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Did the euro change the nature of FDI flows among member states?

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Abstract

In this paper we investigate the impact of the euro integration process on the drivers of FDI inflows. We show theoretically and empirically that the single currency alters the drivers of FDI inflows across its Member States. Estimating bilateral gravity models of FDI inflows into euro area countries, we show that the euro facilitates intra-euro area vertical FDI flows but reduces incentives for horizontal or market seeking FDI. Instead, horizontal FDI flows stemming from investor countries located outside the monetary union increase. Such flows are however not more likely be directed towards euro area countries with larger domestic markets but rather to countries that are close to large euro area markets and that have higher quality institutions. Overall, these results suggest that while the euro has been beneficial to FDI inflows into the monetary union, the impact differs significantly across countries. The global financial crisis does not change our main findings. Our results are robust to various economic specifications.

Keywords: Foreign direct investment, euro, economic structures, institutions, euro area countries.
JEL codes: F21, F23, F45, O43

Non-technical summary

Foreign Direct Investment (FDI) represents a key source of external financing. It helps countries to enter new markets (horizontal FDI) or to outsource part of their production chain (vertical FDI). FDI facilitates convergence towards higher GDP per capita and supports technology diffusion that, in turn, underpins productivity growth and job creation. In view of the positive nature of FDI for development, growth and employment it is essential for countries to understand which factors drive investors' decisions to invest in certain locations but not in others.

FDI plays a particularly important role for the euro area. In 2016, the total inward FDI stock stood at around 47 percent of euro area GDP, compared to a total inward FDI stock of 34 percent of GDP in the United States and 3 percent in Japan. In view of its relevance for the euro area, it is important to understand which factors determine the inflow of FDI across Member States and what role the introduction of the single currency has played.

A number of studies already exist that aim to quantify and determine the impact of the euro on FDI flows. However, these studies have focused on the impact for the euro area as a whole. By contrast, to our knowledge, to date, no study has assessed whether and how the euro introduction affected the drivers of FDI inflows among Member States, i.e. the locational choice among the countries. In addition, we also contribute to the literature by considering a wide range of FDI flow determinants, including the quality of institutions and economic structures. The importance of such factors, while often analysed as drivers of FDI in emerging market economies, have been lesser studied for euro area countries. Finally, we also use a larger sample compared to previous studies to analyse the impact of the euro, looking at more than 30 decades of data, of which 15 years of observations cover the post-euro period.

We start our analysis by considering the impact of the euro introduction on FDI flows according to a theoretical model. The model suggests that the euro adoption is positive for intra-euro area vertical FDI, due to the positive effect on trade costs. However, the model also suggests that the euro may reduce intra-euro area horizontal FDI, as the single currency lowers trade costs, prompting firms to export instead of opening plants in other euro area Member States. In terms of FDI stemming from countries outside the monetary union the model results show that the greater integration of the euro area market makes it more attractive to have a production platform inside the euro area.

Empirically, we test the model hypotheses by estimating a gravity model of bilateral FDI inflows over the period 1985-2016. Our empirical results provide support for the theoretical model outcomes. For intra-euro area FDI flows, we find that following the introduction of the euro, factors such as relative unit labour costs and fixed costs of doing business (i.e. institutions and economic structures) gained prominence, thereby pointing to an increased

relevance of vertical FDI. By contrast, horizontal or market seeking FDI motives became less relevant among euro area countries. For investors outside the monetary union, we find that the proximity to large euro area markets and the country specific fixed cost (such as the institutional quality and the cost of doing business) became more relevant.

Finally, we show for both intra- and extra-FDI inflows, that on aggregate any potential negative impacts of the single currency introduction on FDI are outweighed by the positive effects.

Our results are robust to various economic specifications and to the inclusion of a comprehensive set of controls, including investor country, host country, bilateral and time fixed effects. The global financial and sovereign debt crises do not affect our results.

Taken together, our results confirm the euro's pro-FDI effects on aggregate. However, the benefits could differ significantly across countries. Countries with better functioning institutions, lower unit labour costs or a geographic location closer to the largest euro area markets have benefited most. By contrast, for countries with weak institutions or high unit labour costs, the euro introduction may have actually reduced FDI inflows. These results would stress that to reap fully the benefits of the euro as regards FDI inflows, countries need to pay attention to the evolution of their costs competitiveness and quality of their economic structures.

1 Introduction

Foreign Direct Investment (FDI) represents a key source of external financing for the euro area. In 2016, the euro area total inward FDI stock stood at 5.6 trillion USD, or 47 percent of euro area GDP. This contrasts with a total inward FDI stock of 34 percent of GDP in the United States and 3 percent in Japan.

In recent years, attracting FDI inflows into the euro area has however become increasingly challenging. After the strong FDI inflows during the 1990s (with the creation of the Single Market and ahead of the creation of the monetary union, see Shatz and Venables (2000))[1] the euro area has been losing importance as an investment destination, a trend which is continuing up to this day.[2]

From a theoretical point of view, determining whether a country or an area is an attractive investment destination for a firm is relatively straightforward: firms choose the investment location that entails the highest expected profitability, i.e. either because it minimizes the cost of production (including reducing the riskiness of the investment) and/or maximises the expected return. In this regard, the literature has put forward a number of host country advantages that could be considered to either lower the cost of production or increase the expected return. These include inter alia:[3] a large-sized market or a market with high potential (i.e. high growth or high GDP per capita); low relative factor prices (i.e. natural resources, labour cost, and human capital); high trade openness[4] and the existence of a common trade policy framework; macroeconomic stability (such as a stable exchange rate, low inflation and low debt); tax benefits or a low tax rate; sound institutions and a stable political system.[5]

[1] Shatz and Venables (2000) refer inter alia to the work of Barrell and Pain (1997) who report that UK and German investment to the rest of the EU from the 1980s through 1992 rose sharply in those sectors that previously had the highest barriers to cross-border market entry.

[2] Note that total FDI inflows into the euro area have not declined; however an important share of the recent FDI inflows into the euro area stem from financial roundtripping and Special Purpose Entities (SPEs). Excluding these flows to arrive at a measure of "genuine" FDI would show that the euro area is losing importance as an investment destination.

[3] See Antonakakis and Tondl (2012) for a detailed overview of the existing literature analysing the importance of all these host country characteristics. The most widely-known and cited framework in this regards is the OLI-framework as developed by Dunning (1993); whereby OLI stands for Ownership, Location and Internalisation advantages. Locational advantages relate to the country-specific advantages that the firm gains when investing abroad. Internalisation advantages relate to the production kind of activities undertaken by the firm itself rather than licensing them to another party. Ownership advantages may include firms superiority over its competitors in terms of marketing practices or on the technological front (see Alam and Shah (2013)).

[4] Note that ex ante it is not clear whether FDI flows and trade flows act as substitutes or complements. Both the theoretical and empirical literature remains inconclusive. However, for the EU, Martinez et al. (2012) have found that EU commercial integration and FDI reinforce each other. This effect is apparent for both intra and extra-EU FDI.

[5] Good quality institutions are widely seen to help attract FDI as they reduce the riskiness of investment and thereby reduce the cost of doing business. However, some of the recent literature in international trade has argued that a firm may choose to engage in FDI as a mode of entry as opposed to outsourcing because of the hold-up problem (Antras (2003)), in which case higher FDI would be associated with lower institutional quality.

While there exists a vast literature on the drivers of FDI inflows across a large range of countries, to date no study exists that focuses on whether and how the euro affects the drivers of FDI inflows *across* Member States. The existing studies have instead analysed the impact of the euro on FDI inflows into the monetary union as a whole. The consensus emerging from this literature is that the euro has been pro-FDI, in particular as regards intra FDI flows, i.e. flows among monetary union countries (see Baldwin et al. (2008) for a review of the earlier literature and Stojkov and Warin (2018) for a more recent study).[6]

In more details, Baldwin et al. (2008) and Neary (2009) suggest that the Single Market programme and the euro adoption should be positive for intra-euro area vertical FDI (due to the pro trade effects of the Single Market integration and euro adoption) but should discourage intra-euro area horizontal FDI (as the single currency and Single Market integration reduce trade costs). Empirically, the positive effect appears to dominate as shown inter alia by DeSousa and Lochard (2011). Baldwin et al. (2008) also conclude that the euro stimulates vertical FDI based on the observation that the euro's pro-FDI effect was much larger in manufacturing than it was in services (see also Coeurdacier et al. (2009)). As regards FDI stemming from countries outside the monetary union, Baldwin et al. (2008) and Neary (2009) would argue that the greater integration of the Eurozone market might make it more attractive to have a production platform inside the Eurozone. Empirically, this is confirmed by Petroulas (2007) who finds also a pro-FDI euro effect for flows stemming from investor countries outside the monetary union. However, this effect was found to be smaller than for intra-euro area FDI.

While these studies focus on the aggregate euro area impact of the Single Market integration and monetary union creation, to date, no study has looked into the impact this may have had on firms' locational FDI choices between the Member States of the monetary union. There are however good reasons to expect that the drivers of FDI inflows into monetary union Member States could be affected by a country's entry into the Eurozone.

In this paper, we aim to fill this gap in the literature by analysing from both a theoretical and an empirical perspective how the single currency changes the drivers of FDI inflows across monetary union countries. We start by showing conceptually in a simplified theoretical framework how the introduction of a common currency might alter the drivers of firms' FDI decisions - both for investor firms located outside and inside the monetary union. We then test the theoretical model outcomes empirically by estimating gravity models of bilateral FDI flows over the period 1985-2016. In addition, we also add to the literature by analysing the impacts on a very long data sample, namely over 30 years of which more than 15 years are in the post-euro introduction period. Finally, we also consider in our gravity model the role of institutional quality and economic structures. The importance of such factors, while often

[6] One exception to this literature is Taylor (2008) who finds that the euro was negative for intra-zone FDI. The author did find that FDI inflows from major economic areas did increase following the euro introduction.

analysed as drivers of FDI flows in emerging market economies, have been lesser studied for euro area countries.

Our empirical results provide support for the theoretical model outcomes. For intra-euro area FDI flows, we find that following the introduction of the euro, factors such as relative unit labour costs and fixed costs of doing business (i.e. the quality of institutions and economic strucures) gained prominence, thereby pointing to an increased relevance of vertical FDI. By contrast, motives for market seeking intra-euro area FDI tend to decline. This stands in contrast to FDI flows from investor countries outside the monetary union. However, the locational choice of FDI for investors from outside the monetary union is not so much driven by the domestic market size, but rather by the proximity to large euro area markets and the host country's fixed costs (such as the institutional quality and the cost of doing business).

We show that, for both intra- and extra-FDI flows, the negative impact of the single currency introduction on FDI is outweighed by the positive effects so that the overall impact of the euro introduction on FDI inflows has been positive.

Our results are robust to various economic specifications and to the inclusion of a comprehensive set of controls, including investor country, host country, bilateral and time fixed effects. The global financial and sovereign debt crises do not affect our results.

Taken together, these results confirm the euro's pro-FDI effects on aggregate. However, our results also suggest that the benefits differ significantly across countries. Countries with better functioning institutions, lower unit labour costs or a geographic location closer to the largest euro area markets benefited most. In contrast, for countries with weak institutions or high unit labour costs, the euro introduction may have reduced FDI inflows. These results would stress that to reap fully the benefits of the euro as regards FDI inflows, countries need to pay attention to the evolution of their cost competitiveness (among others its unit labour costs) as well as the quality of their institutions and economic structures more generally.

The remainder of the paper is organized as follows. Section 2 presents a conceptual framework that illustrates why the euro[7] could alter the drivers of FDI inflows. Section 3 introduces the data and empirical strategy applied in our analysis, Section 4 presents the main results, while Section 5 presents some robustness analysis. Section 6 concludes.

2 FDI in a monetary union: conceptual framework

The EU's Single Market programme and the subsequent introduction of the single currency have altered commercial realities in the euro area by lowering the cost of business, reducing

[7]Note that in the remainder of the paper when we refer to the impact of the euro on drivers of FDI, this refers to the euro adoption but also potentially to the Single Market integration. Both euro adoption and the Single Market integration are expected to impact FDI flows and drivers through similar channels: namely by lower the transaction and trade costs and by facilitating the movement of capital.

transaction costs and facilitating the movement of capital. All these elements should make it easier for firms based in one euro area country to compete in other euro area countries, in turn potentially changing the weight attached to the various factors determining firms' FDI decisions.

To conceptualize our thinking on how integration could affect FDI decisions for these various groups, we draw on Baldwin et al. (2008). This analysis is in turn based on the Heterogeneous Firms (henceforth HF) model of Helpman et al. (2004) and Melitz (2003). In the model, it is assumed that there is one sector which produces a homogeneous product while H sectors produce differentiated products. In each of the differentiated goods producing sectors, it is assumed that there is a continuum of horizontally differentiated varieties and preferences across varieties have the standard Constant Elasticity of Substitution (CES) form, while the market structure is monopolistic competition. In that case, the equilibrium price for each variety is a constant mark-up over marginal cost and firms' relative output and revenues depend solely on their relative productivities.

Concretely, in the domestic market (closed economy), if φ represents a firm's productivity and σ the elasticity of substitution, then the operating profits for serving a market would be:

$$\pi = B(\varphi)^{(\sigma-1)} - F \tag{1}$$

Whereby F represents the firm's fixed cost and B equals

$$B = \frac{(1-\alpha)A}{\alpha^{1-\sigma}} \tag{2}$$

Where A is the demand level which is exogenous from the point of the individual supplier and $\frac{1}{\alpha}$ represents the mark-up factor. In this set-up, the decision of the firm whether or not to operate in the market is determined in two steps. In the first step, the firm observes its level of productivity (φ) and determines its optimal level of production ($B(\varphi)$). On this basis, in the second step, the firm would decide whether this is sufficient to cover the fixed cost (F) and thus whether or not to enter the market. Overall, in this HF model we therefore find that less competitive firms will not enter the market, whereas more competitive firms will sell more and make a higher operating profit in any given market.[8]

Allowing for costly international trade in this set-up would imply that, any firm in country i wishing to operate in country j would gain additional profits from exporting in country j

[8]The HT model assumes that firms are heterogeneous in terms of their competitiveness. Different firms can thus look at the same two-step problem and come to different conclusions. In equilibrium, big, competitive firms will enter the market; smaller, less competitive firms will not.

(assuming that B^i equals B^j):

$$\pi^{ij} = B\tau_{ij}^{1-\sigma}(\varphi)^{(\sigma-1)} - F_x \tag{3}$$

But exporting firms will face a higher fixed cost (F_x) compared to the domestic production fixed cost (F) as exporting firms face an additional *market access* or *beachhead* cost that does not vary with export scale but exceeds the domestic costs (see for instance Baldwin et al. (2008).[9] In addition, exporting firms also face a variable transport cost (τ_{ij}), which is assumed to be of the iceberg type such that $\tau_{ij} > 1$ units must be shipped from country i to country j for one unit to arrive in country j.

Instead of exporting, a firm can also decide to serve the foreign market j by setting up a local plant in country j. In this case the firm's additional profits from serving country j would be:

$$\pi^{ij} = B(\varphi)^{(\sigma-1)} - F_i \tag{4}$$

Assuming that the firm's productivity would be the same in country i and country j, the main difference in profits would relate to the higher fixed cost (F_i) that the firm would face when setting up a plant in country j.

Visually, the firm decision is illustrated graphically in the left hand side chart of Figure 1. The chart shows the relationship between profits π and productivity φ. In the chart, firms are organized in order of increasing competitiveness, along an upward sloping solid line, denominated π_d for the domestic market, π_x for the foreign market through export and π_i for the foreign market through FDI. In this set up, we find that firms below a_1 will not serve the foreign market while firms in the range (a_1-a_2) will decide to export, and those above a_2 will serve the foreign market through local production (FDI).

In the following two subsections we analyse how the euro would alter the threshold decisions for FDI for investors from non-monetary and from monetary union countries.

2.1 Impact of euro adoption on FDI decisions of non-monetary union countries

Using this model framework, we can analyse how the euro adoption alters locational and trade decisions for firms outside the monetary union. We study only the case of horizontal FDI as the euro adoption should in our model framework not alter the locational decision for vertical FDI in case the parent company remains outside the monetary union. 'Vertical' FDI means that the FDI-generating firm is engaged in a process in a facility located at home that is

[9] The market access cost can be seen as including for instance distribution, advertising and conforming to regulation costs.

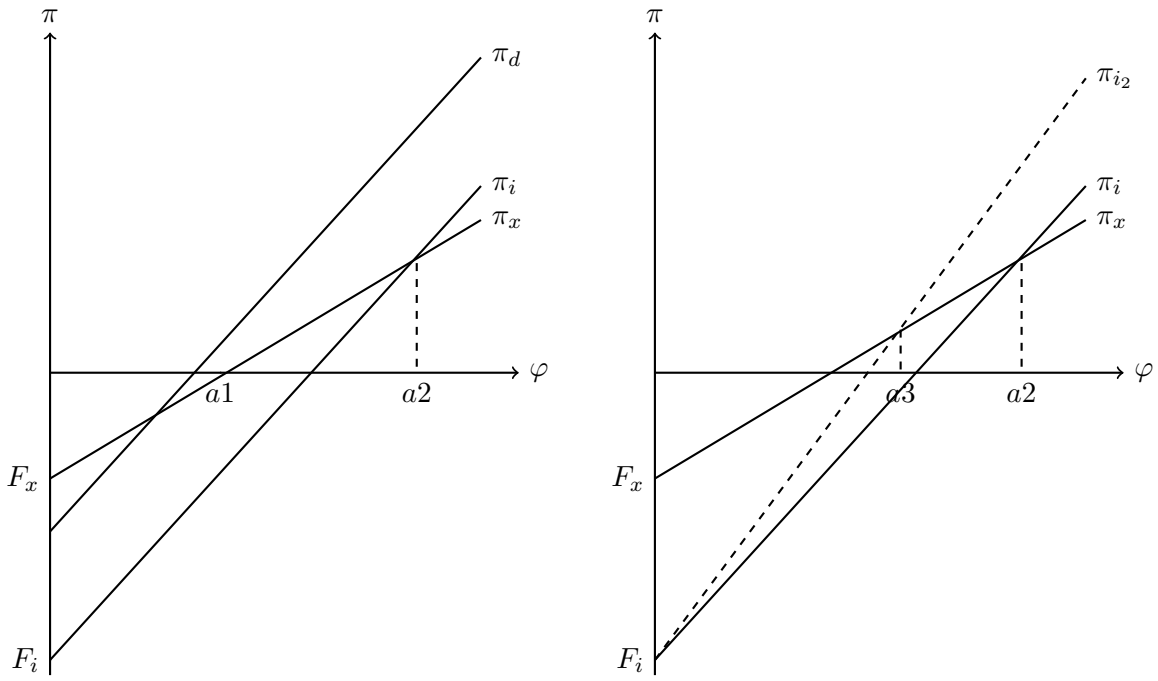

Figure 1: Impact on export versus FDI decision of integration for non-monetary union countries

different from the process in the facility located abroad. Vertical FDI would, in a first step, not be expected to be affected by the monetary union as integration only lowers trade barriers *between* monetary union members and not between monetary union and non-monetary union member countries. Note that vertical FDI contrasts with the concept of horizontal FDI. The latter means that the firm doing the FDI is making the exact same good in one factory located in the home market and in another factory located in the foreign market.

The impact of euro adoption is visually illustrated in the right hand side chart of Figure 1. First, for firms outside the monetary union, we should not expect any impact on their export profile line (π_x) as it does not change their trade costs. However, it should affect the FDI profit line (π_i): any local plant would benefit from the reduction in trade costs inside the union. Neary (2009) calls this the *export platform gain*. In this case, the decision whether or not to set up a new plant depends not only on the size of the host-country market but also on the size of the trade-cost-adjusted market which can be served from that plant. In our presented set-up, firms that sell most initially (i.e. the most competitive) would see their sales and profits rise the most. As a result, π_i steepens. Figure 1 clearly illustrates the consequence of this change: horizontal FDI from firms outside the monetary union increases following monetary integration: firms located in the range (a_2-a_3) would now prefer to rely on FDI rather than export to serve the countries in the monetary union. However, besides the amount of FDI, the Single Market integration and euro introduction could also be expected to affect

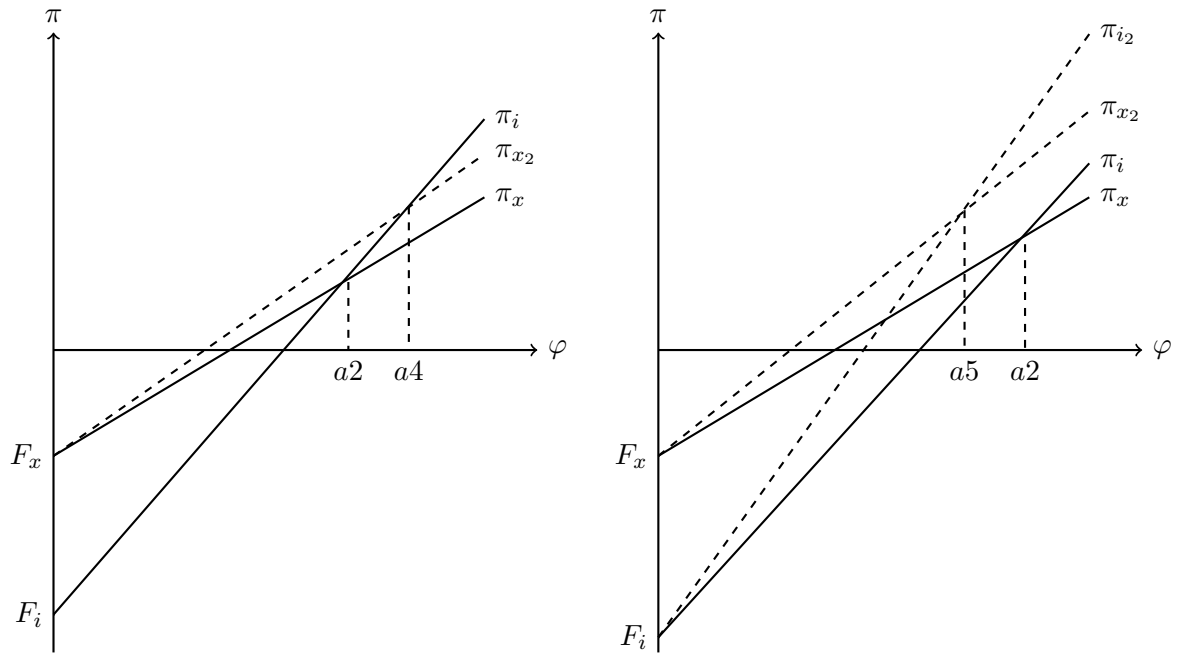

Figure 2: Horizontal (LHS) versus Vertical (RHS) FDI responses to integration for monetary union countries

the locational choice for FDI inside the monetary union as indicated by Neary (2009). First, whereas potentially prior to the monetary union, a firm may have decided to locate in both locations, it is now more likely to serve both markets from a single location and consolidate. In terms of the locational choice for this consolidated plant, we could expect that rather than domestic market size, the trade-cost-adjusted market that can be served from the plant will become the relevant factor. Moreover, other factors, which could have a bearing on the fixed and marginal costs (i.e. costs of doing business, legal system) can also be expected to become more relevant.

2.2 Impact of monetary union on FDI decisions of monetary union countries

Next, we look at the euro impact on FDI stemming for firms operating inside the euro area. In contrast to firms operating outside the euro area, which continue to face trade barriers when moving goods inside the monetary union, the integration of monetary union member countries will lower trading costs. In the context of our illustration, this means that our export profit line (π_x) rotates upwards to π_{x_2}.[10] This is illustrated in Figure 2.

The impact on the FDI profit-line (π_i) will however depend on the type of FDI: vertical versus horizontal.

[10]To the extent that the euro lowers beachhead costs (i.e. fixed market entry costs), the export profit-line would also shift upwards, however this does not alter fundamentally the conclusions.

In the case of horizontal FDI, the FDI profit-line is unchanged. Lowering trade and transaction costs would have no impact on the marginal or fixed costs of the FDI operations in the union. The overall impact of integration is therefore shown in the left hand side chart of Figure 2: integration would increase exports (as the export threshold shifts from a_2 to a_4), while reducing horizontal FDI, as now only firms above a_4 would opt for FDI.

This is different for vertical FDI, as shown in the right hand side chart of Figure 2. In this case, lower trade costs imply that both curves rotate since also vertical FDI involves trade. More precisely, π_i is expected to rotate even more than π_x. This happens as vertical FDI involves the off-shored production of a component that is then re-imported to the home nation to be incorporated into the final good that is then again exported. In such case of unbundling, FDI involves more trade than the bundled production alternative; in both cases, the final good is exported but with unbundling FDI, there is the additional trade in components (see Baldwin et al. (2008)). If the lower trade costs have a bigger impact on the profitability of vertical FDI, the new threshold of exporting when production is bundled (i.e. no FDI) and exporting with unbundled production shifts to the left. This means that the euro will raise the level of FDI (in our chart the range between a_2-a_5 represents the increased FDI). Moreover, the impact will be largest on first timers, i.e. the firms that were competitive enough to export, but not quite large enough to make offshored production profitable.

2.3 Conclusion

Taken together, conceptually we should thus expect that the euro alters the drivers of FDI flows inside the monetary union. Concretely, intra-euro area vertical FDI flows would increase, while intra-euro area horizontal FDI flows become relatively less important. Instead, horizontal FDI from extra-euro area countries increases. However, we should expect consolidation of firms and that the locational choice becomes more driven by the geographical location, with the trade-cost-adjusted market that can be served from a country becoming the more relevant driver. Moreover, marginal and fixed cost factors of the host country vis-a-vis the other Member States can also be expected to become more important.

3 Empirical analysis: FDI gravity model

To empirically test the impact of the euro on the drivers of FDI flows into monetary union countries, we rely on a gravity model of bilateral FDI inflows. This approach has the advantage that it allows us to test within one comprehensive framework the main hypotheses developed in Section 2.

Traditionally, gravity models have been used to explain bilateral trade between countries (see for instance Linnemann (1966)). The original gravity equation indicates that the amount of

trade flow between two countries increases with their economic size and decreases as transport costs rise, whereby transport costs are proxied by the distance between the economic centers of the two countries. More recently, gravity models have also been applied to bilateral FDI flows (see for Wei (2000), Benassy-Quere et al. (2007), or Stein and Daude (2007)). The use of the gravity model in explaining FDI flows is supported theoretically. As for trade flows, where several radically different theoretical models have been shown to yield gravity-like predictions, the main explanatory theories of FDI flows yield a gravity equation. In this context, Kleinert and Toubal (2010) have shown that the FDI gravity model is consistent with a variety of different models of multinational firms. As a result, the gravity model can be seen as a very robust econometric prediction for both flows of goods and capital.

In our set-up we rely on the gravity model to understand whether the drivers and the direction of FDI inflows into monetary union countries have changed since the introduction of the single currency. In particular, we focus on whether horizontal and/or vertical FDI have become more prominent and whether the role of fixed cost factors (which we proxy by a number of structural and institutional indicators) has changed. As the theoretical model shows that the single currency has different effects depending on whether the investor is located inside versus outside the monetary union, we empirically estimate two sets of gravity models: one where we focus only on the flows inside the monetary union and one where we focus on the inflows into host monetary union country whereby the investor country is located outside the monetary union.[11]

3.1 Methodological approach and data used

In our empirical specification, we estimate the following gravity equation:

$$y_{ih,t} = \alpha_i + \alpha_h + \alpha_{ih} + \alpha_t + \beta_1 grav_{ih,t} + \beta_2 rfe_{ih,t} + \beta_3 fc_{h,t} + emu_h + \varepsilon_{i,t} \quad (5)$$

The dependent variable ($y_{ih,t}$) is the log of the bilateral FDI inflows between investor country i and host country h at time t. As noted above, we estimate two models, one whereby both the host (h) and investor (i) countries are monetary union Member States and another model in which the host is a monetary union Member States but the investor is located outside the monetary union. In terms of the country coverage for the non-monetary union members, we focus in our analysis on OECD countries and construct a panel of annual bilateral FDI inflows series for 23 OECD countries over the period 1985-2016. A detailed description of the

[11] Note that an alternative approach would be to estimate one single gravity model which combines the FDI flows stemming from non-monetary union countries with those from monetary union countries. We decided against this approach as the relevant determinants differ between non-monetary and monetary union countries. For instance the trade-cost-adjust market is only a determinant for FDI flows stemming from non-monetary union countries. Moreover, having triple interaction terms in the estimated model may complicate the interpretation and representation of the results.

data can be found in Appendix A. More details on the FDI data and country selection are also provided below in Subsection 3.1.1.

In terms of the explanatory variables, we include in our analysis the traditional gravity variables ($grav_{ih,t}$), namely the size of the host and investor country which we proxy by the (log of the) GDP in USD. We also include a distance variable[12], a common language and a contiguity dummy. Whereas the distance variable serves as a proxy for transportation, transaction or, more generally, information costs, the two dummy variables are designed to capture cultural factors that could strengthen the international financial and trade linkages between countries, for instance through network externalities. In addition we also consider the degree of trade openness of the host and investor country as explanatory variables. Such variables can act as a proxy for the general willingness of a country to engage in international trade and international financial transactions.

It should be noted that, in contrast to the trade literature, the expected sign and significance of a number of the traditional explanatory variables in the gravity model are non-trivial. As regards distance, whereas in trade models, a larger distance is unambiguously negative, its impacted on FDI is ex ante unclear, because transportation costs interact with economies of scale (see Benassy-Quere and Fontagne (2005)).[13] As regards market size, the sign is expected to be positive for the investor country, because large countries have a greater potential than small countries for investing abroad. However, the effect of the host country size is ambiguous: whereas in the case of horizontal FDI, the expected sign is positive, it should be irrelevant in the case of vertical FDI, which is endowment oriented (see for instance Kleinert and Toubal (2010)). In addition, whereas in a trade gravity model, the choice of GDP as the proxy for market size of the host country is rather straightforward, it is less obvious in the case of FDI. It could be argued that the market concept should be wider in the case of FDI compared to trade: the markets of foreign affiliates often reach beyond the host country and extend at least to neighboring countries. This could hold particularly in integration areas, such as the EU/euro area (in line with the point raised in Section 2 and as elaborated in Neary (2009) who refers to this point as *export-platform FDI*). For this reason, we consider in our analysis an alternative proxy for the market size, which is based on the size of the trade-cost-adjusted market concept. To proxy empirically for the trade-adjusted-market we based ourselves on Benassy-Quere and Fontagne (2005)[14] but we translate it to the monetary union level. Concretely, we construct

[12] To measure the distance between the host and investor country we take the log of the "as the crow flies" distance between the countries' capitals.

[13] Concretely, when FDI and trade act as substitutes, then a large distance between the host and investor country will increase FDI at the expense of trade. Instead, whenever FDI inflows also involve additional trade flows, and FDI and trade are hence complements, then distance can be seen as detrimental to FDI.

[14] In their paper the authors measure the market potential of a country as the log of the ratio of the GDP of the host country to its average internal distances.

for each monetary union host country a distance weighted GDP index:

$$mpot_{h,t} = ln(\sum_{j=1}^{k} \frac{GDP_{j,t}}{dist_{h,j}}) \tag{6}$$

whereby k equals the total number of monetary union countries. As such, the assumption in this proxy for the trade-adjusted-market concept is that trade costs increase with distance and hence that markets which are further away get a lower weight in the measure.

Besides the traditional trade model gravity variables, we also look into some of the *new* theories of FDI, and therefore also include endowment related factors ($rfe_{ih,t}$) in our gravity equation. This is based on the premise that FDI may be motivated by finding lower cost locations and would allow us to test the relevance of vertical FDI. To proxy for this, we include the relative labour cost of the host to investor country in our analysis (i.e. $\frac{ulc_h}{ulc_i}$).

In addition, we include in our gravity model a number of variables that could proxy for the host country business costs ($fc_{h,t}$) that relate to the quality of institutions and the framework conditions for doing business. As it is not straightforward to measure such fixed costs of doing business in the host country (see for instance for a more detailed discussion on this Benassy-Quere et al. (2007) and Dellis et al. (2017)), we consider in our analysis not one but rather a range of institutional and structural measures. Our main constraint was that the series should be available for a wide range of countries and over a sufficiently long time period.[15] Based on these criteria, we included in our analysis: the OECD's Employment Protection Legislation (epl) indicator, the Economic Complexity Indicator (eci) as developed by Hildago and Hausmann, the Heritage Foundation's Economic Freedom indicator ($ecfree$) and the World Bank's World Governance Indicator (wgi), Appendix A provides more details on these variables.[16]

Finally, as we are interested in the impact of the euro on the FDI flows, we also include a dummy variable ($emu_{h,t}$) that takes the value 1 when the host country is a monetary union Member State at time t, and zero otherwise. For the gravity equation with monetary union host countries on the left side, given the length of the sample, this means that the dummy equals to a time dummy that measures the different behaviour of FDI flows once a country enters the monetary union. To understand how the impact of the euro differs depending on the main drivers of FDI, we allow in our regression also for an interaction between the EMU dummy and some of the other explanatory variables. Concretely, we interact the EMU dummy

[15] Given the short time length or limited number of observations, we did not use some of the often-used structural indicators, such as the World Bank's doing business indicators or the OECD's product market regulation indicator, in our analysis.

[16] We also tested in our analysis the significance of other possible control variables which are sometimes in the literature considered as relevant. This includes inflation and the tax rate differential (on the latter see for instance Benassy-Quere and Fontagne (2005)). Yet, none of the above-mentioned variables were statistically significant in any of our regressions.

with the log of the host country GDP and with the relative unit labor costs respectively. This allows us to understand whether the role of horizontal and/or vertical FDI has changed due to the euro introduction. To understand whether the importance of fixed costs has changed, we also interact the institutional and structural features of the host country with the EMU dummy.

In our analysis we however face a number of challenges, which are discussed below. Concretely, they relate to the choice of FDI data, methodological issues and the approach to measuring the euro effect.

3.1.1 Data issues: FDI data

Our dependent variable is the aggregate FDI inflows in line with several papers in the literature (e.g. Wong and Tang (2011), Trevino and Mixon (2004), Campos and Kinoshita (2008)). We prefer FDI flows from the balance of payments to using stock data or to using plant level micro data. Indeed, although the latter is subject to smaller measurement errors, its cross country availability is more limited. In addition in our analysis we focus on inflows rather than stocks as stocks can suffer from discrepancies between original book and market value as the value of firms and FDI stocks change (Contessi and Weinberger (2009)). This makes their inter-temporal comparison problematic.

As in any empirical analysis, an accurate measurement of the variable to be explained is essential. Traditionally, the accurate measurement of FDI has proven to be particularly difficult. Stojkov and Warin (2018) for instance note the large statistical discrepancies between the various official FDI data series. Moreover, more recently, the significantly changing landscape of corporate legal forms and financial accounting, have made it even more difficult to accurately measure "genuine" FDI and to correctly match the origin of the direct investor to the direct investment recipient country. Lane and Milesi-Ferretti (2017) document that the continuous expansion of cross-border FDI positions in the aftermath the Global Financial Crisis (which contrasts with positions in portfolio instruments and other investment) is primarily explained by FDI positions vis-a-vis financial centers, which include an important role for so-called Special Purpose Entities (SPEs). While some of these FDI flows could represent a "genuine" financial integration, they are to a large degree likely also reflecting multinational corporate structures or the domicile of investment fund vehicles. The role of such SPEs is particularly relevant for the euro area, with a number of countries (such as Luxembourg, the Netherlands, Austria and Ireland) all having sizable FDI claims and liabilities by SPEs.

Unfortunately, to date no bilateral FDI data adjusted for the the role of financial roundtripping and special purpose entities (SPEs) exist. Such series are currently only available for aggregate data. Dellis et al. (2017) show that mismeasurement from the inclusion of SPEs however does not fundamentally change the relation of aggregate FDI inflows and their fun-

damental drivers for advanced economies. Nevertheless, to ensure that financial roundtripping and/or SPEs do not bias our results, in this paper, we drop a number of countries from our sample for which it has been documented that the size of these SPE-related flows relative to the total FDI flows could be large, namely: Ireland, Luxembourg, Hungary, Iceland, Estonia, Korea and Chile.[17]

3.1.2 Methodological issues

Besides data issue, a number of methodological issues also arise when estimating FDI gravity models. Indeed, while the theoretical foundations for the gravity model are generally accepted, its empirical application to the FDI literature is not so straightforward. One challenge relates to the choice of the dependent variable. In line with the standard practice in gravity models, we take the logs rather than the levels of FDI flows as our dependent variable. This has several advantages (see Levy-Yeyati et al. (2007)): first, the log specification provides a useful normalization that reduces the weight of pairs with very large FDI flows. Second, it allows us to interpret the coefficients of our continuous variables as elasticities. Lastly, it has typically provided the best-fit in gravity equations.

However, empirically, the estimation of the log transformed gravity model has proven to be problematic. In particular, Silva and Tenreyro (2006) pointed out that due to the logarithmic transformation of the equation, the OLS estimator may be inconsistent in the presence of heteroscedasticity and non-linear estimators should be used. To overcome these issues, Silva and Tenreyro (2006) suggest that the gravity model be estimated in its multiplicative form and they suggest to use a Poisson pseudo-maximum likelihood (PPML) estimator that is usually used for count data.

Besides the estimation difficulties, taking logs of FDI is also problematic because the values can be zero or negative. To overcome this issue, ideally we want to adopt the transformation suggested by Levy-Yeyati et al. (2007) (along the lines of Eichengreen and Irwin (1995)):[18]

$$LFDI = sign(FDI) + log(1+|FDI|) \tag{7}$$

However, this transformation is problematic when applying the PPML estimator, as the

[17] Taylor (2008) finds that adjusting the euro area FDI flow series for the "Luxembourg anomaly" (where data distortions due to financial roundtripping are very sizable) can change the conclusions on the impact of the euro on FDI flow in monetary union countries.

[18] Several other approaches have been used in the literature such as excluding the observations that take a negative of zero value, or setting these observations to zero. However, both approaches are arbitrary and without a strong theoretical or empirical justification and could distort the results. (In addition, Heckman (1979) posits that if the zeros are not random, deleting can lead to loss of information; adding an arbitrary constant to the zero observations is tantamount to deliberately introducing measurement error which can lead to selection bias.) Benassy-Quere et al. (2007) instead replaced the dependent variable log(y) by log(a+y). However, this does not overcome the problem of the negative values.

estimator does not allow for negative values for the dependent variable. Hence in our estimation approach we face a trade-off between on the one hand applying a better estimation methodology but risking to introduce a bias in the results by setting non-random observations to zero and on the other hand allowing for the negative observations in our dependent variable but applying a potential biased estimator.

As a result, we consider both options. In the Section 4, we report the results from the PPML estimator and we do not apply the transformation of the FDI values, but set them to zero instead. However, in Section 5, we also report the results using the random effects estimator and transform the FDI values according to equation 7. The random effects estimator could in our case also make sense since the number of zero values in our data sample are rather limited (representing only around 5-6 % of the total number of observations).

3.1.3 Measuring the EMU effect

A final challenge in our set-up relates to capturing the euro effect in our analysis. As noted above, in our baseline regression model we include a euro dummy. However, it is not obvious that this dummy would capture solely the impact of the introduction of the common currency. Following the findings of Rose (2000) that the euro has had a large effect on trade, several papers critically reviewed the approach (see Baldwin (2006) for a review of the literature). In particular the argument was made that gravity model regressions would need to explicitly control for (unobservable) bilateral factors that can be a source of trade (in our case FDI flows) between countries and that are potentially correlated with being part of EMU. We follow this argument by adding (bilateral) fixed effects to each regression, including host country (α_h), investor country (α_h) and bilateral fixed effects (α_{ih}). In addition we also add time fixed effects (α_t). A second point sometimes made is that one would also need to control more explicitly for multilateral resistance factors, which has been identified in the literature on trade-based gravity models (see e.g. Anderson and van Wincoop (2003)). The multilateral resistance introduces the concept that costs to trade (or FDI in our case) do not only depend on the costs of trade among two countries, but also on the ratio of the barriers to trade between two countries compared to the barriers they face in their trade with all their trading partners. In Section 5, we add a robustness check in which we specifically control for this potential bias by augmenting the baseline regressions with time-varying host and investor fixed effects as well as bilateral time fixed effects.

Another difficulty in relying on a simple EMU dummy to capture the euro effect is that it might be a rather imperfect proxy of the integration process. Indeed, first, the euro introduction was not a discrete event, but rather an on-going process which started several years prior to the currency conversion and continued also thereafter (see for instance Baldwin et al. (2008) for a detailed discussion). In addition, the euro introduction can also be seen as a step within

the EU single market project (*Single Market, Single Currency*) and hence the euro adoption dummy may in fact also hide important initiatives that have happened since and in fact are still ongoing. For these reasons, we conduct a robustness check of our main results, as presented in Section 5. It involves inter alia augmenting the euro dummy by an indicator that proxies the EU integration process (in line with Baldwin et al. (2008).[19]

4 Estimation Results

4.1 FDI flows among monetary union countries

In this section we present the estimation results from the gravity model whereby we consider that both the host and investor country are Member States of the Monetary Union. The results from our gravity model are summarized in Table 4.1, columns (1) to (7). Column (1) presents the results from the simplest gravity model estimation. This is then augmented by the EMU dummy (*emu*) in column (2). Column (3) in addition also introduces an interaction term between the EMU dummy on the one hand and the host country log GDP and the labor cost of the host relative to the investor country on the other hand. Finally columns (4)-(7) augment the specification in column (3) each with one indicator that proxies for the institutional quality or framework conditions of doing business in the host country. We estimate the equation for each of the institutional indicator separately as these indicators tend to be strongly correlated with each other, and hence simultaneously including them in the estimated equation may cause multicollinearity problems (see also Dellis et al. (2017)).

Overall, the results in Table 4.1 confirm the relevance and statistical significance of the gravity factors, in line with the existing literature. Concretely, the size of the host and the investor countries are positively related to higher FDI inflows, while a longer distance between the host and investor country is associated with lower FDI flows. Sharing a common language also raises bilateral FDI flows in a statistically significant manner.[20] Moreover, a higher cost of production (captured in our regression by the relative unit labor cost of the host versus investor country) leads to statistically significantly lower FDI inflows. We also used the (relative) corporate tax rate as a proxy for higher production costs. In most of our various estimations (including the robustness checks performed in Section 5), however, the tax rate turned out

[19] It should also be noted that while we are in our paper able to compute the "euro effect" on FDI, the main focus of this paper is not to provide a precise quantification of the effect but rather to understand how the euro and the overall European integration process has affected the locational choice of FDI among monetary union Member States.

[20] Note that we also included in our regression the degree of trade openness and the dummy for sharing a common border but both were not statistically significant. For the common border dummy, this result could possibly be explained by the fact that there may be a very strong correlation between the countries that share a common language and a common border. Moreover, some of these factors may be captured by the fixed effects included in our gravity estimations.

Table 1: Gravity model estimation results for bilateral euro area FDI flows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
lgdp(h)	0.13***	0.19***	0.20***	0.34***	0.34***	0.24***	0.38***
lgdp(i)	0.52***	0.52***	0.52***	0.57***	0.57***	0.50***	0.51***
rel ulc	-0.63***	-0.63***	-0.82***	-0.62***	-0.60***	-0.83***	-0.86***
distance	-0.20***	-0.21***	-0.21***	-0.24***	-0.23***	-0.26***	-0.25***
common	0.17***	0.16***	0.15***	0.16***	0.24***	0.13***	0.16***
epl(h)				-0.41***			
eci(h)					0.70**		
ecfree(h)						0.18	
wgi(h)							0.10
emu		0.21***	0.15***	0.14***	0.11***	0.13***	0.17***
emu*lgdp(h)			-0.02***	-0.05***	-0.09***	-0.11***	-0.09***
emu*rel ulc			-0.17**	-0.29***	-0.15***	-0.17***	-0.19***
emu*epl(h)				-0.37***			
emu*eci(h)					0.06***		
emu*ecfree(h)						0.05	
emu*wgi(h)							0.06
Obs	2209	2209	2209	1982	2061	1664	1900
Fixed effects							
Time	yes	yes	yes	yes	yes	yes	yes
Host country	yes	yes	yes	yes	yes	yes	yes
Investor country	yes	yes	yes	yes	yes	yes	yes
Bilateral	yes	yes	yes	yes	yes	yes	yes

[1] Note: PPML estimation results whereby the negative FDI values were set to zero. *,** and *** represents significance at 10%, 5% and 1% level respectively.

[2] (h) stands for host country, (i) for investor country. *lgdp* is the log of GDP in USD, a proxy for the size of the host and investor countries. *relulc* is the ratio of the host to investor country unit labor cost. *distance* measures the as the crow flies distance between the capitals of the host and investor country. *common* is a dummy with value 1 in case the host and investor country share a common language. *epl*, *eci*, *ecfree*, *wgi* stand for the OECD employment protection legislation index, the index of economic complexity, the Fraser index of Economic Freedom, and an average of the World Bank governance indicators respectively. *emu* is a dummy variable that takes the value 1 when the host country is a Monetary Union Member State at time t. All variable details in Annex A.

insignificant. This is contrary to Coeurdacier et al. (2009) or Benassy-Quere and Fontagne (2005) who found that a lower (relative) corporate tax rate is associated with higher FDI inflows.[21] This result could potentially reflect that in our estimation we have dropped those countries where financial roundtripping or the role of SPEs is considered to be large (which are also the countries which coincidentally tend to have a lower corporate tax rate).

The introduction of the single currency is also found to have affected the FDI flows among

[21] Results including the non-significant relative corporate tax rate can be provided by the authors upon request.

monetary union countries in a statistically significant way. In terms of the magnitude, our estimates would indicate that, ceteris paribus, the adoption of the euro increases intra-EMU FDI flows, on average, by between 11-21%.[22] These results are hence very close to the estimates of Petroulas (2007), who finds that EMU increased inward FDI flows within the euro area by approximately 16%.[23]

While the single currency is found to have overall a significantly positive impact on FDI inflows, the euro has also changed the drivers and the nature of FDI flows among monetary union countries. Concretely, and in line with the theoretical findings presented in Section 2, the relative unit labour cost factor becomes an even more important driver of intra-euro area FDI flows following the introduction of the euro, suggesting that vertical FDI flows have become more relevant. By contrast, the market size of the host country loses in relevance, thereby suggesting that the single currency may have been to the detriment of horizontal FDI. Moreover, host countries with better institutional quality have seen stronger FDI inflows following the introduction of the euro, whereas the countries that have lagged behind are losing out relatively to those former countries.[24] Given that for the EPL and the ECI indicator both non-interaction and interaction term are significant with the same sign, it can be concluded that institutional quality became even more relevant with the entry in the monetary union. These findings thus confirm that institutional and structural features of the economy are also relevant not only for developing but also for developed economies (a finding in line with Dellis et al. (2017) and Benassy-Quere et al. (2007)).

4.2 FDI flows from non-monetary union countries to monetary union countries

In this subsection we describe the estimation results for FDI inflows from outside the monetary union. The results are shown in Table 4.2. Also here the relevance and statistical significance of our standard gravity factors is confirmed. Compared to the estimation results for FDI flows among monetary union countries, we find a similar relevance (in terms of significance and magnitude) of the host and investor country size. However, the cost of production, while also a statistically significant driver, has a much smaller relevance, with the coefficient estimate being less than half the size of the one found in Table 4.1. This result suggests that production costs (at least as proxied by relative unit labour costs) have been less relevant for investors outside the monetary union. This could potentially also point to the vertical FDI motive being less

[22] Note that in our econometric specification we demeaned the interaction variables such that the *emu* coefficient in Table 4.1 can be read directly as the EMU percentage impact.

[23] DeSousa and Lochard (2011) find that the euro lifted intra-area FDI by 29%. However, these estimates are for the FDI stock, rather than the FDI flows.

[24] Note that the sign of the EPL indicator is inverse to the other variables, as a higher variable indicates higher rigidities in the labour market structure of the respective country. For the other variables a higher value indicates stronger institutions.

strong for firms outside the euro area. Moreover, we find that for FDI flows stemming from non-monetary union countries, the distance variable and common language dummy are not statistically significant, whereas the degree of trade openness of the host country is statistically significant. This contrasts with the results for FDI flows among monetary union countries.[25]

Table 2: Gravity model estimates for FDI inflows stemming from non-monetary union countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
lgdp(h)	0.25*	0.35*	0.31**	0.33**	0.38***	0.32***	0.34***
lgdp(i)	1.04***	1.03***	1.08***	0.96***	1.06***	1.39***	1.32***
rel ulc	-0.36**	-0.37**	-0.44**	-0.32**	-0.42**	-0.55***	-0.24***
open(h)	0.01***	0.01***	0.01***	0.01**	0.01**	0.01**	0.01**
epl(h)				-0.12*			
eci(h)					0.02*		
ecfree(h)						0.26**	
wgi(h)							0.26
emu		0.13***	0.09***	0.12***	0.12***	0.12***	0.12***
emu*lgdph(h)			0.32	0.26*	0.27	0.25*	0.18
emu*rel ulc			-0.06*	-0.05	-0.06	-0.10	-0.08
emu*epl(h)				-0.11*			
emu*eci(h)					0.09***		
emu*ecfree(h)						0.04	
emu*wgi(h)							0.19*
Obs	2275	2275	2275	2057	2132	1649	1857
Fixed effects							
Time	yes	yes	yes	yes	yes	yes	yes
Host country	yes	yes	yes	yes	yes	yes	yes
Investor country	yes	yes	yes	yes	yes	yes	yes
Bilateral	yes	yes	yes	yes	yes	yes	yes

[1] PPML estimation results whereby the negative FDI values were set to zero. *, ** and *** represents significance at 10%, 5% and 1% level respectively.

[2] (h) stands for host country, (i) for investor country. *lgdp* is the log of GDP in USD, a proxy for the size of the host and investor countries. *relulc* is the ratio of the host to investor country unit labor cost. *open* denotes the trade openness of the host country. *epl*, *eci*, $ecfree$, *wgi* stand for the OECD employment protection legislation index, the index of economic complexity, the Fraser index of Economic Freedom, and an average of the World Bank governance indicators respectively. *emu* is a dummy variable that takes the value 1 when the host country is a Monetary Union member at time t. All variable details in Annex A.

In line with the results for the FDI flows among monetary union Member States, we find that the euro introduction has a positive impact on the FDI inflows. However, the magnitude

[25] Note that the results qualitatively do not change when we exclude the trade openness variable from our regressions.

of the impact is somewhat smaller than for the flows among the monetary union countries. Concretely, we find that the adoption of the euro increases inward FDI from non-member to member countries by between 9-13%. These findings are in line with the evidence presented in Baldwin et al. (2008), who finds that the pro-euro effect is only half as strong for extra- compared to intra-euro area FDI, and Petroulas (2007), who documents an increase in FDI inflows from non-member countries of around 8%. In addition, we find that also for FDI stemming from outside the monetary union, our proxies for fixed costs become more important following the euro adoption.

Contrary to the results presented in the previous subsection, we find that the euro introduction - in most instances - did not change the relevance of the host country's market size or its relative factor cost of production. However, as noted in Section 3, a more relevant proxy for the market seeking motive of outside investors may be the trade-cost-adjusted market size. In order to account for this, we extend our estimation results by replacing the log of the domestic market size with the market potential variable according to equation 6. The estimation results using this alternative measure are shown in Table 4.2.

Overall, the results in Table 4.2 indicate a statistically significant impact of the market potential variable when interacted with the euro dummy. This would indicate the presence of the *export-platform* motive which is not solely driven by the domestic market size, but also its proximity to large euro area markets. These results thereby are in line with the hypotheses developed in Section 2, namely that following the euro adoption horizontal FDI flows should increase from non-monetary union countries, although it is not necessarily directed to the largest countries inside the monetary union.

5 Results: Robustness analysis

5.1 Alternative proxies for EMU integration

As noted in Section 3, capturing the euro adoption process with a "naive" euro dummy which takes the value 1 as of the euro adoption, and 0 prior to that is prone to a number of problems. One way to overcome this issue is by adopting the approach as also suggested in Baldwin et al. (2008) and use the Mongelli et al. (2005) indicator of EU integration to improve the measurement of the two major integration policies operating in the EU over the past thirty years.

Specifically, we re-estimate the equations as represented in Tables 4.1 and 4.2 but instead of using the standard EMU dummy, we proxy the euro integration process by interacting the standard EMU dummy with the Mongelli et al. (2005) index. The estimation results are shown in Table 5.1. This robustness check confirms the estimation results presented in Section 4: as the integration process has moved along, countries with larger market size attract less intra-

Table 3: Gravity model estimates for FDI inflows stemming from non-monetary union countries with market size proxied by euro area market potential

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
mpot	0.42**	0.46*	0.47**	0.44**	0.49*	0.41**	0.42**
lgdp(i)	1.07***	1.24***	1.21***	1.12***	1.16***	1.58***	1.28***
rel ulc	-0.36**	-0.47**	-0.46**	-0.32**	-0.66**	-0.87***	-0.67***
open(h)	0.01***	0.01***	0.01***	0.01**	0.01**	0.01**	0.01**
epl(h)				-0.16**			
eci(h)					0.11*		
ecfree(h)						0.33	
wgi(h)							0.33
emu		0.15***	0.10***	0.08***	0.14***	0.10***	0.14***
emu*mpot(h)			0.24***	0.26***	0.23***	0.24*	0.25***
emu*rel ulc			-0.06	-0.09*	-0.08	-0.07	-0.11
emu*epl(h)				-0.17**			
emu*eci(h)					0.04*		
emu*ecfree(h)						0.13*	
emu*wgi(h)							0.100
Obs	2275	2275	2275	2057	2132	1649	1857
Fixed effects							
Time	yes	yes	yes	yes	yes	yes	yes
Host country	yes	yes	yes	yes	yes	yes	yes
Investor country	yes	yes	yes	yes	yes	yes	yes
Bilateral	yes	yes	yes	yes	yes	yes	yes

[1] The same notes of Table 4.2 apply.
[2] *mpot* is the market potential of the host country, calculated as in equation 6.

euro area FDI flows, whereas countries with relatively lower unit labor costs are able to attract more FDI from other monetary union countries. Instead, market potential gains in importance as a driver of outside FDI, whereas the relevance of relative unit labor costs does not change. Finally, fixed costs of doing business, as proxied by the various institutional indicators, have become more important for FDI flows.

For intra-euro area, the EMU integration process has, according to these estimates, increased FDI flows by between 3-15% and while it increased FDI flows from outside the monetary union by between 2-8%. These results are somewhat below the estimates presented in Section 4. This is in line with the literature finding which would suggest that a simple EMU dummy would produce upward biased estimates.[26]

[26]Note that we also estimated the model using a Single Market dummy and an EU dummy. The universe of host countries was in this case extended to the EU. We found results which are qualitatively broadly similar to the results we present here.

Table 4: Estimation results using Mongelli et al. (2005) measure of EU integration

i: monetary union country						
	(1)	(2)	(3)	(4)	(5)	(6)
lgdp(h)	0.11***	0.29***	0.17***	0.39***	0.17***	0.52***
lgdp(i)	0.51***	0.52***	0.57***	0.57***	0.50***	0.51***
rel ulc	-0.63**	-0.82**	-0.63**	-0.60**	-0.96**	-0.82**
distance	-0.21**	-0.21**	-0.23**	-0.23**	-0.26**	-0.26**
common	0.16***	0.16***	0.16***	0.24***	0.13***	0.06***
epl(h)			-0.41***			
eci(h)				0.69		
ecfree(h)					0.20	
wgi(h)						0.06
dm_emu	0.03***	0.08***	0.05***	0.03***	0.06***	0.15***
dm_emu*lgdp(h)		-0.01***	-0.01***	-0.09***	-0.02***	-0.14***
dm_emu*rel ulc		-0.15***	-0.08***	-0.07***	-0.15***	-0.15***
dm_emu*epl(h)			-0.10***			
dm_emu*eci(h)				0.16*		
dm_emu*ecfree(h)					0.01*	
dm_emu*wgi(h)						0.02
ii: non-monetary union country						
mpot	0.31*	0.46*	0.44*	0.37*	0.37***	0.36**
lgdp(i)	1.28***	1.23***	1.13***	1.21***	1.56***	1.24***
rel ulc	-0.32**	-0.42**	-0.24**	-0.37**	-0.35**	-0.37**
open(h)	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
epl(h)			-0.19**			
eci(h)				0.03*		
ecfree(h)					0.45***	
wgi(h)						0.34
dm_emu	0.02***	0.05***	0.02***	0.04***	0.04***	0.08***
dm_emu*mpot(h)		0.02***	0.08***	0.09***	0.10*	0.08***
dm_emu*rel ulc		0.19	-0.12	-0.07	-0.05	-0.08*
dm_emu*epl(h)			-0.02*			
dm_emu*eci(h)				0.13***		
dm_emu*ecfree(h)					0.04	
dm_emu*wgi(h)						0.04*
Fixed effects:	same as in Table 4.1					

[1] The same notes of Tables 4.1 and 4.2 apply.
[2] The *emu* dummy variable that is value 1 when the host country is a Monetary Union member at time t is interacted with the Mongelli et al. (2005) measure of EU integration.

5.2 The role of the financial crisis

A key development which has marked the euro area in recent years has been the global financial crisis of 2008-2009 and the subsequent sovereign debt crisis in a number of countries. In this subsection we analyse to what extent controlling for the financial crisis would affect our results.

To do so, we augment the estimations as presented in Table 5.1 by two types of crisis dummies: (i) a dummy which takes the value 1 over the period 2008-2014 across all euro area countries and (labeled as the global financial crisis dummy: *GFC dummy*) and (ii) a dummy which takes the value 1 for those years and for those euro area countries where the 10 year government bond spread vis-a-vis the German Bund exceeds 200 basis points (labeled as the sovereign debt crisis dummy: *SD dummy*).

Table 5: Gravity model estimates: extension with crisis dummies

	i: monetary union country		ii: non monetary union countries	
	GFC dummy	SD dummy	GFC dummy	SD dummy
lgdp(h)	0.29***	0.28***	0.46***	0.45***
lgdp(i)	0.66***	0.66***	1.20***	1.19***
rel ulc	-0.78**	-0.72**	-0.36**	-0.28**
distance	-0.24**	-0.24**		
common	0.16**	0.16**		
open(h)			0.01***	0.01***
dm_emu	0.08***	0.07***	0.05***	0.05***
dm_emu*lgdph(h)	-0.07***	-0.08***	0.03***	0.03***
dm_emu*rel ulc	-0.05	-0.06	0.15	0.18
crisis	-0.11	-0.02	-0.03	-0.08
Obs	2209	2209	2275	2275
Fixed effects				
Time	yes	yes	yes	yes
Host country	yes	yes	yes	yes
Investor country	yes	yes	yes	yes
Bilateral	yes	yes	yes	yes

[1] The same notes of Table 5.1 apply.
[2] GFC stands for the global financial crisis dummy and SD dummy stands for the sovereign debt crisis dummy. For the flows stemming from non-monetary union countries, the host country market size is measured by the market potential variable (calculated as in equation 6).
[3] To save space, the estimates for the institutional variables were not shown. The estimated coefficients of the latter variables were largely unaffected by the inclusion of the crisis dummy.

The results are summarized in Table 5.2. They would suggest that the inclusion of the dummies does not qualitative change the main findings as presented in the previous sections. Moreover, we find that neither the sovereign debt crisis nor the global financial crisis statis-

tically significantly affected FDI inflows in the most affected countries. The insignificance of these results may already be captured by the high number of fixed effect controls included in our regression, in particular the time fixed effects.[27]

5.3 Alternative estimation methodologies

A final robustness check we conduct in this paper is to estimate our gravity equations using an alternative estimation methodology. In the above, the results reported were all based on the PPML estimator of Silva and Tenreyro (2006). In this section, we re-run the estimated equations presented in Section 4 and 5 using random effects estimator. We also apply the transformation of the negative FDI values according to equation 7. We summarize the findings in Tables 5.3 and 5.3 below. The tables show the coefficient estimates in which we use the EMU dummy interacted again with the Mongelli et al. (2005) indicator of EU integration. For the flows stemming from investor countries outside the monetary union we proxy the market seeking FDI again by the market potential variable, rather than by the domestic log GDP variable. The results of those robustness checks overall confirm our main results, both in terms of signs and magnitude. Only the impact of the institutional quality for host countries outside the monetary union (i.e. the non-interaction term that becomes relevant when the EMU dummy is zero) becomes insignificant compared to Table 5.1 lower panel.

Lastly, as noted in Section 3, it is sometimes noted (arguably in particular for trade gravity equations) that an unbiased EMU effect can only be estimated if the model includes time-varying host and investor country fixed effects, in addition to bilateral fixed effects. This further multiplies the already high number of existing dummy variables and makes the estimation computationally highly burdensome. In Table B in Annex B we undertake such efforts, however, in at least two out of the seven initial estimations standard errors cannot be produced (and thus we drop those columns here). We show the remaining four columns to convey the message that even with those additional fixed effects, the main results, and thus the gist of the message, remains very robust.

[27] Note in this regard that when estimating the gravity model without the bilateral fixed effects, the global financial crisis dummy was statistically significant and negative, albeit small.

Table 6: Gravity model estimates for FDI inflows stemming from monetary union countries - random effect estimator

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
lgdp(h)	0.25*	0.17*	0.17*	0.40**	0.55***	0.23*	0.79
lgdp(i)	0.81***	0.84***	0.84***	0.97***	0.97***	0.81***	0.88***
rel ulc	-0.63***	-0.61***	-0.64***	-0.59***	-0.43***	-0.92*	-0.95*
distance	-0.51***	-0.52***	-0.52***	-0.54***	-0.55***	-0.54***	-0.53***
common	0.58***	0.57***	0.57***	0.69***	0.73***	0.71***	0.59***
epl(h)				-0.46***			
eci(h)					-1.06**		
ecfree(h)						0.41	
wgi(h)							0.52
dm_emu		0.09***	0.09***	0.04**	0.04***	0.04**	0.17***
dm_emu*lgdp(h)			-0.06***	-0.02***	-0.06***	-0.06**	-0.16***
dm_emu*rel ulc			-0.03*	-0.03*	-0.07**	-0.07*	-0.04***
dm_emu*epl(h)				-0.15***			
dm_emu*eci(h)					0.31***		
dm_emu*ecfree(h)						0.10	
dm_emu*wgi(h)							0.09
Obs	2209	2209	2209	1982	2061	1664	1900
Fixed effects							
Time	yes	yes	yes	yes	yes	yes	yes
Host country	yes	yes	yes	yes	yes	yes	yes
Investor country	yes	yes	yes	yes	yes	yes	yes
Bilateral	yes	yes	yes	yes	yes	yes	yes

[1] Random effects estimator whereby negative FDI values were transformed according to equation 7.
[2] The same notes of Table 5.1 top panel apply.

Table 7: Gravity model estimates for FDI inflows stemming from non-monetary union countries - random effects estimator

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
mpot	0.74	0.20*	0.85	0.55	0.68*	0.88	0.50**
lgdp(i)	1.44***	1.15***	1.16***	1.16***	1.70***	1.63***	1.28***
rel ulc	-0.32**	-0.28**	-0.36**	-0.35**	-0.49**	-0.38***	-0.39***
open(h)	0.02***	0.01***	0.02***	0.02**	0.02**	0.01**	0.02**
epl(h)				-0.190			
eci(h)					-0.36		
ecfree(h)						0.69	
wgi(h)							0.17
dm_emu		0.12***	0.13***	0.04***	0.07***	0.05***	0.14***
dm_emu*lgdp(h)			0.17**	0.15***	0.15**	0.29*	0.12***
dm_emu*rel ulc			0.02	-0.05*	0.03	-0.02	-0.02
dm_emu*epl(h)				-0.09**			
dm_emu*eci(h)					0.07*		
dm_emu*ecfree(h)						0.10*	
dm_emu*wgi(h)							0.45
Obs	2275	2275	2275	2057	2132	1649	1857
Fixed effects							
Time	yes	yes	yes	yes	yes	yes	yes
Host country	yes	yes	yes	yes	yes	yes	yes
Investor country	yes	yes	yes	yes	yes	yes	yes
Bilateral	yes	yes	yes	yes	yes	yes	yes

[1] Random effects estimator whereby negative FDI values were transformed according to equation 7.
[2] The same notes of Table 5.1 bottom panel apply.

6 Conclusion

In this paper we investigated the impact of the the euro integration process on the drivers of FDI inflows in monetary union countries. We showed both theoretically and empirically that the single currency alters the drivers of FDI inflows across monetary union Member States.

Empirically, we estimated two type of bilateral gravity equations of FDI inflows, one for intra-euro area and one for extra-euro area FDI inflows over the period 1985-2016. Our results showed that the euro introduction has increased inflows into the monetary union, both among monetary union countries but also from investors outside the union. However, the impact was smaller on extra-euro area FDI flows.

Our results also show that the euro introduction has changed the drivers and the nature of FDI flows. In particular, we find that relative unit labor costs become a more important driver of FDI following the euro introduction. This would give support to the conclusion from the theoretical model that intra-euro area vertical FDI rises following the euro introduction. By contrast, market size loses in relevance as a driver of FDI, suggesting that horizontal or market seeking intra-euro area FDI has become less important. Instead, it has increased from investor countries outside the monetary union. In particular, we find evidence that for FDI inflows stemming from outside the euro area, the export-platform motive may have gained in prominence. Finally higher institutional quality and better structures are associated with stronger FDI inflows, in particular following the introduction of the euro.

Taken together these results would thus suggest that, while the euro introduction can provide a boost to FDI inflows into its Member States, the extent to which countries actually do benefit from this depends on a country's cost of production and structural and institutional features. In particular, countries with high relative cost of production and weak institutional features may in fact have seen their FDI inflows being negatively affected by the euro introduction. These results would thus stress that while maintaining a competitive position is generally important, it is even more so for monetary union Member States. Moreover, these results would also point towards an increased vertical/supply-chain interconnected between monetary union countries.

We have conducted a number of robustness tests to our results. We find that more refined proxies for the euro integration process do not qualitatively change our results, but they do lower the overall estimated beneficial impact of the euro integration process. Moreover, our results remain also largely unchanged when we apply alternative estimation methodologies. Among others, we include a broad set of dummy variables with a view to ensure appropriate identification of the EMU effect. The global financial crisis does not change our main results.

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Appendices

A Description of the dataset

Country coverage - intra euro area sample: The following list of countries were included in our estimations: Austria, Belgium, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal, Slovakia, Spain.

Country coverage - extra euro area sample: The following list of countries were included in our estimations: Australia, Canada, Czech Republic, Denmark, Japan, New Zealand, Poland, Sweden, Switzerland, Turkey, UK and US.

FDI inflows: Data from the OECD, applying the OECD's Benchmark Definition (BMD) 3 and the IMF's Balance of Payments and International Investment Position Manual, 6th edition (BPM6).

GDP: Data from the IMF WEO; series in US dollars.

Distance: Data from CEPII. We use the log of the as the crow flies distance between the capital of the host and investor country.

Common language (common) and contiguity dummy: Data from CEPII.

Unit labor costs (ulc): Data compiled by the OECD. Unit labor costs measure the average cost of labor per unit of output. They are calculated as the ratio of total labor compensation per hour worked to output per hour worked.

Openness: Trade openness is expressed as export plus imports in percent of nominal GDO. The data source is OECD.

Fraser Economic Freedom Index (ecfree): The headline index measures the degree of economic freedom present in five major areas: size of government; legal system and security of property rights; sound money; freedom to trade internationally; and regulation. The latter covers – in two sub-indices - both labor and product market regulation. Data are gathered by the Fraser Institute.

Heritage Economic Freedom Index (her): Annual figures from Heritage Foundation for the overall score of Economic Freedom; figures are standardized by the overall mean and standard deviation across countries. The overall Index of Economic freedom is the average of ten different freedom indicators: property rights, freedom from corruption, fiscal freedom,

government spending, business freedom, labor freedom, monetary freedom, trade freedom, investment freedom and financial freedom.

Employment Protection Legislation Index (epl): The version 1 of the Indicator on the Strictness of employment protection from the OECD.

Worldwide Governance Indicators (wgi): Data are compiled by the World Bank. The project reports aggregate and individual governance indicators for over 200 countries and territories over the period 1996–2015, for six dimensions of governance, including voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.

Economic Complexity Index (eci): The index was developed by Hildago and Haussman. It is a holistic measure of the productive capabilities of a country. In particular, the ECI looks to explain the knowledge accumulated in a population and that is expressed in the economic activities present in a country.

Tax rate (taxr): The data used are the corporate tax rates. The dataset was created by combining the OECD data with historical data from the OECE and IECONOMICS.

B Estimation results of Gravity Model with Time-Varying Host and Investor Country Fixed Effects

Table 8: Gravity model estimates for FDI inflows stemming from monetary union countries - time-varying fixed effects

	(1)	(2)	(3)	(4)
lgdp(h)	0.50***	0.79*	0.67***	0.51***
lgdp(i)	0.60***	1.09***	1.43***	0.91***
rel ulc	-0.42***	-0.74***	-0.88***	-0.88*
epl(h)			-0.15	
wgi(h)				0.52
dm_emu		0.06***	0.08**	0.61***
dm_emu*lgdp(h)		-0.48***	-0.17***	-0.16***
dm_emu*rel ulc		-0.06*	-0.05*	-0.40***
dm_emu*epl(h)			-0.33***	
dm_emu*wgi(h)				0.14
Obs	2209	2209	1982	1900
Time varying effects				
Host country	yes	yes	yes	yes
Investor country	yes	yes	yes	yes
Fixed effects				
Bilateral Fixed	yes	yes	yes	yes

[1] The same notes of Table 5.1 top panel apply.

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