, New Cronos
Inward FDI_{ij}	Equity + Other Capital, net*Millions current US $.*
Inflows	Inward FDI for country i reported as an inflow for i.
Outflows	Inward FDI for country i reported as an outflow for j.
Average	Inward FDI for country i measured as the average of above variables.
Corrections	Extension of inward FDI dataset by correcting for missing values when possible, for inflows (outflows) by using their outflow (inflow) counterpart corrected by an average asymmetry.
	Source: IMF, IFS
REX i or j	Real Effective Exchange Rate Index, CPI Based
Y i or j	GDP, *Millions current US $*
	Source: Penn World Tables
Trade	1/Openess
Costs	
	Source: International Country Risk Guide
Investment	Composite Index using Corruption, Bureaucracy
Costs	and Rule of Law.
	Source: Barro-Lee Database
Skill	Average number of school years,'tyr' variable.
	Source: World Bank, WDI
Stock	Market capitalization of listed companies share price $*$ no. of shares outstanding*Millions current US $*

Dummy Variables	
EMU	0 prior to the introduction of the Euro in 1999, 1 afterwards if
EMU 11	both countries i and j belong to the EMU.
EMU 12	country i belongs to the EMU and country j does not.
EMU 21	country j belongs to the EMU and country i does not.
EU 12	0 prior to 1993 and 1 afterwards if
EU 12 in	country i belongs to EU 12 and country j is non EU
EU 12 out	country j belongs to EU 12 and country i is non EU
Austria Sweden Finland	0 prior to 1995 and 1 afterwards if
ASF in	country i belongs to ASF and country j is non EU
ASF out	country j belongs to ASF and country i is non EU

Countries in the sample

- **Group 1, EMU members:** Austria, Belgium-Luxembourg, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain.
- **Group 2, non-EMU members:** Denmark, Japan, Norway, Sweden, Switzerland, UK, USA.

Average asymmetries

Average asymmetries are used to calculate corrected series. For each year there is a difference for reported aggregate inflows and outflows for a certain area. This aggregate difference is used to correct missing data on inflows(outflows) between two countries for a certain year, if their outflow(inflow) counterpart exists.

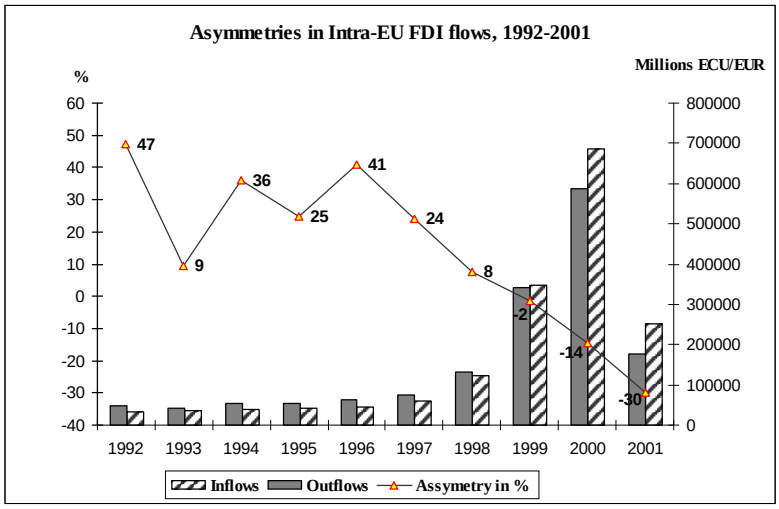

Figure A1

APPENDIX II: FDI development

As mentioned in the paper, some results may vary depending on the measure used for inward FDI. The first four diagrams show the development of FDI using Inflows and Outflows as well as the corrected series. The fifth diagram shows the development of our groups of interest relative to the control group. The last diagram shows the proportion of world or OECD total FDI that is used in this paper.

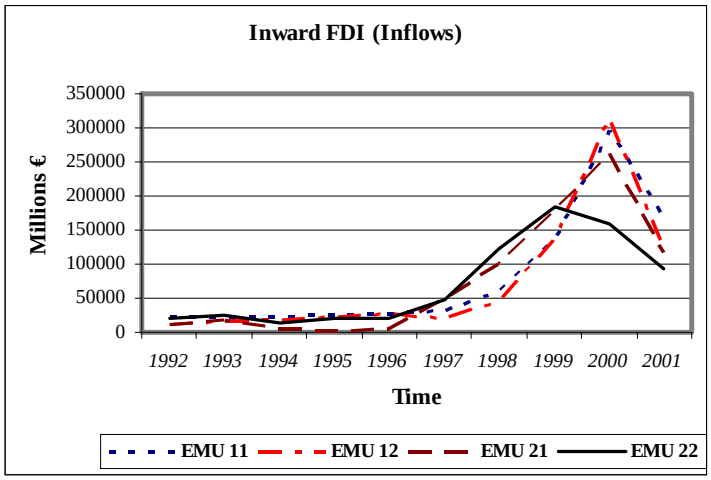

Figure A2

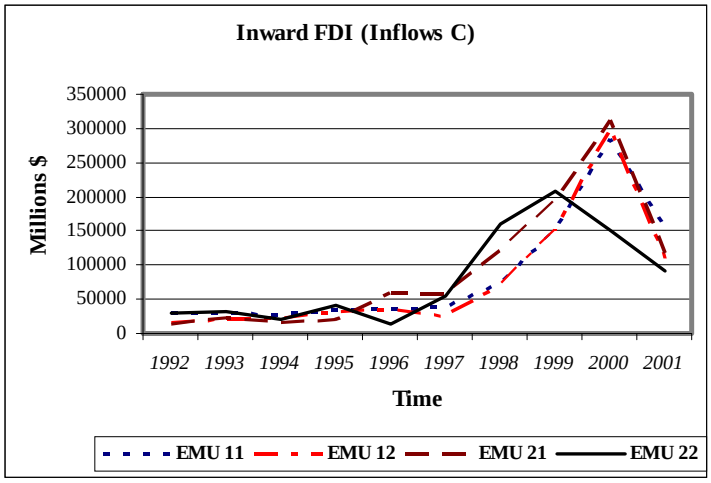

Figure A3

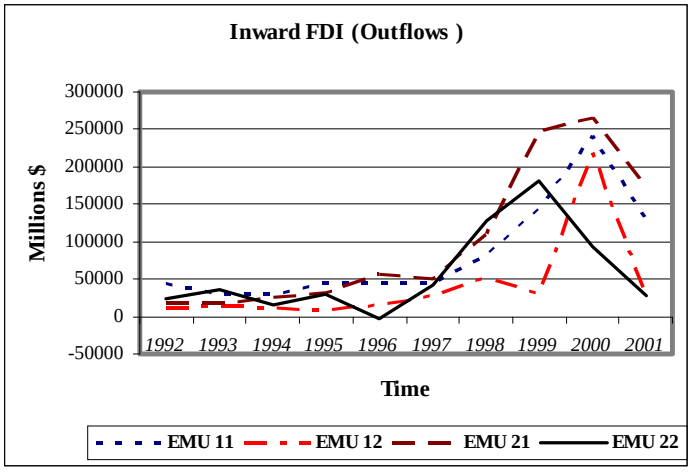

Figure A4

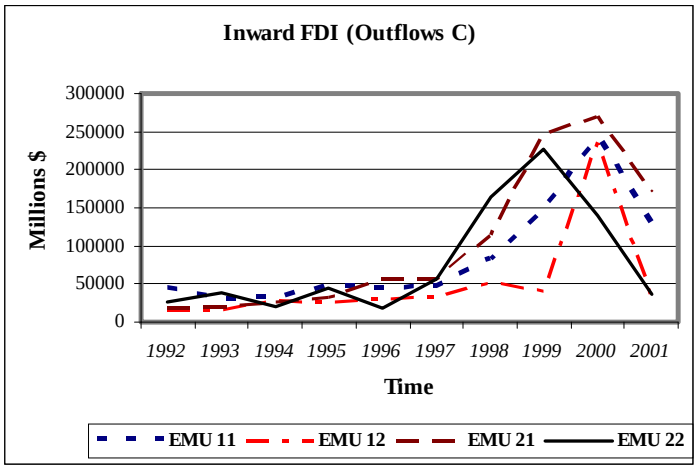

Figure A5

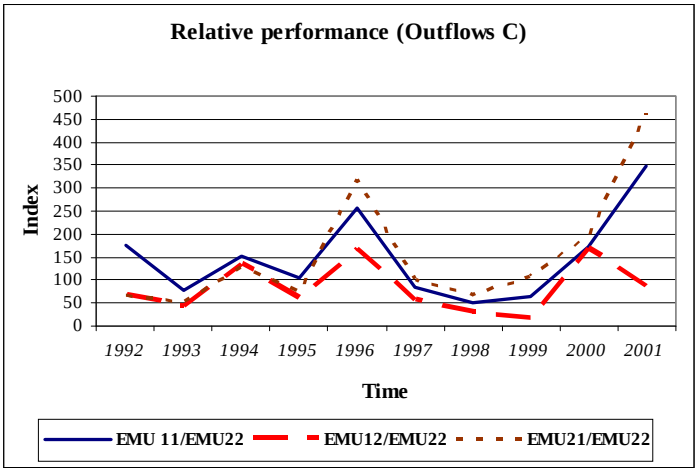

Figure A6

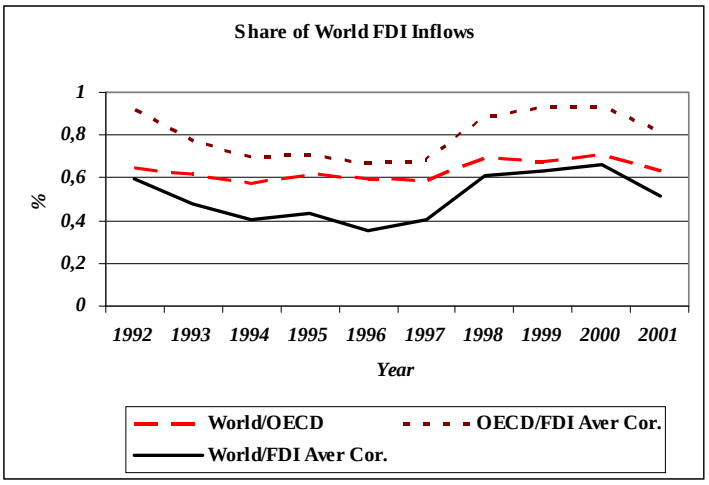

Figure A7

APPENDIX III: Measurement, Specification and Robustness

Table A, Gravity regression, Definition of FDI and IV estimations
Dependent variable: Inward FDI, millions US

	(1)	(2)	(3)	(4)	(5)
	Inflows	IVinflows	Outflows	IVoutflows	Average C
Y_i	0.006^{***}	0.004^{***}	0.006^{***}	0.004^{***}	0.006^{***}
	(3.56)	(4.22)	(3.46)	(3.56)	(4.34)
Y_j	-0.002	-0.003	-0.005	-0.001	-0.003
	(0.95)	(1.17)	(1.17)	(0.95)	(1.46)
$Stock_j$	0.0005^{*}	0.001^{*}	0.001^{*}	0.0003^{*}	0.0006^{**}
	(1.90)	(1.75)	(1.75)	(1.90)	(2.25)
$\Delta Stock_i$	-2.12	-1.08	-1.73	-1.40	$-0,82$
	(0.46)	(0.92)	(0.92)	(0.46)	$(0,49)$
$Tradec_i$	29.06^{*}	11.38	18.13	19.21^{*}	24.55^{***}
	(1.74)	(1.55)	(1.55)	(1.74)	(2.60)
$Tradec_j$	-7.09	-0.68	-1.08	-4.68	-4.47
	(0.49)	(0.05)	(0.05)	(0.49)	(0.43)
REX_i	-49.48	-11.68	-18.61	-32.70	-22.57
	(1.30)	(0.51)	(0.51)	(1.30)	(0.90)
REX_j	90.44	40.71	64.85	59.77	72.88^{*}
	(1.62)	(0.85)	(0.85)	(1.62)	(1.75)
EMU 11	2034.8^{***}	1128.3^{***}	1795.9^{***}	1344.8^{***}	1616^{***}
	(2.82)	(2.71)	(2.71)	(2.82)	(3.17)
EMU 12	1687.6^{**}	844.8	1345.9	1115.3^{**}	1081^{*}
	(2.09)	(1.05)	(1.05)	(2.09)	(1.74)
EMU21	1931.0^{**}	1288^{**}	2051.9^{**}	1276.2^{**}	1503^{**}
	(2.03)	(2.32)	(2.32)	(2.03)	(2.44)
Obs.	2092	2722	2177	2722	2722
R^2	0.39	0.28	0.28	0.36	0.35

Notes: Robust |t-values| in parenthesis, Fixed effects not reported.

Common time effects: Splines

*,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

Table B1:
Dependent variable: Inward FDI (Aver Corr), yearly dummies

Regressors *Gravity*		Regressors *CMM*		Regressors *BDH*	
Y_i	0.006^{***}	Y_{sum}	0.01^{***}	Y_{sum}	0.01^{***}
	(4.48)		(4.40)		(4.41)
Y_j	-0.002	Yd^2	$-4.1e^{-16***}$	Yd^2	$-4.1e^{-16***}$
	(1.15)		(2.99)		(2.98)
$Stock_j$	0.0005^{*}	skd	683.1^{***}	$\|skd\|$	553.7^{*}
	(1.94)		(2.92)		(1.84)
$\Delta Stock_i$	0.08	$skd * Yd$	-0.0001	$\|skd\| * \|Yd\|$	-0.0002^{*}
	(0.05)		(1.11)		(1.85)
$Tradec_i$	27.99^{***}	$Tradec_i$	15.1^{**}	$Tradec_i$	17.5^{***}
	(3.35)		(2.29)		(2.60)
$Tradec_j$	1.07	$Tradec_j$	45.42^{***}	$Tradec_j$	42.94^{***}
	(0.09)		(5.00)		(4.93)
REX_i	-18.75	$Invc_i$	-527.3	$Invc_i$	-321.9
	(0.71)		(0.66)		(0.39)
REX_j	74.76^{*}	$Tradec_j * skd^2$	0.50^{**}	$Tradec_j * skd^2$	0.32
	(1.66)		(2.24)		(1.27)
EMU 11	1275	*EMU 11*	1136	*EMU 11*	1124
	(1.56)		(1.39)		(1.35)
EMU 12	632	*EMU 12*	699	*EMU 12*	631
	(0.69)		(0.74)		(0.66)
EMU21	1050	*EMU21*	1275	*EMU21*	1325
	(1.20)		(1.41)		(1.46)
Obs	2722		2802		2802
R^2	0.36		0.36		0.36

Notes: Robust |t-values| in parenthesis, Fixed effects and EU entry dummies not reported.

*,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

Table B2:
Dependent variable: Inward FDI (Aver Corr), No time controls

Regressors *Gravity*		Regressors *CMM*		Regressors *BDH*	
Y_i	0.006^{***}	Y_{sum}	0.01^{***}	Y_{sum}	0.01^{***}
	(4.24)		(4.30)		(4.34)
Y_j	-0.004^{**}	Yd^2	$-4.1e^{-16***}$	Yd^2	$-4.1e^{-16***}$
	(2.12)		(2.99)		(2.97)
$Stock_j$	0.0007^{***}	skd	629.7^{***}	$\|skd\|$	607.5^{**}
	(2.99)		(2.68)		(2.04)
$\Delta Stock_i$	1.64	$skd * Yd$	-0.0001	$\|skd\| * \|Yd\|$	-0.0002^{*}
	(1.03)		(0.73)		(1.77)
$Tradec_i$	17.38^{**}	$Tradec_i$	6.48	$Tradec_i$	9.71
	(2.13)		(0.91)		(1.37)
$Tradec_j$	-14.38	$Tradec_j$	35.50^{***}	$Tradec_j$	33.88^{***}
	(1.48)		(4.37)		(4.33)
REX_i	-13.35	$Invc_i$	610.7	$Invc_i$	729.1
	(0.54)		(0.90)		(1.06)
REX_j	83.21^{**}	$Tradec_j * skd^2$	0.58^{**}	$Tradec_j * skd^2$	0.37
	(2.01)		(2.50)		(1.44)
EMU 11	1629.8^{***}	*EMU 11*	1077.4^{***}	*EMU 11*	1081.9^{***}
	(4.30)		(1.39)		(2.71)
EMU 12	1084^{**}	*EMU 12*	784.9	*EMU 12*	729.1
	(2.12)		(1.34)		(1.27)
EMU21	1477.3^{***}	*EMU21*	1452.9^{***}	*EMU21*	1495.0^{***}
	(3.07)		(2.83)		(2.93)
Obs	2722		2802		2802
R^2	0.35		0.35		0.35

Notes: Robust |t-values| in parenthesis, Fixed effects and EU entry dummies not reported.

*,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

Table A is a continuation in trying to discern differences in the way measurement of inward FDI affect the results. One difference is that the use of inflows gives consistently about a 10 percent increase in explanatory power. Another is that the significance of various explanatory variables differ between the measurements. Moreover, very little seems to change in regressions when the raw data are expanded. We can note that the IV-estimations that are used in order to correct potential

measurement errors are not very helpful. The instrumented variables take on entirely the attributes of the instruments. That is, IV-inflows (IV-outflows) look, in terms of significance and magnitude, very much like the regressions using outflows (inflows) directly. Since no gain in consistency is apparent from the IV-estimations,[37] the end result is only loss of efficiency that comes from using instruments. Lastly we can note that regression using the corrected average series seems to inherit the significant attributes from both inflows as well as outflows, a result that was a happy surprise for once. This leads us, in the light of prior arguments, to believe it is to be preferred for measurement issues.

Tables B1 and *B2* give us interesting insights concerning time controls. In *Table B1* where yearly dummies are used in order to capture common time effects we can note that the EMU variables are insignificant. Comparing the estimates of the EMU variables with those obtained in *Table B2* where the EMU variables are significant, we see that the point estimates of both equations are not significantly different. This leads us to believe that even if *Table B1* has the most flexible definition, it is not the most efficient. From *Figures 1, 2* and *3* presented in the text we may easily fit common time trends to the development of FDI. We can thereby increase the efficiency in our estimations by imposing a functional form on our regression. This is done in *Table 3*, where the main results are presented, where two splines are introduced as a mean to cope with common time effects. Our first spline comes from *Figure 1* and is a simple quadratic exponential function which, as mentioned earlier, explains fifty to ninety percent of the variables in *Figure 1*. The second spline comes from *Figures 2* and *3* and is linear until 1999 and increasing thereafter, in order to control for any common structural breaks around that period. Since again the point estimates of the regressions in *Table 3* and *Table B1* are not significantly different, we can conclude that by controlling for common time effects in an efficient, albeit restricted, manner the effects of the EMU on *inward FDI* become more pronounced. In addition, both splines tend to be highly significant as a rule, even if not reported.

[37] Hausman tests reject the use of instruments in this case. The null of no difference in estimates cannot be rejected with χ^2 values of 0.91 and 0.67.

Table C1

Dependent variable:Log Inward FDI

Regressors *Gravity*		Regressors *CMM*		Regressors *BDH*	
$\log Y_i$	0.30	$\log Y_{sum}$	4.12^{***}	$\log Y_{sum}$	4.12^{***}
	(0.34)		(3.75)		(3.81)
$\log Y_j$	1.51	$\log Yd^2$	-0.045	$\log Yd^2$	-0.18^{*}
	(1.49)		(0.46)		(1.60)
$\log Stock_j$	0.11	skd	0.37^{***}	$\lvert skd\rvert$	-0.31^{*}
	(1.19)		(3.74)		(1.69)
$\Delta Stock_i$	-0.001	$skd * Yd$	$8.7e^{-9}$	$\log \lvert skd\rvert * \lvert Yd\rvert$	0.308^{**}
	(1.00)		(0.32)		(2.36)
$Tradec_i$	0.001	$Tradec_i$	0.0001	$Tradec_i$	0.001
	(0.55)		(0.04)		(0.35)
$Tradec_j$	0.001	$Tradec_j$	0.0001	$Tradec_j$	0.0001
	(0.48)		(0.49)		(0.05)
REX_i	0.02	$Invc_i$	-0.42	$Invc_i$	-0.44
	(0.32)		(1.48)		(1.56)
REX_j	0.02	$Tradec_j * skd^2$	0.0001^{*}	$Tradec_j * skd^2$	0.0002^{**}
	(0.29)		(1.69)		(2.03)
EMU 11	0.39^{**}	*EMU 11*	0.49^{***}	*EMU 11*	0.47^{***}
	(2.55)		(3.40)		(3.19)
EMU 12	0.18	*EMU 12*	0.26^{*}	*EMU 12*	0.22
	(1.09)		(1.65)		(1.41)
EMU21	0.50^{**}	*EMU21*	0.56^{***}	*EMU21*	0.61^{***}
	(3.08)		(3.54)		(3.87)
Obs	2171		2234		2234
R^2	0.78		0.78		0.78

Notes: Robust |t-values| in parenthesis, Fixed effects and EU entry dummies not reported. Splines are used to control for time as year effects. *,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

Table C2

Dependent variable: Log Inward FDI, Heckman two step estimations

Regressors *Gravity*		Regressors *CMM*		Regressors *BDH*	
$\log Y_i$	1.29	$\log Y_{sum}$	2.99	$\log Y_{sum}$	3.58*
	(0.64)		(1.56)		(1.92)
$\log Y_j$	1.12	$\log Yd^2$	0.019	$\log Yd^2$	−0.08
	(0.85)		(0.11)		(0.40)
$\log Stock_j$	−0.05	skd	0.28*	$\lvert skd\rvert$	−0.28
	(0.31)		(1.74)		(0.96)
$\Delta Stock_i$	0.0003	$skd * Yd$	$4.4e^{-8}$	$\log\lvert skd\rvert * \lvert Yd\rvert$	0.19
	(0.12)		(0.81)		(0.97)
$Tradec_i$	0.0002	$Tradec_i$	−0.001	$Tradec_i$	0.0001
	(0.05)		(0.21)		(0.02)
$Tradec_j$	0.0008	$Tradec_j$	0.001	$Tradec_j$	0.0004
	(0.26)		(0.40)		(0.16)
REX_i	0.003	$Invc_i$	−0.14	$Invc_i$	−0.21
	(0.36)		(0.32)		(0.45)
REX_j	0.004	$Tradec_j * skd^2$	0.0001	$Tradec_j * skd^2$	0.0002
	(0.52)		(1.10)		(1.25)
EMU 11	0.46*	*EMU 11*	0.45*	*EMU 11*	0.41*
	(1.91)		(1.94)		(1.82)
EMU 12	0.197	*EMU 12*	0.26	*EMU 12*	0.24
	(0.86)		(1.14)		(1.05)
EMU21	0.71***	*EMU21*	0.68**	*EMU21*	0.70***
	(2.67)		(2.55)		(2.69)
Obs	2097		2124		2124
$Wald - \chi^2$	1891		1875		1928
$Mills - \lambda$	−2.05		−2.07		−2.04
First step probit					
c	0.76***		0.77***		0.77***
	(21.75)		(22.15)		(22.15)
$Fdiin$	0.001***		0.001***		0.001***
	(11.60)		(11.57)		(11.57)
$LR - \chi^2$	223.4		221.9		221.9

Notes: |z-values| in parenthesis, Fixed effects and EU entry dummies not reported. Splines are used to control for time. *,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

Tables C1 and *2* try to address issues of skewness and kurtosis in the data by logging the non-index variables. However, this is not without problems. Firstly we loose information by deleting all FDI that are negative due to disinvestment. This might not be a serious issue though, since even if we drop the negative data and run the regressions in levels the results do not change. Secondly, as we can see from the Tables, variables that are deemed crucial FDI determinants simply do not matter anymore. Moreover, the EMU dummies continue to be significant and positive but have really large values. A note is due to the Heckman two-step approach. First, it relies heavily on having the correct model in order to be estimated and the above results indicate strongly that this is not the case, the results do not change if we use the explanatory variables as the first step probit. Second, the Heckman selection model is used if there is an issue of selection, i.e., whether to make an investment or not and subsequently to investigate the magnitude, which is not a question we try to answer here. All these results in conjunction tends us towards the conclusion that the issue of skewness and kurtosis is not a primary one. It is rather that no model is correctly specified in order to address the issue and it is most probable that we suffer from omitted variables. This gives perhaps an additional dimension on the importance of developing and testing alternative theories as well as empirical specifications concerning the location of FDI.

Table D1: EMU effect over time, changing starting date.
Dependent variable: Inward FDI

	EMU starting date:					
	1993	1994	1995	1996	1997	1998
EMU 11	−0.01	−0.003	0.02	−0.01	0.02	0.08**
	(0.11)	(0.04)	(0.19)	(0.16)	(0.42)	(2.24)
EMU 12	0.12	0.04	0.014	−0.02	−0.01	0.03
	(0.95)	(0.66)	(0.25)	(0.37)	(0.25)	(0.58)
EMU 21	−0.06	−0.04	−0.01	0.001	0.02	0.06
	(0.40)	(0.55)	(0.10)	(0.01)	(0.39)	(1.50)

Notes: Robust |t-values| in parenthesis.

*,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

Table D2: Time sensitivity
Dependent variable: Inward FDI

	Sample starting at:			
	1993	1994	1995	1996
EMU 11	0.167***	0.169***	0.174***	0.178***
	(3.77)	(3.39)	(3.55)	(3.29)
EMU 12	0.08*	0.08*	0.09*	0.08*
	(1.91)	(1.78)	(1.89)	(1.66)
EMU 21	0.12***	0.12***	0.13***	0.14***
	(2.70)	(2.55)	(2.73)	(2.63)

Notes: Robust |t-values| in parenthesis.

*,** ,*** denote significance at the 10-, 5- and 1 %-level respectively.

Tables D1 and *D2* simply confirm the time sensitivity analysis obtained by 'eye-ball' econometrics from *Figure 4*. By changing the date of the euro creation dummy and running our gravity style regression again, we can observe the significance of the dummy variables. If we truly capture a euro effect, we should observe a jump around the formal creation in 1999. For example, Micco et al. (2003), Flam and Nordström (2003) find that for trade, the euro has been anticipated and positive results start to show in 1998. The results displayed are the post estimation elasticities of the EMU variables. Also, the time aspect of the robustness check also requires a shortening of the time period prior to the EMU in order to check that the estimated effects are not obtained due to any sample selection bias. The elasticities of the EMU variables obtained from the regressions, where the pre-euro time period is shortened, are stable in terms of significance, with a slight inflation when the pre-EMU period is shortened.

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