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A fresh assessment of the euro effect on outward US FDI*

Mariam Camarero† Sergi Moliner‡ and Cecilio Tamarit§

Abstract

This paper analyzes the potential determinants of the US stock of outward FDI (OFDI). As our research question is whether the introduction of the euro has changed the pattern of US OFDI, we consider a large group of host countries from different continents, zooming in on the European case, where we analyze different country groupings for the European Union and the Euro Area. With this aim, we estimate a gravity equation using the Pseudo Poisson Maximum Likelihood (PPML) estimator. Furthermore, we use the Bayesian Modelling Averaging (BMA) analysis results in Camarero et al. (2021) as a benchmark for the initial specification. We find that US OFDI is explained by horizontal and vertical FDI motives in all country groups. As for the *euro effect*, we show that the single currency has prominently promoted US OFDI to the EA members with effects ranging between 10% and 20%. However, while in the core Euro Area, the euro has favored both HFDI and intra-industry VFDI strategies, in the periphery has mainly stimulated pure VFDI.

Keywords: FDI determinants; US; European Union; BMA; PPML

JEL classification: F21, F23, C11

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1 Introduction and motivation

The European Union (EU) has followed over the years a continuous path of economic and financial integration. Its origins date back to the European Economic Community (EEC), created by the Treaty of Rome in 1957 with the aim of achieving a common market among its member states based on the free movement of goods, people, capital and services. In this regard, further steps were given, including the creation of the Customs Union in 1968, and of a Common Market (Single Market) in 1993.

In order to achieve a Common Market, there was a need for intra-area exchange rate stability. Therefore, when the Bretton Woods exchange rate system collapsed, it was initially replaced by the "snake in the tunnel" and, later, by the European Monetary System (EMS). Twenty years later, in 1999, the EMS was replaced by the Economic and Monetary Union (EMU)[1].

The adoption of the single currency has provided valuable economic benefits to the Euro Area (EA) members, such as the elimination of intra-area currency risks, the reduction of country-risk premia, improved economic stability and growth, and better integrated and more efficient financial markets. Moreover, all these conditions have created a favorable environment for the entry and mobility of foreign direct investment (FDI) flows.

There is an ample literature on the impact of the single currency on capital flows. Most empirical literature has identified a positive euro effect on FDI from both countries inside and outside the EA[2]. In addition, Baldwin et al. (2008), and Neary (2009) suggest that the euro adoption should encourage intra-EA VFDI, due to the pro-trade effects of both the Single Market and the euro, but should discourage intra-EA HFDI, as the common currency and the Single Market reduce trade costs. Finally, regarding FDI stemming from countries outside the monetary union, Baldwin et al. (2008), Neary (2009) and Sondermann and Vansteenkiste (2019) argue that the monetary union might make it more attractive to establish a production platform inside the EA.

In this paper, we analyze the magnitude and determinants of FDI with a particular focus on the *euro effect* from a third-country perspective, namely, the FDI coming from the US, his-

[1] The countries that adopted the euro in 1999 are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.

[2] See Carril-Caccia and Pavlova (2018), Petroulas (2007), De Sousa and Lochard (2011), Brouwer et al. (2008) and Sondermann and Vansteenkiste (2019), among others.

torically the most prominent investor in the EU. We can observe in Figure 1 that American investment in EU countries has progressively grown for the last 35 years. Moreover, this path has accelerated since the beginning of the XXI century. In fact, in 1985, US outward FDI (OFDI) stock in the EU was about 100 billion US dollars, and in 2019 around thirty-five times more, close to 3,500 billion US dollars.

The US and the EU (and its predecessors) have had extensive trade and investment ties since World War II. According to Kim (2004), by the early 1960s, most US foreign investment in Europe was horizontal FDI (HFDI). However, since the 1980s, due to the progressive economic integration in Europe, which culminated with the euro's inception, other additional strategies have gained relevance, such as export platform FDI and vertical FDI (VFDI). Therefore, the persistent trade and investment links between both regions and the changing evolution of US FDI in Europe, largely motivated by the euro's inception, make it especially relevant whether the single currency has changed the patterns of US OFDI when studying host country FDI determinants of EU members.

In addition, in our analysis, we not only focus on EU countries but also include a group composed of countries from different regions of the world to assess if the euro's inception has changed the patterns of US FDI at a worldwide level by making the EA a more attractive destination. In particular, our sample contains the stock of US OFDI in 56 host countries from 1985 to 2019, representing over 70% of the total US OFDI stock in 2019. Against this, we compare the determinants of US FDI in the EU, which includes some countries that did not adopt the euro. Finally, we distinguish between the core and the periphery within the EA. The effect of the common currency and the determinants of US OFDI may differ between countries. This division is based not only on geographical criteria but also on economic similarities. Indeed, Bayoumi and Eichengreen (1993), Zhang and Artis (2001) and Konstantakopoulou and Tsionas (2011), among others, found that this classification could be based on business cycles synchronicity and common economic shocks. In the core, we include Germany and its immediate neighboring EA countries, whereas in the periphery are those Eurozone countries that are farther from the center, that is, those of Northern and Southern Europe. Mainly in the latter, labor costs and GDP per capita are lower. Therefore, although both HFDI and VFDI motivations are possible in these two groups, we expect that in the core, HFDI predominates, whereas VFDI could be a more important motivation in the periphery.

Most researchers have applied the gravity equation approach to study the patterns of FDI, which has proved to be solid concerning the good fit to the data and the underlying theoretical foundations. Traditionally, these FDI gravity models have been estimated through the Ordinary Least Squares (OLS) estimator. However, according to Silva and Tenreyro (2006), using the log-linear form could lead to misleading results in the presence of heteroskedasticity and zeros in the dependent variable. In order to solve this bias, they suggest using the multiplicative form of the gravity equation, known as the Pseudo Poisson Maximum Likelihood (PPML) estimator. Due to its success in empirical applications, this method has progressively replaced the OLS estimator in gravity models.

Another common problem in the empirical FDI literature is that previous works have generally focused on a specific regression model and a *ad hoc* gravity setting in studying FDI patterns. This practice could also lead to biased results when the researcher does not know the true model and omit or include variables arbitrarily depending on the particular theoretical framework for FDI they chose to analyze. Bayesian Modelling Averaging (BMA) techniques have emerged as a potential tool to solve this issue. Some examples are the works of Eicher et al. (2012), Blonigen and Piger (2014), Antonakakis and Tondl (2015), and Jordan and Lenkoski (2018), among others. This approach consists of attaching probabilities to any possible model specifications over the model space. These studies find that many of the FDI determinants considered by the previous literature are not robust.

In our case, how to measure the effect of the euro is an additional question to take into account. Previous literature has frequently used a dummy variable to capture the impact of the single currency. Nonetheless, according to Sondermann and Vansteenkiste (2019), the launching of the euro was not a discrete event but rather an ongoing process that started several years prior to the introduction of the new currency and also continued after that. Indeed, the path of monetary integration in Europe started with the creation of the EMS in 1979, twenty years before the euro's inception. In our work, we try to capture this whole monetary integration process using a variable that can take several values depending on the degree of monetary integration.

Against this backdrop, we contribute to the empirical literature in several respects. First, to analyze the US OFDI determinants and whether the euro has changed these patterns, we apply the PPML estimator of Silva and Tenreyro (2006). To the best of our knowledge, few papers have diverged from the traditional OLS estimator to study the effect of the

single currency on FDI determinants. In addition, we compare the EA countries with other hosts and distinguish between EA core and peripheral countries. Second, instead of just focusing on a specific regression model and a predetermined set of variables, we start from the variables considered robust in Camarero et al. (2021). These authors study the euro's effect on US OFDI by applying a BMA analysis. Lastly, to measure the effect of the common currency, we use a variable that accounts for previous steps followed in the path of monetary integration, even before the common currency's inception.

The main findings suggest that US OFDI is explained by horizontal and vertical FDI motives in all country groups. However, HFDI strategies predominate in EA core countries, whereas VFDI prevails in the EA periphery. As for the *euro effect*, the single currency has generally encouraged US OFDI to the EA members, with an overall effect that can reach up to 20%. However, it has affected these countries differently. In the case of the core countries, the euro has favored HFDI and intra-industry VFDI strategies. As for the periphery, the common currency has mainly encouraged pure VFDI.

The reminder of the paper is organized as follows: in Section 2 we briefly review the empirical literature of FDI determinants; Section 3 describes the PPML methodology and the data; Section 4 presents the results of our paper, and finally, Section 5 concludes.

2 The underlying literature

2.1 Types and decisions of foreign direct investment

The diversity of multinational companies (MNCs) and reasons for investing abroad makes the analysis of FDI determinants a complex task. The literature has traditionally focused on two forms of FDI: HFDI, motivated by market access, and VFDI, driven mainly by comparative advantage.

According to Markusen (1984), and Markusen and Venables (1998, 2000), a firm invests abroad by replicating a part of its activities or production processes in another country to avoid transportation costs, tariffs, and other types of trade costs. This strategy is referred to as the "market access motive" and gives rise to HFDI. In HFDI models, exports and FDI are substitutes, and the decision to serve a market via exports or set up an affiliate company abroad constitutes a proximity-concentration trade-off. Therefore, FDI increases when transportation and trade costs are substantially high.

On the other hand, firms engage in VFDI when they fragment their production processes across countries. The main reason for such disaggregation is the cost considerations in production factors. In this way, firms are encouraged to fragment production and locate a stage in a country where the factor used intensively in that stage is abundant. This strategy is known to as the "comparative advantage motive" and was introduced by Helpman (1984) and Helpman and Krugman (1985). In this case, the effect of trade and transportation costs is negative for VFDI.

More recently, other foreign investment strategies, alternatives to HFDI and VFDI, have appeared in the literature. This is the case of the knowledge capital (KK) model (Markusen et al., 1996; Carr et al., 2001; Markusen and Maskus, 2002), complex integration strategies (Yeaple, 2003), and export-platform FDI (Ekholm et al., 2007; Bergstrand and Egger, 2007). Under the KK model, similarities in market size, factor endowments and transport costs favor HFDI, while differences in relative factor endowments encourage VFDI. In addition, export-platform FDI and complex integration strategies include the role played by the neighboring markets of the host country when analyzing FDI strategies.

The eclectic OLI[3] paradigm proposed by Dunning (1980) also has crucial importance in the literature on FDI decisions. This contextual framework explains that FDI decisions of MNCs are determined by the interaction of three sets of interdependent variables: Ownership, location and internalization advantages. The eclectic paradigm reflects the economic and political conditions of the investing and host country, as well as the industry and characteristics of individual investing firms (Dunning, 2000). Consequently, this theoretical approach leads to four types of FDI: Market-seeking FDI or HFDI, resource-seeking FDI or VFDI, efficiency-seeking FDI and strategic asset-seeking FDI.

2.2 The gravity equation

The estimation of gravity equation commonly applied in trade has been successfully implemented in the FDI empirical literature. Its origins date back to Tinbergen (1962) and Pöyhönen (1963), who modeled bilateral trade flows as being proportional to the product of the economic size of the trading partners (as measured by their gross domestic products (GDPs) and inversely proportional to the geographic distance between the countries. Although early empirical applications of the gravity equation lacked deep theoretical founda-

[3]Ownership, Location and Internationalization.

tions, essential steps were taken in filling this gap, as the contributions of Bergstrand (1989, 1990) and Deardorff (1998). Nevertheless, it was the work of Anderson and Wincoop (2003) that implied significant progress in this field. They developed a method that consistently and efficiently estimated a theoretical gravity equation and calculated the comparative statics of trade frictions. More recently, other papers have significantly contributed to consolidating the academic foundations in the modelization of trade and investment. This is the case of Bergstrand and Egger (2007), Head and Ries (2008), Kleinert and Toubal (2010), Yotov et al. (2016), and Anderson et al. (2019, 2020).

In our research, in a similar vein, as Kox and Rojas (2020), we adapt the trade and investment theoretical model of Anderson et al. (2019, 2020) to construct our FDI gravity model. The model is based on the KK model FDI, where this type of capital assumes proprietary knowledge that can be used on a non-rival basis in several locations. Flows of knowledge capital between two countries are proxied by the stock of bilateral FDI between countries i and j. However, in our particular case, since we study the US foreign investment determinants and whether the euro has changed these patterns, we use unilateral US OFDI stock to the host country instead of bilateral FDI stocks. Consequently, unlike the models mentioned above, our model is not a structural one.

In this model, the free flow of knowledge capital across national borders is hindered by absolute and relative FDI frictions. Absolute FDI frictions include legal and statutory barriers that a country imposes on access to foreign capital. These are total bans, restrictions on the activity of multinationals in specific sectors, or any other access-related policy measures. Relative FDI frictions refer to opportunity costs of operation in a host country j compared to the other potential alternative location choices. These include, among others, operational costs in the host country, such as distance, labor costs, legal system, communications infrastructure, trade and investment openness, macroeconomic instability, and being part of the EA.

Concerning the model specification, the value of FDI stock originated in the US and hosted in country j is represented by FDI_{ij}, where i is the US. It is positively affected by the size of the country of origin (Y_i), in our case the US, because larger economies tend to invest more in knowledge capital. US OFDI stock is also positively affected by the size of the destination country (Y_j), as larger recipient countries have more consumers and firms that can absorb foreign technology. Therefore, Y_i and Y_j represent the economic mass of the

origin and destination country. As mentioned, the free flow of FDI is affected by absolute and relative foreign investment frictions. The parameter ω_{ij} collects absolute FDI frictions. It goes from 0 to 1, being 0 that no knowledge capital from country i (the US) is admitted, and 1 that country j is fully open to the entry of knowledge capital from country i. In addition, for the origin country i, P_i is the average of inward relative friction costs in all destination countries. On the other hand, Π_j is the average of outward relative friction costs of all countries investing in destination country j. Both parameters represent the inward and outward multilateral resistance terms in our gravity model, respectively. Thereby, we have the following equation:

$$FDI_{ij} = \omega_{ij} \frac{\alpha Y_i}{P_i} \frac{\beta Y_j}{\Pi_j} \tag{1}$$

The parameters α and β represent the reaction of US OFDI stock to the economic masses of the origin country i and the host country j. The size of origin and destination countries are weighted by P_i and Π_j. Consequently, a higher relative FDI friction reduces US OFDI stock to the host country. On the other hand, more openness to foreign capital (ω_{ij}) increases the entry of US FDI to the destination country. This equation is the baseline specification of our theoretical gravity model on which we will build our estimations.

Traditionally, gravity models have been estimated by OLS. However, the use of the log-linear form could lead to misleading results in the estimation of the parameters of the model. Through the Jensen's inequality[4], Silva and Tenreyro (2006) demonstrate that in the presence of heteroskedasticity, the application of the usual log-linear specification of the gravity equation could produce biased and inconsistent results. Moreover, observations with zero value in trade and FDI gravity models create an additional problem for using the log linear form. Several methods have been proposed to deal with this problem, such as dropping the observations whose dependent variable is zero, or substituting them with one. However, these procedures also generally induce inconsistent estimators of the parameters of interest. To address the former problems, Silva and Tenreyro (2006) proposes the PPML estimator, which is robust to different patterns of heteroskedasticity and, in addition, provides a natural way to deal with zeros in the dependent variable.

[4]This implies that the expected value of the logarithm of a random variable is different from the logarithm of its expected value ($E(\ln y) \neq \ln E(y)$).

Consequently, in the last fifteen years, the estimation of trade and investment gravity models through the PPML estimator has replaced the log-linear estimator as the new standard practice. Some of the major contributions in this regard are the works of Yotov et al. (2016), Anderson et al. (2018), and Anderson et al. (2020), among others. Furthermore, related to our research topic, several papers have applied the PPML estimator to study the effect of the euro or economic integration in Europe on FDI.

Sondermann and Vansteenkiste (2019) use the multiplicative form of the gravity equation to analyze the euro's effect on the drivers of FDI inflows in the EU for the period 1985-2016. They find that the single currency has encouraged FDI inflows into the monetary union and quantify the effect as an increase between 2%-21%. However, the impact on the determinants of FDI inflows differs significantly across countries. In particular, the euro facilitates intra-euro area vertical FDI flows but reduces incentives for horizontal or market-seeking FDI among EA members. Instead, launching the common currency has strengthened export platform FDI from countries outside the Eurozone.

Camarero et al. (2018) apply the same methodology to study the effect of the euro on trade flows in a sample of 28 countries within and outside the EA for the period 1990-2013. Moreover, they also analyze how the single currency has affected the relationship between these flows and FDI inward and outward stocks. Their results suggest that the EMU positively affects trade and favors a complementary relation between trade and FDI.

Additionally, Dorakh (2020) studies the FDI determinants of EU countries for the period 2002-2017 also with the multiplicative form of the gravity equation. Her findings reveal that efficiency-seeking and complex FDI strategies are more critical in the new EU member states, whereas market-seeking FDI prevails for the whole EU.

Last, Bruno et al. (2021) analyzes the impact of EU membership on FDI inflows, how the effects of such deep integration differ from other treaties, and what drives these effects. They estimate a structural gravity framework using the PPML estimator on annual bilateral FDI data for a large group of countries from 1985 to 2018. Their findings indicate that EU membership leads to about 60% higher FDI investments into the host economy from outside the EU and around 50% higher intra-EU FDI.

In the next section, we briefly summarize our empirical strategy, based on the PPML estimator, and we describe the data.

3 Econometric methodology and data

3.1 Poisson Pseudo Maximum Likelihood estimator

In our paper, we estimate, using PPML, the model of equation (1) that can be represented by the following equation:

$$FDI_{ijt} = \exp[\gamma_1 X_{ijt}] + \epsilon_{ijt} \tag{2}$$

where FDI_{ijt} is the US OFDI stock from the US to the host country j. Moreover, X_{ijt} is a vector of gravity variables related to the elements mentioned previously in equation (1): the economic mass of the US and the host country j, and absolute and relative FDI barriers such as distance, common language, labor costs, trade, and investment openness, macroeconomic instability, taxes, institutional quality, national policies, communications infrastructure, and economic integration, among others. Lastly, $\epsilon_{j,it}$ is a white noise error with zero mean and constant variance. Moreover, we also include individual host country (γ_j) and year (γ_t) fixed effects in order to control for country and time unobservable factors in our estimation. Consequently, we use the following empirical specification:

$$FDI_{ijt} = \exp[\gamma_1 X_{ijt} + \gamma_j + \gamma_t] + \epsilon_{ijt} \tag{3}$$

It is important to highlight that our econometric estimation differs from Kox and Rojas (2020) in several respects. First, they analyze the effect of trade and investment agreements on bilateral FDI stock. Therefore, their work includes country-pair and time-varying origin and destination fixed effects. However, since we focus on unilateral US OFDI stock, we only include individual country and time dummy variables. Secondly, Kox and Rojas (2020) study the sole effect of bilateral policy variables on FDI. Consequently, they do not consider explicitly other time-varying gravity variables in their estimation. Instead, these covariates are collected in the origin-time and destination-time fixed effects. However, in our paper, as we are interested in the US OFDI determinants and whether the euro has changed these patterns, we consider time-varying gravity variables related to the economic size of countries i and j and FDI frictions. Therefore, our time dummy variables only capture possible unobservable factors not accounted for by the gravity variables considered explicitly in our specification.

3.2 Data

This paper analyzes the potential determinants of US OFDI stock for 1985-2019, focusing on the *euro effect*. In addition, we also study whether these determinants change when we consider all the host countries of our sample and different groups, namely the EU, EA, and core and peripheral EA countries. The countries included in each group are enumerated in Table 1.

As for the gravity variables included in our model, we differ from most of previous studies. Researchers have generally focused on a predetermined set of variables depending on the theoretical framework they adopt. However, this practice could lead to misleading results when estimating a regression model due to the inclusion of insignificant variables or the omission of relevant ones. Particularly, inference regarding the effects of the covariates included in a particular specification can depend critically on the rest of the included or even omitted variables (Blonigen and Piger, 2014). In our case, instead of just focusing on a particular regression model, we start from the variables considered robust in Camarero et al. (2021). The authors of this paper study the effect of the euro on US OFDI for the period 1985-2017 applying a BMA analysis. For this aim, they work with a wide set of 63 different determinants related to country characteristics, and study which ones have the highest probability to be part of the true model. The variables that are found to be robust in the BMA analysis are shown by group of countries in Table 2. Moreover, those selected for our estimations are marked in red, and described in detail in Table 3. Since Camarero et al. (2021) and us use country fixed effects in the estimations, time-invariant variables are not included[5]. The covariates chosen slightly differ depending on the group of countries analyzed, as the results of the BMA analysis detected different robust determinants for each country group. However, as we will see in Section 4, all our model specifications pass the Ramsey Regression Equation Specification Error Test or RESET test. This confirms that our models are well specified.

In some exceptional cases, we add variables to those found to be robust in the BMA analysis. This is the case of *Euro*, *Euro*LogRealGDP* in the EA core, *UrbanPopulation* in the EA group, and *SkillLevel* and *Euro*SkillLevel* in the core and the periphery. However, they were robust in at least one of these groups. We include them for the sake of comparison.

[5]For more information about fixed effects estimation in panel data, see Fernández-Val and Weidner (2016, 2018) and Weidner and Zylkin (2019).

Concerning the effect of the common currency, we follow Sondermann and Vansteenkiste (2019), and instead of just analyzing the launching of the euro as a discrete event, we aim to capture the whole process of monetary integration in Europe. The variable *Euro* that Camarero et al. (2021) use in their BMA analysis is inspired by the methodology that Baier and Bergstrand (2007) apply in their Economic Integration Agreement (EIA) database, where the variable adopts different values for a country[6] depending on the level of economic integration with its trade and investment partners. Particularly, Camarero et al. (2021) distinguish three levels in the process of monetary integration in Europe: a value of 1 is given if the host country is outside the ERM, but its currency is pegged to either the DMark/the ECU/or the Euro; 2 if its currency is pegged to the ECU or the euro via the ERM; 3 if its currency is the euro, and 0 otherwise. In order to assess whether the common currency has changed the US OFDI patterns, they interact this variable with other robust determinants related to the market size, labor endowments, trade openness, or institutional quality of the host country. As mentioned, the selection of these interactions by a group of countries depends on which are robust according to the BMA analysis and whether the specification passes the RESET test.

The variables selected correspond to a wide range of different host country's characteristics. This is the case of **economic and monetary integration**, that contains the variable *Euro*; **market size and population**, including the *the real GDP*, *urban population*, and *the spatial lag of the host country*; **labour market conditions**, represented by *skill level of the destination country's workforce*, as well as *population density*, and *skill level differences between the US and the host country*; **trade and international openness**, included in our specifications using *trade openness of the host market* and the *KOF globalization index*; **investment openness**, that includes the *black market index*; **institutional quality**, measured through *corruption* and *democratic accountability indexes of the destination country*; and other determinants related with the **government size**, **banking regulations**, and **communications infrastructure**, as is the case of *top marginal taxes*, *ownership bank index*, and *cellular subscriptions* of the host country.

In the following Section we describe the empirical results of our paper based on this selection of robust determinants.

[6]These values are 0 when there is no existing Economic Integration Agreement, 1 for a one-Way Preferential Trade Agreement, 2 for a two-Way Preferential Trade Agreement, 3 for a Free Trade Agreement, 4 for a Custom Union, 5 for a Common Market, and 6 for an Economic Union.

4 Empirical results

In our empirical strategy, we estimate two specifications for each group of countries. The first specification that we call "Simple model specification" and presented in Table 4 does not include interactions between the variable *Euro* and other FDI determinants found to be robust in the BMA analysis. The second specification contains the interactions (see Table 5) and we denote it "Augmented model specification". By including the interactions, we do not only account for the *Euro effect* on the US outward FDI but also whether the creation of the common currency has changed the pattern and sign of the other determinants in the model.

4.1 Simple model specification

Table 4 presents the results for the specification with no interactions. As shown at the bottom of the Table, all the estimated models pass the RESET test.

To ease the interpretation of the results, we have divided the variables in groups that have in common the nature of the effect captured by them.[7] The first group of variables we analyze is **economic and monetary integration**. The only variable chosen in the BMA selection process is *Euro*. The results clearly indicate that US FDI stock has been attracted by the countries that have adopted the common currency or have been in the ERM. According to our findings, we obtain an overalle uro effect of between 10.6% and 20.4%. As expected, the largest value of the parameter corresponds to the Eurozone countries and its core (around 0.2 or 20%). It is smaller for the groups that include more non-euro countries, such as the complete group of countries, that only accounts for 10.4%, or the periphery of the EA, with a 12.8%. These results are consistent with those obtained by Petroulas (2007), Brouwer et al. (2008), De Sousa and Lochard (2011), Carril-Caccia and Pavlova (2018) and Sondermann and Vansteenkiste (2019), among others. All these papers find that the Euro has increased inward FDI to Eurozone members in a range between 2%-30%. In our case, the only negative parameter is found for the EU group (-0.063). The reason for the negative sign is the presence of the UK in the group, as it is one of the leading FDI destinations for the US while being no member of the EA. Indeed, the effect is positive when we only focus on the EA groups.

[7] The particular covariates used in the specifications for each one of the country groups are the result of the BMA analysis.

A second group of variables is related to **market size and population**. The *real GDP of the host country* is significant at 1% and has a positive sign for all country-groups and the expected magnitude: a 1% increase would rise US OFDI stock between 1.4%-3.3%, depending on the group, with a larger size of the parameter for all the European countries groups. This effect is consistent with HFDI strategies, where market size is an important motivation for FDI. Carr et al. (2001), Markusen and Maskus (2002) and Bergstrand and Egger (2007), among others, obtained similar results. Concerning *UrbanPopulation of the host country*, its coefficient is positive and significant for the EA group. However, there are important differences when we analyze the core and the periphery. For the former, it has a positive effect (the parameter is 0.055); for the latter, the magnitude is similar but negative. The former implies that even if, overall, in the Eurozone and for the core, urbanization would be compatible with HFDI, this is not the case in the periphery, where FDI is more vertical. Finally, the *spatial lag of the host country* has a positive sign for the whole group (0.101%) but negative for the EU and core countries. A plausible interpretation is that agglomeration forces and having suppliers in neighboring regions is relevant for US MNCs in their global strategy of vertical specialization. On the other hand, the negative coefficient for the EU and core countries (-0.274 and -0.427, respectively) is consistent with pure VFDI cost considerations in the neighboring markets (Blonigen et al., 2007). The probable reason is that the neighbors of our EU group are Eastern European countries and the EA periphery, where VFDI is a predominant strategy for foreign investment.

Concerning **labor market** covariates, *the population density of the host country* has a negative effect for the whole group but is positive for the EA. In particular, for the larger group, a 1% increase in density would decrease the US FDI stock by 1.17%. As, in principle, more population density may attract a concentration of firms looking for abundant and cheaper labor, the competition effect may probably offset the positive spillovers arising from a common pool of resources, deterring the entry of new firms (Crozet et al., 2004). However, the coefficient is positive when we consider the EA countries (2.597), which can be attributed to vertical strategies, looking for an abundant and cheaper workforce. Concerning *SkillLeveldiff*, this variable has a positive sign for the EU group, in line with the KK model of Markusen and Maskus (2002), and also involves VFDI. In this case, a provisional conclusion is that the US global FDI strategy differs from the one adopted when investing in European countries, as we have also found with previous variables. Finally, the *skill level of the host country* is only significant when we interact it with the euro. We will study the impact of

this variable in the next section.

Regarding **trade and international openness**, the coefficient of *trade openness of the host country* is positive and significant at 1% for the EA core. A one point increase raises US OFDI stock by 1.9%. The former implies complementarity between FDI and trade and probably points towards trade in intermediate goods across subsidiary firms. The same effect was found previously by Brainard (1997), Camarero and Tamarit (2004) and Camarero et al. (2018), among others. The parameter of the variable *globalization index of the host country* is negative for the whole group (first column). In this case, a one point increase reduces US OFDI stock by 3.3%. Therefore, trade and FDI would be substitutes, as many of the main destinations of US OFDI, such as China, India, and Brazil, are still relatively closed countries compared with other destinations.

Concerning the variables included in **institutional quality**, the *level of corruption* for the EU countries, as well as the *democratic accountability index* for the EA periphery have a negative impact on US OFDI stock (-0.7% and -0.5%, respectively). Since an increase in the score of both indexes implies higher institutional quality, at first sight, this sign could seem counter-intuitive. However, according to Lui (1985) and Egger and Winner (2005), MNCs might be willing to accept paying bribes to speed up the bureaucratic processes. In this case, corruption acts as a "helping hand."

As for **investment openness**, the *black market index of the destination country* is positive and significant for the Eurozone group (3.3%). The former is the expected sign, as a higher score in this index suggests better investment conditions. Indeed, previous FDI literature, such as Neumayer and Spess (2005), Busse et al. (2010), Rose-Ackerman and Tobin (2005) and Camarero et al. (2019), to name a few, has found that a higher degree of investment openness increases foreign investment inflows.

Regarding the variables related to **government size**, *top marginal income taxes of the destination country* is a robust determinant for the largest and EA groups. In particular, one percentage increase reduces US OFDI stock by 0.7% and 2.1%, respectively. Therefore, American investment is located in countries with lower income taxes. Di Giovanni (2005) and Chiappini (2014), found similar results, as high taxes deter FDI.

Last, we discuss the results for two variables related to **banking and credit regulations** and **communications infrastructure**. *OwnershipBanks* and *Cellular* are only relevant in the larger

group, and both have a negative effect on the US OFDI stock. A priori, this sign may be unexpected. Nonetheless, a possible explanation could be the large degree of heterogeneity in this group, where we have a wide variety of countries in terms of size and income. The coefficient of these two determinants is probably giving insights into the importance of emerging countries for US OFDI, where banking and telecommunications development is meager compared to other fully developed regions.

4.2 Augmented model specification

To study whether the common currency has changed the US FDI patterns, we augment our simple model specifications with interactions between the variable *Euro* and other robust FDI determinants. Since the sign and magnitude of the coefficients of the original variables are very similar to those of the simple model, in this Section, we only focus on the analysis of the interactions[8]. The results are shown in Table 5. Again, all the specifications pass the RESET test.

As for **economic and monetary integration**, once we demean the interaction variables from the coefficient of the covariate *Euro* in Table 5, we obtain that the impact of the European monetary integration on US OFDI is 4.5% for the whole group, 4% for the EU countries, 27.6% in the case of the EA, 54.6% for the core and 9.3% for the periphery. Therefore, we confirm what we already found in the previous section: monetary integration in Europe and the creation of the euro have had a large impact on American FDI in the Eurozone countries and its core. On the other hand, this effect has been smaller for the EA peripheral countries and those groups with non-euro countries. In addition, with the sole exception of the EA core[9], the magnitude of the effects obtained is in line with the findings obtained by the previous literature.

Regarding **market size and population**, the interaction between the *Euro* and the *real GDP of the host country* is negative for most of the country groups, except for the EA core, and reduces the positive effect of the original variable. Therefore, for those countries participating in the European monetary integration process, the magnitude of the coefficient of

[8]This applies not only to the variables not involved in the interactions but also to those, such as *Euro* that are involved. In this particular case, the value of the first row coefficients in Table 5 are the result of the transformations from the interactions.

[9]A possible explanation for the magnitude of the coefficient obtained in this group could be that except for Austria, all these countries where members of the ERM since its beginning and have been highly monetary integrated for the whole period considered in our work.

real GDP is lower than for those other states outside the Eurozone. A possible explanation could be that due to the pro-trade effects of the single currency and the consequent increasing participation in GVCs, the market size becomes less relevant, moving in favor of vertical strategies. This finding is in line with the results obtained by Sondermann and Vansteenkiste (2019). Nonetheless, the opposite is true in the case of the core countries, where the *real GDP of the host country* remains positive (0.09). The former implies that with the increase in monetary integration in Europe, HFDI motivations have remained significant in the EA core.

As for **labor market** covariates, in contrast to the simple specification, the parameter of the *skill level of the host country* is significant in three cases when we include in the specification its interaction with the Euro. In the core, the sign is negative (-5.4%). Since this variable could be a proxy for wages, FDI would be linked to less skilled labor and lower labor costs. Martí et al. (2017) and Chiappini (2014) find similar results. However, this same variable is positive for the EA peripheral countries, where one unit increase in skill augments FDI by 2.3%. According to Alfaro and Charlton (2009), many subsidiaries are generally located in high-skill countries and sectors that also produce high-skill inputs involving products at stages close to the parent firm's final stage of production. This strategy is known as intra-industry VFDI. Therefore, beyond labor cost considerations, skilled workers can also be attractive for VFDI. However, the results are the opposite once we interact this variable with the *Euro*. For the core countries, *skill level* turns into positive (1.7%) and reduces the negative coefficient of the original variable, whereas, for the periphery, this change is negative (-1.2%) and diminishes the positive impact of the same covariate without interaction. Therefore, with the introduction of the common currency, intra-industry VFDI has gained relevance in the core, whereas pure VFDI has become an important motivation in the periphery. Lastly, the parameter of *Euro*LogPopulationDensity* is only significant and positive for the whole group and reduces the negative effect (-1.339) of the variable before interaction. Consequently, with the participation in the ERM and the launching of the Euro, US OFDI has been attracted by more populated countries where the necessary workers are more abundant and, consequently, cheaper, following a vertical FDI strategy.

Lastly, concerning **institutional quality**, the joint effect of *Euro* and the *corruption index of the destination country* is only significant and positive for the EU countries (0.4%) and reduces the negative impact of the variable alone. Therefore, according to our findings, the

single currency has attracted US OFDI to countries with better institutions.

5 Conclusions

This paper studies the determinants of US OFDI stock and whether the process of monetary integration in the EU has changed these patterns. For this aim, we use a sample of 56 host countries (that represent 70% of total American FDI) during the period 1985-2019. We start our study by analyzing this whole group composed of countries from different regions of the world. Subsequently, we focus on EU and EA countries, and within this last group, we distinguish between the core and the periphery. In our research, we diverge from the traditional OLS regression and apply the PPML estimator suggested by Silva and Tenreyro (2006). In addition, instead of focusing on a predetermined set of variables and a specific regression model, we start from the variables considered robust in the BMA analysis carried out by Camarero et al. (2021). Moreover, we follow Sondermann and Vansteenkiste (2019) and use a variable that include the whole process of monetary integration in Europe to proxy the effect of the common currency.

Our results show that the behaviour of US OFDI stock is explained by various host country characteristics, such as market size, labor market, trade, investment openness, institutional quality, government size, bank and credit regulations, and communications infrastructure. This diversity, in line with Camarero et al. (2021), is more evident when we analyze our largest and heterogeneous group. In addition, we find evidence of HFDI and VFDI in all country groups. However, HFDI strategies predominate in EA core countries, whereas VFDI prevails in the EA periphery.

As for the *euro effect*, our findings suggest that the Euro has generally increased US OFDI in those countries that have adopted the euro. Moreover, the interactions of our variable *Euro* with other determinants explain essential changes in the patterns of US FDI in Europe. Market size variables indicate that the common currency may have been to the detriment of HFDI in favor of VFDI for all country groups. One exception is the EA core, where we find that the euro has encouraged HFDI strategies. As for the labor market, the euro has favored pure VFDI strategies in the EA periphery, whereas intra-industry VFDI has predominated in the core. Finally, we can also conclude that adopting the common currency has reinforced US OFDI in countries with higher quality institutions.

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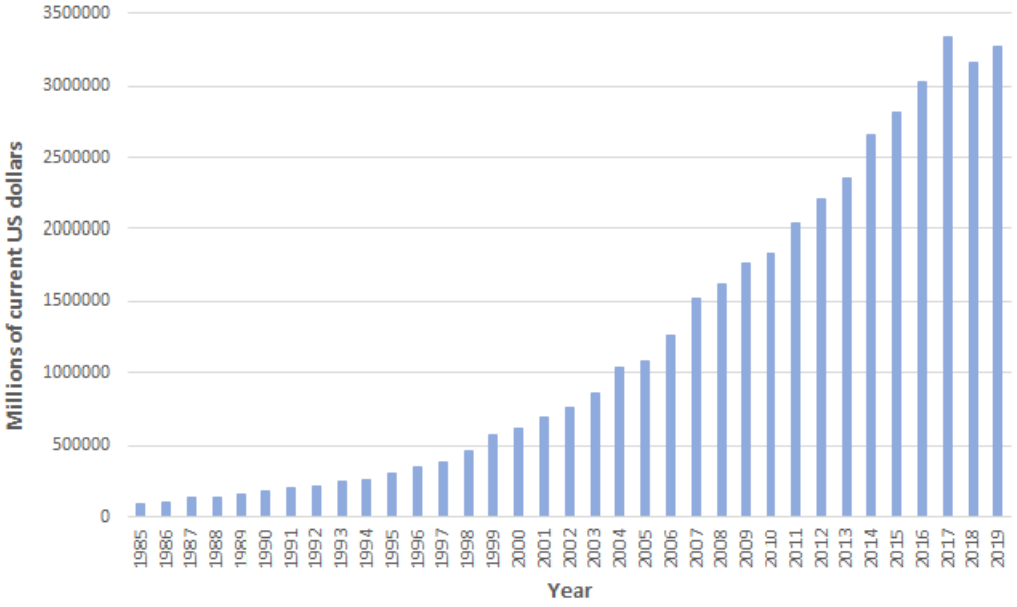
Figure 1: FDI outward stock from the United States in the EU



Source: Own elaboration. Data obtained from Bureau of Economic Analysis (BEA).

Table 1: Groups of countries

Groups of countries	**Countries included**	**Number of countries**
Whole group	Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Canada, Chile, China, Colombia, Costa Rica, Cyprus, Denmark, Dominican Republic, Ecuador, Egypt, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Nicaragua, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Republic of Korea, Romania, Senegal, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Turkey, United Kingdom, and Uruguay	56
EU countries	Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Romania, Spain, Sweden and United Kingdom.	18
EA countries	Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain.	12
EA core countries	Austria, Belgium, France, Germany and Netherlands.	5
EA peripheral countries	Cyprus, Finland, Greece, Ireland, Italy, Portugal and Spain.	7

NOTES: We exclude from our sample the micro-states where US MNCs invests largely. The reason is that most FDI to these countries is not reflecting decisions based on long-run factors. A large proportion of these FDI outflows are just flows going in and out of the country on their way to their final destination, with this stop due to the favorable corporate tax conditions of the host country (see Blanchard and Acalin (2016)). These are the cases of Antigua and Barbuda, Bahamas, Barbados, Bermuda, Fiji, Grenada, Hong Kong, Luxembourg, Mauritius, Singapore and Trinidad and Tobago.

Table 2: Variables selected as robust determinants of US FDI. Results of the BMA analysis in Camarero et al. (2021)

Variables	Whole group	EU countries	EA countries	EA core countries	EA peripheral countries
Economic and monetary integration					
Euro	X	X	X	X[a]	X
EconomicIntegration		X	X	X	X
Market size and population					
LogRealGDP	X	X	X	X	X
Euro*LogRealGDP	X	X	X	X[a]	X
UrbanPopulation	X		X[a]	X	X
Euro*UrbanPopulation	X				
LogSumRealGDP	X	X			
LogRealGDPdiff	X				
RealGDPgrowth	X				
LogRealMarketPotential	X				
LogSpatialLagUSFDI	X	X		X	
LifeExpectancy					
OldDependencyRatio			X		
Labour market					
SkillLevel			X	X[a]	X[a]
Euro*SkillLevel			X	X[a]	X[a]
HCI		X	X		
Euro*HCI					
LogPopulationDensity	X	X	X		X
Euro*LogPopulationDensity	X	X	X		X
EducLevel					
SkillLeveldiff		X			
EducLeveldiff	X				
LogRealGDPdiff*SkillLeveldiff					
LogRealGDPdiff*EducLeveldiff	X				
LabourCompensation			X		
TFP	X	X			
Trade and international openness					
TradeOpenness	X			X	
Euro*TradeOpenness	X				

Variables	Whole group	EU countries	EA countries	EA core countries	EA peripheral countries
MeanTariffRate			X		X
Euro*MeanTariffRate			X		X
FTA					
DepthFTA					
RevenueTradeTaxes	X	X			
KOFSoGIdf	X				
Investment openness					
Chinn-ItoIndex	X				
BlackMarket		X	X		
BIT	X				
Institutional quality					
Corruption		X			
Euro*Corruption		X			
DemocraticAccountability					X
Euro*DemocraticAccountability					X
LawOrder	X				
BureaucracyQuality					
ProtectionPropertyRights	X				
IntegrityLegalSystem					
CivilLiberties					
PoliticalRights	X				
Government Size					
GovernmentConsumption			X		
GovernmentInvestment	X				
TopMarginal	X	X	X		
StateOwnershipAssets					
Banking and credit regulations					
OwnershipBanks	X				
PrivateSectorCredit					
InterestRateControls	X				
Monetary conditions					
InflationCPI		X			
MoneyGrowth		X			
ForeignCurrencyBankAccounts					

Variables	Whole group	EU countries	EA countries	EA core countries	EA peripheral countries
Communications infrastructure					
Telephone					
Cellular	X			X	
Internet	X	X			
Natural resources					
OilRents					
GasRents					
Exchange Rate					
NominalExchangeRate			X	X	

NOTES: The selected variables are market in red. [a] The variables *Euro*, *Euro*LogRealGDP* in the EA core, *UrbanPopulation* in the EA group, and *SkillLevel* and *Euro*SkillLevel* in the core and the periphery were not robust determinants in Camarero et al. (2021). However, they were in at least one of these groups. We include them to compare the US OFDI determinants and the effect of the euro among the Eurozone countries.

Table 3: Variables and definitions

Variable	Definition	Source
Dependent variable		
USFDIstock	Outward FDI stock from the United States to the host country at current U.S. dollars.	Bureu of Economic Analysis
Economic and monetary integration		
Euro	Variable which takes value 1 if the host country is outside the ERM with a currency pegged to D-Mark/ECU/Euro, 2 if its currency is pegged to the ECU/euro via the ERM, 3 if its currency is the euro, and 0 otherwise.	Own elaboration
Market size and population		
LogRealGDP	Logarithm of the host country's real GDP at constant 2010 US dollars	WDI from Wold Bank and WEO from IMF
Euro*LogRealGDP	Interaction between the variable Euro and the logarithm of the host country's real GDP	Own elaboration
LogSpatialLag	Logarithm of the sum of US FDI in the host country neighbours weighted by distance between host and neighbouring capital cities.	Own elaboration.
UrbanPopulation	Percentage of population of the host country living in urban areas	WDI from World Bank
Labour market		
SkillLevel	Skill level of the host country measured as the percentage of population age 25 + with completed and uncompleted secondary schooling.	Education statistics from World Bank and UNDP.
Euro*SkillLevel	Interaction between the variable Euro and the skill level of the host country	Own elaboration
LogPopulationDensity	Logarithm of the population density of the host country	WDI from World Bank
Euro*LogPopulationDensity	Interaction between the variable Euro and the logarithm of the population density of the host country.	Own elaboration.
SkillLeveldiff	Absolute difference between the host country's and US skill level	Own elaboration

Variable	Definition	Source
Trade and international openness		
TradeOpenness	Total imports and exports of the host country divided by total GDP at current US dollars.	WDI from World Bank
KOFSoGIdf	KOF de facto social globalization index of the host country	
Institutional quality		
Corruption	Index measuring the absence of corruption in the host country. It ranges from 0 to 6, being a higher score a lower level of corruption.	International Country Risk Guide
Euro*Corruption	Interaction between the variable Euro and the corruption level of corruption	Own elaboration
DemocraticAccountability	Index measuring how responsive government is to its people in the host country. It ranges from 0 to 6, being a higher score a higher level of democratic accountability.	International Country Risk Guide
Investment openness		
BlackMarket	Index measuring the absence of a black-market exchange rate in the host country. It ranges from 0 to 10, being a higher score a lower existence of a black-market exchange rate.	Fraser Institute
Government size		
TopMarginal	Top marginal income tax rates of the host country	Fraser Institute
Banking and credit regulations		
OwnershipBanks	Index measuring the percentage of bank deposits held in privately owned banks in the host country. It ranges from 0 to 10, being a higher score a higher share of privately held deposits.	Fraser Institute
Communications infrastructure		
Cellular	Mobile cellular subscriptions of the host country per 100 people	WDI from World Bank

NOTES: WDI=World Development Indicators, WEO=World Economic Outlook, IMF=International Monetary Fund and UNDP=United Nations Development Program.

Table 4: Simple model specification

Variables	Whole group	EU countries	EA countries	EA core	EA periphery
Euro	0.106**	-0.063**	0.204**	0.201***	0.128**
	(0.042)	(0.031)	(0.099)	(0.069)	(0.059)
LogRealGDP	1.412***	2.041***	1.901***	3.283***	2.943***
	(0.092)	(0.216)	(0.215)	(0.520)	(0.190)
LogSpatialLag	0.101***	-0.274***		-0.427***	
	(0.026)	(0.069)		(0.073)	
UrbanPopulation			0.106***	0.055***	-0.059***
			(0.006)	(0.006)	(0.017)
SkillLevel			0.002	-0.004	-0.006
			(0.003)	(0.003)	(0.005)
LogPopulationDensity	-1.171***		2.597***		
	(0.253)		(0.675)		
SkillLeveldiff		0.026***			
		(0.003)			
TradeOpenness				0.019***	
				(0.001)	
KOFSoGIdf	-0.033***				
	(0.004)				
Corruption		-0.007***			
		(0.002)			
DemocraticAccountability					-0.005
					(0.003)
BlackMarket		0.033***			
		(0.008)			
TopMarginal	-0.007***		-0.021***		
	(0.003)		(0.005)		

Variables	Whole group	EU countries	EA countries	EA core	EA periphery
OwnershipBank	-0.006***				
	(0.001)				
Cellular	-0.004***				
	(0.001)				
Host Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Reset Test	0.997	0.356	0.891	0.624	0.254
N ° of observations	1950	620	420	175	245

NOTES: ***, ** and * denote significance at levels 1%, 5% and 10%, respectively. Robust standard errors are in parenthesis.

Table 5: Augmented model specification

Variables	Whole group	EU countries	EA countries	EA core	EA periphery
Euro	1.714*	1.361*	3.089***	-3.276***	4.411***
	(0.953)	(0.811)	(0.858)	(1.201)	(0.651)
LogRealGDP	1.502***	1.913***	2.152***	2.120***	3.148***
	(0.085)	(0.193)	(0.191)	(0.556)	(0.183)
Euro*LogRealGDP	-0.134***	-0.060**	-0.122***	0.091**	-0.134***
	(0.038)	(0.029)	(0.031)	(0.041)	(0.025)
LogSpatialLag	0.116***	-0.283***		-0.531***	
	(0.026)	(0.067)		(0.076)	
UrbanPopulation			0.105***	0.040***	-0.142***
			(0.006)	(0.007)	(0.025)
SkillLevel			-0.012**	-0.054***	0.023**
			(0.006)	(0.107)	(0.010)
Euro*SkillLevel			0.007***	0.017***	-0.012***
			(0.002)	(0.003)	(0.004)
LogPopulationDensity	-1.339***		2.298***		
	(0.245)		(0.665)		
Euro*LogPopulationDensity	0.401***				
	(0.056)				
SkillLeveldiff		0.028***			
		(0.003)			
TradeOpenness				0.019***	
				(0.001)	
KOFSoGIdf	-0.032***				
	(0.004)				
Corruption		-0.013***			
		(0.003)			
Euro*Corruption		0.004***			
		(0.001)			
DemocraticAccountability					-0.011***
					(0.004)

Variables	Whole group	EU countries	EA countries	EA core	EA periphery
BlackMarket		0.035***			
		(0.008)			
TopMarginal	-0.006**		-0.024***		
	(0.003)		(0.005)		
OwnershipBank	-0.005***				
	(0.001)				
Cellular	-0.005***				
	(0.001)				
Host Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Reset Test	0.597	0.578	0.933	0.570	0.192
N ° of observations	1950	620	420	175	245

NOTES: ***, ** and * denote significance at levels 1%, 5% and 10%, respectively. Robust standard errors are in parenthesis.