Currency Union and Investment Flows: Estimating the Euro Effect on FDI

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Abstract

This paper studies the effect of the euro introduction on international FDI flows. Using country-pair data on 35 OECD economies during 1997-2008 and adopting the propensity score matching as identification strategy, we investigate the impact of the euro on capital reallocation. In general, the euro exhibits no significant impact on FDI. However, the effect becomes significant on the subset of EU countries, increasing FDI flows by 14.3 to 42.5 percent. Furthermore, we find that the EU membership fosters FDI flows much more than the euro, increasing FDI flows by 55 to 166 percent. Among other FDI determinants, high gross domestic product, low distance between countries and low unit labor costs in target country have a positive effect on FDI. On the contrary, long-term exchange rate volatility deters FDI flows.

Keywords: monetary union, foreign direct investment, common currency area, euro

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1 Introduction

In 1999, the euro was introduced as a common currency in eleven countries of the European Union (EU). The establishment of the European Monetary Union (EMU) was viewed as a necessary step towards closer political and economic integration. From the political perspective, the common currency was expected to become a unifying symbol of European identity. From the economic perspective, the common currency was supposed to enhance a free movement of capital which is a fundamental principle of the EU. At the same time, it would promote trade through diminishing transaction costs resulting from the elimination of exchange rate volatility (Rose 2000). In a broader context, the common currency was believed to ensure better functioning of the European Single Market (Delors 1989).

The euro project has been generally supported by policymakers and politicians. Expectations about the economic gains of a common currency were ambitious and several waves of enlargement took place over the last decade (Table 1).[1] Nevertheless, eurosceptics objected that one currency does not fit monetary needs of diverse economies and the initial weak growth of the euro area only fueled their arguments. Among academics, the decision to form a common currency area led to a huge interest. The literature ranges from the assessment of the fulfillment of Mundell-McKinnon-Kenen criteria, evaluation of arguments in favor and against a currency union (e.g. Giavazzi and Torres 1993), comparison of co-movements in macroeconomic variables between the EU and the USA or the analysis of their asymmetric shocks (e.g., Bayoumi and Eichengreen 1993).

The debate on the contribution of a common currency to economic development is vital. In our paper, we contribute to the mosaic of the impacts of a common currency on the economy by investigating one specific aspect of a common currency – the link between the introduction of the euro and the inflow of foreign direct investment (FDI). Two main research questions regarding euro and FDI are being asked: first, has the common currency enhanced FDI flows for countries that adopted the euro as compared with the rest of OECD countries and, second, has the euro fostered capital reallocation for euro countries as compared with the rest of the EU? In addition, the role of both economic and monetary integration is inspected and the impact of introducing the euro is compared with the impact of the EU membership.

The euro exerts influence on many economic activities, one of them being the flow of capital among countries resulting from the removal of restrictions on investment location decisions (Baldwin et al. 2008). It is important to study and understand firms' international strategies as FDI is associated with higher economic growth, developed technologies and knowledge spillovers among countries (Harris and Taylor 2005). Literature has shown that uncertainty negatively affects investment and, more specifically, that uncertainty about exchange rate movement has adverse effect on FDI decisions

[1] Greece joined the club in 2001. The EMU was enlarged later by Slovenia in 2007, Cyprus and Malta in 2008, Slovakia in 2009 and the newest euro area member is Estonia which joined the EMU in 2011. Thus, 17 of 27 EU countries now use the euro as an official currency.

(Carruth et al. 2000). In particular, a persistent deviation of the exchange rate from the long run equilibrium negatively affects FDI flows (Campa 1993). Thus, it is natural to ask whether the elimination of the exchange rate movements resulting from the introduction of a common currency influences firms´ long-term investment decisions and FDI in general.

The common currency can affect FDI inflows through three channels: reduced exchange rate uncertainty, reduced transaction costs and increased price transparency. First, the elimination of exchange rate risk leads to cost saving stemming from the absence of a need for hedging, thereby positively affecting expected returns to firms. Many multinational enterprises (MNEs) are export-oriented and FDI serves mainly as a production platform for their exports (Bergstrand and Egger 2006). Naturally, a motivation of MNEs to locate their manufactures in the EMU increases as foreign investors' expansion into the euro area leads to an access to the rest of the euro area countries and to the surrounding EU market. Secondly, the reduction of transaction and operational costs associated with the use of many currencies decreases the cost of capital flows. Thirdly, the common currency enhances price transparency, facilitating a comparison of factor prices and costs calculations. Many investments abroad are motivated by firms' effort to produce efficiently and the endowment and prices of primary factors of production – land, labor and capital – are important determinants of firms' localization decisions.

Answering the question about the euro impact on capital reallocation through FDI would bring about broad policy implications. Apart from traditional location determinants (infrastructure, human capital), countries use various institutional factors to attract FDI. Specifically, governments spend vast amounts of public money on FDI promotion policies and investment incentive schemes. Thus, the quantification of the impact of the euro on FDI flows might become one of the factors under consideration of the EU countries that have not adopted the euro so far. Furthermore, it may also indicate the advantage of a common currency for different regions or groups of countries, too.

The reminder of the paper is organized as follows. In Section 2 we analyze global FDI flows and the role of the FDI in the EU. In Section 3 we review related literature. Sections 4 and 5 are devoted to methodology issues and data description and Section 6 presents the identification strategy. In Section 7 we present our results and robustness checks. Section 8 summarizes and presents concluding remarks.

2 FDI in the EU

Global FDI flows have grown dramatically over past three decades, increasing from \$54 billion in 1980 to \$1,771 billion in 2008. In the 1980s and early 1990s, there was an evident increasing trend in FDI to developing countries as productive factors were emphasized as one of the most important motivation for FDI.[2] These countries

[2]Locating firm's activities to countries with the lowest production costs leads to vertical FDI.

capitalized on the advantage of lower productive costs, mainly labor costs, and their share in global FDI flows rose from 14 percent in 1980 to 37 percent in 2008, as shown in Table 2. There is a dip in world FDI flows starting in 2001 related to the slowdown in the world economy and a decline in cross-border mergers and acquisitions. After recovering during 2004-2007, there was a more recent decline in 2008, mainly due to an incoming economic and financial crisis. However, the overall share of FDI flows to developing countries has remained significantly lower than the share of flows to developed economies (37 vs. 57 percent in 2008).

Europe is absorbing about two thirds of total FDI inflows to developed economies, followed by North America with the share of 26 percent (Table 3). Besides being the main recipient of world FDI flows, Europe is also the main source of these flows, followed by the United States and Japan. Further disentangling the structure of FDI flows, approximately 96 percent of FDI flows into Europe aim to the EU and more than 66 percent into the EMU. From 1995, FDI inflows to Europe have increased, with an exception of periods 2001-2004 and 2008-2009 when the world FDI flows decreased due to a financial and economic crisis. However, it has remained the prevalent global recipient of FDI flows.

The euro area, becoming a single huge market with more than 300 millions consumers, is expected to attract FDI by its enormous size, economic power and no exchange rate risk. FDI is often associated with indirect effects on host countries through spillovers on domestic suppliers, customers or firms in general. These spillovers are either horizontal or vertical. Horizontal FDI spillovers occur when a new foreign company with a high productivity influences domestic competing companies which are in turn forced to increase their efficiency either by new technology implementation or by hiring new, better trained workers and managers (Javorcik 2004). Vertical FDI spillovers are represented by the influences of the foreign company on domestic suppliers or consumers. Nevertheless, the literature on FDI technology spillovers offers ambiguous empirical evidence. Using meta-analysis approach, Havranek and Irsova (2010) examine numerous empirical FDI spillover studies and they conclude that FDI spillover effect is positive only for certain situation, e.g. the impact on domestic suppliers. In this light, it will be interesting to analyze the effect of the common currency on FDI.

3 Literature Survey

A rapid growth of investment flows in a globalized world economy over the last decades has sparked academic interest in FDI determinants and the FDI effects on both host and home economies. The empirical literature acknowledges that foreign investors' location decisions are influenced by firm-level factors as well as macroeconomic, geographic and institutional variables. One strand of literature on the FDI determinants arises from the eclectic paradigm (Dunning 1997) which is also known as OLI model.[3] Based on

[3]OLI model is based on three categories of advantages of foreign investment: O – Ownership advantage (trademark, entrepreneurial skills etc.), L – Location advantage (access to raw materials,

the new trade theory it emphasizes ownership and location advantages and analyzes FDI from the investors´ point of view. Investors' decisions whether to become a multinational enterprise is examined mainly through firm costs represented as plant-level costs and trade costs (Markusen and Venables 1998; Kleinert 2001). Another strand of literature looks at determinants of FDI location from the perspective of country differences, attempting to identify how country-level factors such as size, institutions, taxes, exchange rate, trade protection, production factor prices and human capital endowment affect FDI flows.[4]

Literature focusing on the effect of exchange rate on FDI has two branches, one examining the relation between exchange rate levels and international investment flows and the second focusing on the exchange rate volatility and the role of uncertainty and expectations about future exchange rate. Studies based on the firm-level framework and the option theory find that greater exchange rate uncertainty increases the outside option for firms so that it pays off to delay their investment, which depresses current FDI.[5]

Since the formation of the European Monetary Union (EMU), analysis of the role of exchange rate uncertainty on FDI flows is supplemented by the aspect of common currency and its impact on investment flows. The literature studying the link between the euro and FDI finds a significant positive impact of euro on FDI (Petroulas 2007; Schiavo 2007; De Sousa and Lochard 2006; Buch et al. 2003). However, there is no accordance regarding the size of the effect, therefore the exact magnitude of the impact of the euro on FDI remains unclear.

Baldwin et al. (2008) highlight that usual shortcoming preventing a proper estimation of the euro effect on FDI is a less-developed methodology and identification strategy. In our paper, we use a rigorous identification technique to obtain more reliable estimates on the common currency impact on international investment.

Standard approach to analyze the impact of euro on FDI employs a gravity model augmented with a dummy variable for a common currency. De Sousa and Lochard (2006) investigate FDI decision of a firm to set up an affiliate abroad and estimate the effect of euro on FDI for 21 OECD countries. They find that a common currency has a positive impact on FDI within the euro area. They also find that impact of euro on FDI is higher in the EU peripheral countries like Greece or Italy. When they drop these two countries from the sample, the effect of euro on FDI decreases by 10 percentage points to 19 percent. However, the question whether the euro has attracted also capital from the rest of the world is not addressed. Petroulas (2007), using a difference-in-differences approach for a panel of unilateral FDI flows for 18 countries, tackles also this issue as he explores changes in FDI flows within euro area, between euro area countries and non-euro area countries, and between non-euro area countries, too. He

prices of production factors etc.), I – Internalization advantage (licensing, joint venture etc.).

[4]Bloningen (2005) offers a good survey of literature on FDI determinants.

[5]Dixit (1989) theoretically models firm's entry and exit decisions under uncertainty and Carruth et al. (2000) provide a complete survey of empirical literature on exchange rate volatility and FDI based on the option theory.

finds that the introduction of euro raised inward FDI flows by approximately 16 percent within the euro area and by about 11 percent for non-member states. FDI flows from the non-member countries into the euro area increases by 8 percent. On the same note, Schiavo (2007) estimates the effect of a common currency on bilateral FDI flows among 25 OECD countries applying a gravity-type empirical model with a parsimonious set of explanatory variables. He concludes that a reduction in exchange rate uncertainty due to the introduction of euro increases cross-country investment flows by 160 to 320 percent. An alternative specification using three-year averages in order to eliminate a high variability in FDI flows decreases the magnitude to 70 to 250 percent. The endogeneity of FDI with respect to GDP is partly resolved by the use of fixed effects. However, the wide range of the results suggests that estimates should be interpreted with caution.

The majority of mentioned papers (Sousa and Lochard 2006; Petroulas 2007; Schiavo 2007) use country-pair fixed effects, capturing time-invariant heterogeneity between country-pairs, thereby reducing concerns about endogeneity of investment flows. However, this variation includes also time-invariant observable controls (e.g. common language) and, consequently, precludes the quantification of their impact separately. This poses a serious concern for a validity of the use of gravity model, as the model's intuition is built behind the incorporation of time-invariant factors like land area and distance between countries.

Apart from examining FDI flows using the data from balance of payments, there are studies inspecting plant-level micro data. Buch et al. (2003) analyze the impact of euro on German data from a mandatory firm-level survey organized by the Bundesbank.[6] They find that FDI from the EU significantly increases after the introduction of the euro. The effect is present to a smaller extent also for non-euro countries. The advantage of their approach is the use of reliable firm-level data as compared to general capital account FDI data. However, they face the problem of using a single nation's data and the uncertainty that the results are driven by national asymmetric shocks. These suspicions are partly confirmed by Petroulas (2007) who finds that Germany and Belgium-Luxembourg act as a hub for FDI flows of the euro area.[7] Thus, the size of the impact of the euro on FDI flows for individual countries seems to be ambiguous as Schiavo (2007), contrary to Petroulas (2007) and Sousa and Lochard (2006), does not find that any country faces higher impact of euro on its FDI flows.

Summarizing, exchange rate uncertainty has received a considerable interest in the empirical literature on FDI in recent years. However, all papers work with the data ending by the year 2001 or 2002, and thus the question whether the euro has influenced firms' long-term investment decisions and actually their decisions on FDI has still remained mostly unanswered. Furthermore, since the common currency affects

[6] In general, firm-level studies on FDI issues are not numerous due to unavailable or insufficient data.

[7] After excluding Germany and Belgium-Luxembourg, most of the euro effect disappears. On the other hand, if they are excluded only as a receiver country or only as an investor country, the euro effect remains nearly the same.

international investments via various channels, we might be suspicious that some of these channels might need a longer period for transmission than two or three years after the common currency is introduced. Therefore, our paper investigates the impact of the euro using the data on FDI flows until 2008. It allows us to examine the effect of common currency on FDI in the longer period (nine years after EMU establishment) and to shed light on foreign investor's motivation by including countries from the latest wave of the euro area enlargement.

4 Methodology

We adopt the approach commonly used in the trade literature employing the gravity-equation model specifying trade flows between countries as a function of the GDP of each country and the distance between these two countries.[8] Recently, the gravity equation models have proven to be useful also in explaining international investment flows.[9] The focus is put on time-invariant exogenous and policy variables so that endogeneity problem is eliminated. Explanatory variables such as geographic distance, cultural ties (common language) and policy changes are used. The advantage is taken from the fact that panel data makes it possible to analyze structural policy breaks. In our paper, such an exogenous break is represented by the accession of a country to the euro area.

The model thus combines institutional factors with environmental factors. The traditional gravity literature (e.g., Brainard 1997) specifies financial flows between countries as a function of various institutional and geographical factors. Following this approach, the amount of FDI flow from a country i into a country j at time t can be expressed as

$$\begin{aligned} \ln FDI_{ijt} &= \phi(\ln dist_{ij}, \ln GDP_{ijt}, \ln ULC_{ijt}, EERSR_{ijt}, EERLR_{ijt}, \\ &\quad border_{ij}, lang_{ij}, t, EU_{ijt}, euro_{ijt}), \end{aligned} \tag{1}$$

where FDI_{ijt} is FDI flow from a country i into a country j , $dist$ represents the geographical distance between countries, GDP stands for a product of gross domestic products, ULC is a ratio of exchange rate adjusted unit labor costs, $EERSR$ stands for a short-term exchange rate volatility and is expressed as a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices, $EERLR$ stands for a long-term exchange rate volatility and is expressed as a five-year coefficient of variation of a ratio of countries' real effective exchange rate indices, $border$ indicates a common border, $lang$ is a dummy indicating countries share the same language,[10] t is a time trend capturing changes in FDI flows affected by aggregate factors (e.g.

[8] Anderson (1979) presented a theoretical foundation for the gravity model. This approach has widely been used to inspect trade flows between countries (e.g. Anderson and Wincoop 2003).

[9] Frankel and Wei (1996) first applied the gravity equations on FDI flows.

[10] In case a country has more than one official language, it is sufficient if any of these languages is shared with the second country in a pair.

macroeconomic factors) common to all countries, *EU* is a dummy indicating presence of both countries in the EU and *euro* is a dummy indicating that both countries belong into the euro area.

The semi-log functional form is chosen over the linear specification due to a better fit of the model. Given the skewness of FDI data, this specification leads more likely to robust standard errors (Bloningen and Davies 2004). Moreover, it reduces the weight of outliers with very large FDI flows and it allows us to interpret the estimated coefficients of continuous variables as elasticities. However, this transformation is at the expense of losing information from negative flows.

The abovementioned variables are traditional determinants of FDI flows, each having its economic rationale.[11] The size of the two economies measured as a product of their GDP approximates the market potential of these countries. Empirical literature finds that increasing size of two economies enhances FDI flows between them. International price competitiveness expressed by unit labor costs affects FDI negatively. An improvement in ULC may occur via increases in labor productivity or cuts in taxes and the size of this effect on FDI depends on the sensitivity of a particular type of FDI. The sensitivity of FDI to a change in unit labor costs varies across sectors; FDI demanding highly qualified labor force is not very sensitive, while FDI demanding low qualified labor force is very sensitive to changes in unit labor costs.[12] The effective exchange rate as a measure of whether a currency is appreciating or depreciating to the exchange rate against a basket of foreign currencies with whom the country trades enhances the effect of exchange rate and its volatility on FDI flows. The literature supposes negative relation between FDI and exchange rate volatility as volatility increases macroeconomic uncertainty, thereby reducing the attractiveness of domestic assets. We distinguish between short term volatility of exchange rate and long term misalignments. The distance between countries is another factor affecting FDI location mechanism. Empirical literature typically finds that it has a negative impact on FDI flows as greater distance between countries makes a foreign affiliation more difficult to establish, manage and monitor (Egger and Pfaffermayer 2001). Following the same logic, the border dummy is expected to affect FDI flows positively as common border represents smaller communication costs and closer ties between countries. The effect of the common language on FDI is expected to be also positive as the common language decreases communication costs for FDI flows. These three variables - geographical distance, border and language are often named as cultural distance - are proxies for time-invariant asymmetries between countries which can strengthen the investment linkages between countries. The EU membership captures the overall benefits of the single market on FDI flows and is expected to be positive. Finally, the euro dummy is pivotal for our paper as it expresses the effect of the common currency on FDI.

[11] Billington (1999) offers summary of economic and political determinants of FDI. Chakrabarti (2001) examines the impact of the whole set of variables on FDI and checks their robustness to small changes in conditioning information set. Martín and Velázquez (1997) present FDI determinants for OECD countries.

[12] Bellak et al. (2008) investigate the effect of labor costs on FDI.

5 Data

Annual FDI flows data during the period 1997-2008 are used for the analysis. The availability of the such span presents an advantage over previously mentioned studies on FDI impact of euro, which use only a limited number of years (one to three) after the euro introduction. As the focus of this paper is the analysis of European FDI flows, the main source of the data on investment flows is Eurostat, compiling harmonized FDI from regulatory reports to central banks and surveys filled by resident business units.[13] It provides data on unilateral FDI flows for each reporting country by partner country. Both FDI inflows and outflows are reported for 35 countries (29 OECD members and 6 non-OECD countries).[14] The choice of countries is motivated by the effort to cover FDI flows between the majority of European countries and their major FDI partners. Overall, the data sample consists of 589 country-pairs, providing us with an unbalanced panel of 11,457 observations.[15]

One-way outward investment flows FDI_{ijt} are used, representing investment from country i to country j in period t. It can occur that FDI flow from country i to country j is measured in two different ways – either reported by investing country i as an outflow to country j or reported by recipient country j as an inflow from country i. In reality, there is often a discrepancy between these two values. There is no information indicating that any of these values is "better", therefore, we ameliorate this measurement error by constructing the average of the two series.

Table 4 displays the descriptive statistics of covariates for both euro and non-euro country pairs.[16] The majority of observations belongs to non-euro country pairs (10,367 vs. 1,090 observations). With the exception of FDI flows, exchange rate volatility, language and border dummy, observable characteristics for euro and non-euro pairs are not very different. This is not surprising as most OECD Member States are developed and quite homogenous economies. More important, it suggests that the variance in FDI

[13]FDI benchmark definition, according to OECD, regards FDI as a sum of "the net sales of shares and loans (including non-cash acquisitions made against equipment, manufacturing rights, etc.) to the parent company plus the parent firm´s share of the affiliate´s reinvested earnings plus total net intra-company loans (short- and long-term) provided by the parent company".

[14]Out of a total number of 34 OECD countries, Luxemburg, Israel, Chile, Mexico and Switzerland are omitted. Unit labor costs data for Switzerland are not available. In case of Luxemburg, balance of payment data displays large FDI flows associated with the favourable bank environment which is not a primary focus of this paper. Israel, Chile and Mexico exhibit a considerable number of missing values on bilateral FDI flows. Six non-OECD countries are Bulgaria, Cyprus, Latvia, Lithuania, Malta, Romania.

[15]Although 35 considered countries constitute 35*34/2 = 595 country-pairs, we do not possess information for FDI flows between Australia, Canada, New Zealand and South Korea (6 country-pairs) for any year during 1997-2008. Out of 589 country-pairs, there is information on both FDI inflow and outflow during the whole period of 12 years for 191 country-pairs, the rest contains at least one missing value. However, we have at least 20 observations for 353 country-pairs and at least 10 observations for at least 567 country-pairs.

[16]As stated above, a pair is viewed as "euro pair" during a given period when both countries use the euro as a currency during this period. Otherwise (when one or both countries do not use euro), the pair is referred to as non-euro pair.

flows is not directly attributed to the level of GDP or distance between countries.

Table 5 compares a trend of FDI for euro and non-euro pairs over time. It illustrates the U-shaped behavior of both groups of country-pairs, with a modest decline during 2000-2003, indicating that time trend is not a significant factor in explaining the difference in FDI flows between euro vs. non-euro country pairs, too.

The source of unit labor costs data is OECD and we construct unit labor costs ratio as a fraction of unit labor costs in an originating country over unit labor costs in a recipient country. The source of data on GDP is the International Monetary Fund (IMF) and the real effective exchange rate indices (REER) are obtained from the Bank of International Settlements (BIS) database.[17] A short-term exchange rate volatility is expressed as a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices and a long-term exchange rate volatility is expressed as a five-year coefficient of variation of a ratio of countries' real effective exchange rate indices. Additional data include geographical and cultural factors such as distance between countries (measured as a distance between capital cities), common border and language dummies.

6 Econometric Analysis

Empirical results of euro impact on FDI have been less numerous than on other issues concerning the impact of a common currency (e.g. trade effect), mainly due to a less developed empirical methodology and a lack of data (Baldwin et al. 2008). A simple OLS estimation may be potentially biased due to the self-selection of countries to adopt the euro. Therefore, after presenting OLS results, we address this shortcoming by exploiting variation in FDI flows before and after the introduction of the euro and performing a Tobit estimation due to a left-censored character of the dependent variable.[18] Moreover, a pivotal aspect of our paper is that we account for a potential selection bias for euro adoption: the estimation is performed only for a comparable subset of country pairs matched by propensity score matching technique. Using this approach, the analysis is based on the comparison of otherwise similar country-pairs (identified by a similar propensity to share the euro), the only difference being the adoption of euro.

6.1 Difference-in-differences estimation

A difference-in-differences estimation allows us to exploit policy change and estimate the impact of euro adoption on FDI flows. The following econometric specification is

[17] The BIS real efective exchange rate indices are calculated as geometric weighted average of a country's currency relative to an index of other major currencies adjusted for the effects of inflation.

[18] Due to disinvestment, many FDI flows are negative, thereby precluding a conversion into a logarithmic scale. These missing observation are considered as censored from the left.

estimated:

$$\begin{aligned}\ln FDI_{ijt} &= \beta_1 \ln dist_{ij} + \beta_2 \ln GDP_{ijt} + \beta_3 ULC_{ijt} + \beta_4 EERSR_{ijt} + \beta_5 EERLR_{ijt} + \\ &\quad \beta_6 border_{ij} + \beta_7 lang_{ij} + \beta_8 t + \gamma_1 EU_{ijt} + \gamma_2 euro_{ijt} + \epsilon_{ijt}, \end{aligned} \tag{2}$$

where γ_1 and γ_2 are the coefficients estimating the impact of the EU and the euro on FDI flows, respectively.

However, because of data nature, using simple OLS regression would bias our estimates. Due to disinvestment, reported FDI flow is often zero or even negative which imposes a serious limitations when using logarithmic form of the dependent variable.[19] In order to exploit the maximum amount of information from the available dataset, data are modified in a way that also observations with negative FDI flows can be used. One possibility of data modification is to perform a transformation $\ln FDI_{ijt} \equiv \ln(x + FDI_{ijt})$, where x is a positive scalar (Gujarati 1995). However, in such case, it would be difficult to correctly interpret the parameter estimates. Alternative transformation enables the adoption of the Tobit model (Tobin 1958), defining the dependent variable in a following way:

$$\begin{aligned}\ln FDI_{ijt} &\equiv 0 && \text{if } FDI_{ijt} \leq 0 \\ \ln FDI_{ijt} &\equiv \ln(1 + FDI_{ijt}) && \text{if } FDI_{ijt} > 0.\end{aligned}$$

This specification of the dependent variable exhibits a left censoring threshold at zero. Tobit estimation controls for this feature of the data and yields consistent parameter estimates.

6.2 Propensity Scores Matching

A propensity score matching technique attempts to provide an unbiased estimation of treatment effects using the approximation of a counterfactual outcome despite the lack of experimental data (Rosenbaum and Rubin 1983). It allows us to match country-pairs based on their observable characteristics and compare the potential outcomes between country-pairs which share euro currency and the countries that do not. In this way, we identify a control group of country-pairs with a similar propensity of sharing euro which actually do not share the euro.

Let FDI^1_{ijt} denote the value of FDI flow from country i to country j in the case they both use euro at time t and let FDI^0_{ijt} denote the level of FDI flows from country i to country j in the case they do not share a common currency. The impact of adopting the euro is then estimated as $FDI^1_{ijt} - FDI^0_{ijt}$.

The main problem in identifying the effect of euro on FDI flows is that FDI is observed only for one scenario of the treatment variable ($euro_{ijt}$) and remains unobserved for the other. One way how to solve this problem is to use similar countries selected by some matching mechanism and use this group as an approximated counterfactual.

[19] Out of 11,457 observations, 1,908 report negative FDI flows.

This identification strategy assumes that the potential amount of FDI between countries that adopted the euro would be the same as was the amount of FDI for the control group that did not adopt the euro:

$$E(FDI^0_{ijt}|euro = 1) = E(FDI^0_{ijt}|euro = 0). \tag{3}$$

However, it is difficult to match country-pairs based on many observable characteristics. A more lucid way is to construct a one-dimensional metric as a matching indicator. For this purpose, we employ a method uniting relevant observed characteristics into a single score known as a propensity score matching. These propensity scores are obtained from the probit equation estimating the probability of the event that a country-par shares the euro as a function of specified independent variables.

The probability of receiving the treatment (sharing the euro) is estimated as follows:

$$P(euro_{ijt} = 1) = \phi(\ln dist_{ij}, \ln GDPcap_{ijt}, \ln area_{ij}, lang_{ij}, bord_{ij}, landlock_{ij}) \tag{4}$$

where $P(euro_{ijt} = 1)$ stands for the probability that countries i an j both use the euro at time t, $dist$ represents the geographical distance between countries i and j, $lang$ is a dummy for the same language, $bord$ states for a common border,$landlock$ is a number of landlocked countries in a country-pair, $GDPcap$ is standing for the product of countries' GDP per capita and $area_{ij}$ as a product of the land mass of i and j in km^2.

After estimating the probit equation and obtaining the propensity scores, a matching algorithm is defined. Each treated pair, or in other words pair in which both countries share a common currency, is matched to one or more control pairs (depending on the matching technique) that consist of countries that do not share a common currency. The difference in their FDI flows serves as an estimate of the euro impact on FDI flows. The most common technique for matching is the nearest neighbor (NN) matching in which euro-pair is matched to the non-euro pair with the most similar value of propensity score. Unmatched pairs are discarded. Afterwards, the gravity equation 2 is estimated only for matched country-pairs in order to estimate the impact of the euro on FDI flows.

We perform two matching specifications of probit equation - restricted and unrestricted, differing by the constraint applied to the potential control group. The unrestricted specification does not constrain matched observations to be from the same year, matching a combination of a country-pair/year to control country-pair/year. In contrast, the restricted specification matches a treated country-pair to a control country-pair from the same year. Thus, we estimate an alternative specification of the probit equation:

$$P(euro_{ij} = 1) = \phi(\ln dist_{ij}, \ln GDPcap_{ij}, \ln area_{ij}, lang_{ij}, bord_{ij}, landlock_{ij}), \tag{5}$$

where $P(euro_{ij} = 1)$ is the probability that countries i an j adopted the euro during 1999-2008 and $\ln GDPcap_{ij}$ denotes the logarithm of $GDPcap$ as for 1998 (prior to

the euro adoption). Including all observations for treated and control country-pairs in difference-in-differences estimation (2), this restricted specification effectively compares FDI flows from the same year (heterogeneity across country-pairs is controlled by fixed effects and differences between years is partly captured by the trend).

It is crucial to stress that the objective of the probit equation is not to build a statistical or even a political model explaining the EMU membership in the best possible way. It is even possible that some relevant variables affecting the euro area membership are missing. Conversely, the close-to-perfect match would make matching more difficult as there would be only few country-pair matches with a similar probability of sharing the euro, the only difference being the euro currency. The imperfect prediction of the treatment does not present a problem as long as the omitted variables are unrelated to other FDI determinants. Summarizing, the aim is not to obtain the best fit for euro membership in probit estimation, but obtain a tool to identify and evaluate the impact of the euro introduction on FDI flows.

A propensity framework setup requires the fulfillment of some assumptions. First, the potential amount of FDI in the case of not sharing the euro is equal for euro and non-euro country-pairs so that the latter group can serve as an adequate control group (conditional independence assumption). This assumption is satisfied as the explanatory variables FDI equation include a vast set of indicators affecting FDI flows such as distance between countries, variable for GDP measure, unit labor costs ratio, exchange rate volatility, border and language dummies and time trend, filtering out heterogeneity in FDI flows caused by observable characteristics. All remaining differences can be attributed to the common currency dummy. Second, country-pairs with similar values of the relevant covariates have a positive probability of sharing and non-sharing the euro (common support assumption). In other words, there should be no significant difference between means of explanatory variables in equation (4) for euro and non-euro country-pairs. Based on the descriptive statistics displayed in Table 4 this condition is assumed to be satisfied. Third, FDI of a country-pairs sharing the euro is not affected by another country-pair's euro or non-euro state (stable unit treatment value assumption). Here, it can not be assumed that there are no spillovers as a particular country-pair's assignment into the euro area might be affected by other country-pairs' assignments.

Nevertheless, we can still make some inference about the impact of the euro by redefining the causal effect: instead of measuring the effect as "the difference between what would have been observed in a world in which units received the treatment and what would have been observed in a world where no treatment exists", we define the effect as "the difference between the particular unit's observed outcome and what would have been observed had that unit received no treatment." The average of these estimated unit-level effects gives us the demanded estimate of the average effect for the treated. Therefore, even in the absence of the stable unit treatment value assumption, well-defined causal question enables an attempt at an analysis.

7 Results

7.1 The Gravity Model

Results for several baseline specifications using the full sample of country pairs are reported in Table 6. The first specification is a simple OLS and the second specification is Tobit estimation which accounts for the left-censoring character of the dependent variable. The third and fourth specifications are augmented by country-pair fixed effects, helping to control for unobserved heterogeneity among various country-pairs.

Before focusing on a relationship between a common currency and FDI flows, we briefly present the results for other explanatory variables. Results confirm the idea behind a gravity model – the product of countries' GDP has positive and significant impact on FDI flows, indicates the link between economic strength of particular countries in a country-pair and FDI flows.[20] Geographical distance between two economies has a significant negative effect as expected. On the same note, common border and a common language (measuring a cultural proximity) both exhibit a positive and significant effect on FDI flows. These findings confirm the positive role of geographic factors in FDI allocation.

Unit labor cost variable indicates that the higher relative labor costs in originating country, the higher the FDI flow in recipient country, which is also in line with a theoretical proposition that investors seek cheap labor force. Finally, we find negative impact of exchange rate long term volatility while short term volatility remains insignificant. These findings reflect an easier and less expensive possibility of firms to insure against the risk of short term volatility by foreign exchange market instruments, meanwhile the long run exchange rate misalignments are more costly and hardly avoidable, therefore they have a deterrent effect on FDI flows.

7.2 EU vs. Euro impact

Following with the interpretation of the results displayed in Table 6, the main contribution is the segregation of the effect of EU membership on FDI flows from that of the EMU membership. In a simple OLS specification, the impact of euro is estimated to be positive. However, in more appropriate specifications accounting for unobserved heterogeneity (fixed-effects) or left-censoring (Tobit), this effect becomes insignificant. On the contrary, the magnitude of the EU dummy capturing the benefits of the common market remains significant even with the inclusion of fixed effects. As can be observed in last column, the EU membership increases bilateral FDI flows by exp(0.732)-1 = 107.9 percent.[21] On the other hand, the EMU impact is insignificant, increasing FDI

[20] In our regressions we use the log of the product of the gdp_{ijt}, assuming that the coefficient on "sender country GDP" should be equal to the coefficient on "receiving country GDP". We also tried an estimation with a less constrained specification, namely one coefficient for log (gdp_i) and another for log (gdp_j) and, the coefficients were not statistically different.

[21] The interpretation of a dummy cooefficient γ when the dependent variable is log-tranformed is given by $\Delta = 100*(\exp(\gamma)-1)$.

flows only by exp(0.138)-1 = 14.8 percent.

The findings from the baseline specifications become even more robust by using the propensity score matching technique. Elaborating the analysis, the Tobit estimation is run only for country-pairs matched by propensity score matching. Table 7 reports the coefficients for the EU and the euro variables. Under unrestricted matching (linking country-pair in a particular year to other country-pairs in other years), the impact of belonging to the EU on FDI flows ranges from 54.5 to 71.9 percent. In restricted-matching specification (matching treated country-pair with a control country-pairs and using this match for the whole period), this impact increases to 150.7 to 166.2 percent. On the contrary, the effect of sharing the euro ranges around zero (from -5.6 to 7.4 percent) and is clearly insignificant. Smith and Todd (2004) find that restricted matching estimators are more robust as they allow for time-invariant unobservable differences in outcomes between euro country-pairs and non-euro country-pairs. Thus our preferred estimator is the restricted matching estimator and the unrestricted estimates are performed as a robustness check. In addition, the robustness of the results is checked also by employing various versions of matching techniques.[22]

The sign and significance of other estimates are similar to those from baseline specifications. In particular, long-term exchange rate volatility reduces FDI between countries, high gross domestic product in both originating and target country encourages FDI flows, while the distance between countries and the unit labor costs gap decrease FDI flows.

Overall, the findings suggest a limited impact of the common currency on FDI flows. Being the EU member shows to be a far more crucial factor in FDI boost. However, it should be noted that the euro adoption inherently reduces exchange rate volatility. As a result, the coefficient of the euro dummy in Table 7 captures the part of the euro effect on FDI not caused by reduction of exchange rate volatility.[23]

[22]We use following matching techniques: three nearest neighbours (NN3), Radius matching and Kernel matching. The difference among theme lies in the number of available comparasion units and, more units for matches avoid the risk of bad matches.The NN3 allows matching of euro country-pair to the weighted outcome of three nearest non-euro country-pairs. Radius matching uses not only three nearest neighbours but also equally weights all of the comparison members within the radius. And last Kernel matching requires that all euro-pairs are matched with a weighted average of all non-euro pairs where weights are calculated using a kernel function and weights are inversely proportional to the differences between propensity scores.

[23]Indeed, excluding short-term and long-term exchange rate volatility variables from the model slightly increases the euro impact; however, it remains statistically insignificant. For the sake of brevity, these results are not reported.

7.3 Euro impact within EU

In our dataset, all countries using the euro are members of the European Union.[24] In order to extend our analysis, we investigate the impact of a common currency solely for the EU countries. It should be noted that the new sample does not contain countries like U.S., Canada or Australia, which should be taken into consideration when interpreting the estimates.

Table 8 presents the effect of the common currency on FDI flows within the European Union. Under this baseline specification, the euro dummy is significant, increasing bilateral FDI flows by exp(0.338)-1 = 40.2 percent. Table 9 shows estimates obtained only on the subsample of the EU countries and limited by country-pairs matched by propensity score matching. The euro increases bilateral FDI flows by 16.8 to 42.5 percent in unrestricted specification and by 14.3 to 36.5 percent in restricted specification. Overall, this finding suggests that the common currency positively affects FDI flows within a group of relatively integrated markets. These results should be viewed in the context of the hypothesis of endogeneity assuming that higher economic linkages among the members of currency union lead to the creation of optimal currency union ex post (Frankel and Rose 1998). Thus, the findings on the positive effect of the euro on FDI flows might indicate also a creation of closer linkages between countries.

7.4 Time dimension of the euro effect on FDI flows

The results on the link between the common currency and FDI flows are slightly contradictory to the existing literature on the FDI effect of the euro as most of the existing literature finds a positive and significant effect (Petroulas 2007; Schiavo 2007). Two possible explanations of this discrepancy are of methodological and time-dimensional nature, respectively. Firstly, the previous findings of a significant and often huge impact of the euro on FDI flows might be biased due to selection bias.[25] Secondly, using data until 2001 or 2002, these studies suffer from a short time span. Addressing this issue, we explore the time dimension of the euro impact on FDI, analyzing separately the period 1997-2003 which corresponds roughly to the time span used in previously mentioned studies.

Table 10 offers a comparison of estimates for the initial period (1997-2003) and the full time span (1997-2008). The results reveal that the euro impact is more pronounced in the first years after the launch of the euro currency (ranging from 23.7 to 54.1 percent), becoming negligible only in the longer run. It should be recognized that the

[24] Strictly speaking, it is possible for a country to use the euro without being the EU member. There are formal agreements between the EU and Vatican City, San Marino and Monaco, specifying the use of the euro as a legal tendar. In addition, Montenegro and Andorra use the euro without a formal approval.

[25] According to Persson (2001), within-sample estimation might be seriously biased if the countries belonging to existing currency union are non-randomly selected. Applying propensity matching technique, he contradicts the findings by Rose (2000) who finds that a currency union expands bilateral trade between two members by 200 percent or more.

euro dummy covers a different set of country-pairs for different years as new countries adopted the euro as the official currency.

The findings indicate a positive initial impact of the euro on FDI. However, this effect is only temporary and vanishes over the upcoming years. A possible explanation of this behavior might be a saturation of investors inclined to locate in the euro area. Arguably, it can be concluded that the common currency union impact is present in the form of one-off capital reallocation of multinational companies, nevertheless, reverting to pre-euro levels in the longer run.

8 Conclusion

In this paper, we investigate the impact of the euro currency on international FDI flows. Analyzing bilateral FDI flows between 35 developed countries during 1997-2008, we estimate the difference in FDI flows for country-pairs sharing the euro and country-pairs with at least one country using other currency. The identification strategy is based on propensity score matching, ensuring that the control group of districts contains only similar countries in terms of probability to introduce the euro.

The findings indicate that the impact of the euro on FDI flows is negligible (-5.6 to 7.4 percent). Interestingly, the EU membership fosters FDI much more that the euro, increasing FDI flows by 54.5 to 166.2 (depending on the matching specification).

The effect of the euro on FDI flows, however, differs for the sample of OECD countries and for the subsample of EU countries. In former case it does not significantly increase FDI flows, while in latter case it accelerates FDI flows by 14.3 to 42.5 percent.

The results suggest that the impact of the euro on FDI flows is smaller than presented in recent literature. One reason of this discrepancy may be the use of a more elaborated econometric technique (propensity score matching). Another reason may the different (longer) time span used in our study. Indeed, the short time span of three years (used in prevous studies) shows a positive effect of the euro on FDI also in our setup. Nevertheless, considering the high variability of FDI flows, this impact should be interpreted with caution. The EU membership, being a more dominant factor in FDI attraction that the euro, also contributes to a weakening role of the euro over time.

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Table 1: A timeline of the euro area enlargement

EMU membership	1997-98	1999-2000	2001-06	2007	2008	2009-10	2011
Austria		x	x	x	x	x	x
Belgium		x	x	x	x	x	x
Cyprus					x	x	x
Estonia							x
Finland		x	x	x	x	x	x
France		x	x	x	x	x	x
Germany		x	x	x	x	x	x
Greece			x	x	x	x	x
Ireland		x	x	x	x	x	x
Italy		x	x	x	x	x	x
Luxembourg		x	x	x	x	x	x
Malta					x	x	x
Netherlands		x	x	x	x	x	x
Portugal		x	x	x	x	x	x
Slovakia						x	x
Slovenia				x	x	x	x
Spain		x	x	x	x	x	x

Note: Sign "x" indicates EMU membership during a particular period of time.

Table 2: World FDI flows by recipient country

FDI flows	World	Developing	Transition	Developed	EU	EMU
year	bil. USD (at current prices)	%	%	%	%	%
1980	54	14	0	86	39	-
1990	208	17	0	83	47	-
2000	1382	19	1	81	49	36
2001	825	26	1	73	47	35
2002	628	28	2	70	49	39
2003	566	33	4	82	46	39
2004	733	40	4	56	29	17
2005	986	34	3	63	51	27
2006	1459	30	4	67	40	23
2007	2100	27	5	69	43	28
2008	1771	37	7	57	30	17

Source: http://unctadstat.unctad.org/

Note: According to UN methodology, countries are classified as developed economies, developing economies or transition economies. The development of a country is represented by the Human Development Index (HDI), a compound indicator integrating income per capita, life expectancy and the rate of literacy.

Table 3: Annual FDI flows to developed economies

FDI flows	Europe	N. America	Asia	Oceania	Developed Total
mil. USD (current prices)					
1995	137	68	2	16	222
1997	155	115	5	10	285
1999	532	308	16	3	851
2001	395	187	8	11	601
2003	280	61	10	12	362
2004	218	136	11	45	410
2005	509	131	8	-23	625
2006	628	297	9	36	970
2007	988	375	31	49	1,444
2008	551	380	35	52	1,018
2009	378	149	16	23	566

Source: http://unctadstat.unctad.org/

Note: North America is represented by the United States, Bermuda, Canada, Greenland, Saint Pierre and Miquelon.

Table 4: Comparison of averages, euro vs, non-euro country-pairs (1997-2008)

	$euro_{ij} = 1$	$euro_{ij} = 0$
$\log(FDI_{ij})$	4.49	2.77
$\log(GDP_i * GDP_j)$	39.19	37.62
log(distance)	7.14	7.84
ULC ratio	1.00	1.02
EER short	0.11	0.44
EER long	0.03	0.07
common border	0.18	0.06
common language	0.09	0.05
landlocked	0.18	0.24
# observations	1,090	10,367

Note: Dummy $euro_{ij}$ equals 1 if both countries in a pair use the Euro currency; otherwise it equals 0. FDI_{ij} stands for FDI flows from country i to country j in mil. USD, GDP is a gross domestic product per capita in USD (deflated to year 2000), ULC ratio is a ratio of exchange rate adjusted unit labor costs in country i compared to country j, EER short is a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices, EER long is a five-year coefficient of variation of a ratio of counties' real effective exchange rate indices, landlocked takes values 0, 1 or 2 according to number of landlocked countries in a country-pair.

Table 5: Comparison of dependent variable means, by year

year	$euro_{ij} = 1$	(# obs.)	$euro_{ij} = 0$	(# obs.)
1997			2.50	679
1998			2.61	711
1999	4.83	78	2.37	708
2000	5.30	78	2.25	793
2001	4.70	98	1.02	892
2002	4.11	109	1.89	948
2003	4.17	110	1.87	989
2004	4.18	110	2.09	1026
2005	4.46	110	2.18	1047
2006	4.74	110	2.46	1060
2007	4.72	132	2.75	918
2008	4.03	155	2.82	596

Table 6: Baseline results: FDI inflow determinants

	OLS		Tobit		Fixed effects		Tobit (FE)	
	(1)		(2)		(3)		(4)	
$\log(GDP_i * GDP_j)$	0.602***	(0.008)	0.895***	(0.014)	0.471**	(0.220)	0.613***	(0.022)
log(distance)	-0.603***	(0.026)	-1.026***	(0.043)				
ULC ratio	0.872***	(0.103)	1.377***	(0.163)	0.105	(0.113)	1.449***	(0.143)
EER short	-1.609*	(0.856)	-1.777	(1.393)	0.101	(0.733)	-0.252	(1.289)
EER long	-1.834***	(0.636)	-4.102***	(1.042)	-0.706	(0.619)	-2.734**	(1.091)
EU	0.493***	(0.058)	0.653***	(0.090)	0.447***	(0.064)	0.732***	(0.112)
euro	0.178**	(0.080)	- 0.084	(0.121)	0.124	(0.113)	0.138	(0.192)
common border	0.488***	(0.093)	0.344**	(0.141)				
common language	1.562***	(0.095)	1.904***	(0.143)				
Country-pair dummies	No		No		Yes		Yes	
Observations	11,457		11,457		11,457		11,457	
			4,613	censor.			4,613	censor.
R2	adj.	0.401	pseudo	0.108	overall	0.319	pseudo	0.175

Note: The dependent variable is the logarithm of FDI flow from originating to recipient country. Unit labor costs ratio is a fraction of unit labor costs in originating country over unit labor costs in recipient country, short exchange rate volatility is a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices, long exchange rate volatility is a five-year coefficient of variation of a ratio of countries' real effective exchange rate indices. Time and country-pair dummies are not reported. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 7: The impact of the EU and the euro on FDI inflow: matching

Model	PSM algorithm	NN3		Kernel		Radius	
		EU	Euro	EU	Euro	EU	Euro
Unrestricted	coef	0.435*	0.014	0.508***	-0.016	0.542***	-0.013
	std	(0.26)	(0.18)	(0.17)	(0.14)	(0.11)	(0.13)
	% impact	54.5*	1.4	66.2***	-1.2	71.9***	-1.3
Restricted	coef	0.979***	0.028	0.924***	0.022	0.919***	-0.098
	std	(0.17)	(0.18)	(0.14)	(0.15)	(0.23)	(0.21)
	% impact	166.2***	2.5	152.1***	7.4	150.7***	-5.6

Note: Table contains results of the Tobit estimation on the dataset containing treated country-pairs with control country-pairs identified by propensity score matching: NN3 - nearest three neighbors, kernel-matching, radius matching. The dependent variable is the logarithm of FDI flow from originating to recipient country. The impact on FDI flows in percentages is calculated as 100*(exp(coef)-1). Unrestricted specification performs matching of country-pair/year to a country-pair/year, i.e., allows different control country-pairs for different years. Restricted specification matches a country-pair with a different country-pair (based on observables from 1998 – prior to euro adoption) and uses this match for the whole period 1997-2008. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 8: Baseline results: Euro impact on FDI flows for EU countries

	OLS		Tobit		FE(3)		Tobit	
	(1)		(2)		(3)		(4)	
$\log(GDP_i * GDP_j)$	0.627***	(0.019)	0.786***	(0.026)	0.821*	(0.487)	0.285	(0.195)
log(distance)	-0.855***	(0.085)	-1.091***	(0.116)				
ULC ratio	0.243	(0.353)	0.280	(0.480)	0.178	(0.367)	0.396	(0.416)
EER short	1.294	(2.899)	3.100	(3.933)	-1.528	(2.685)	-0.832	(3.698)
EER long	-1.652	(1.745)	-2.231	(2.391)	1.113	(2.314)	1.324	(3.107)
Euro	0.215**	(0.102)	0.264*	(0.138)	0.227	(0.149)	0.338*	(0.205)
common border	0.343**	(0.164)	0.302	(0.219)				
common language	1.178***	(0.183)	1.273***	(0.245)				
Country-pair dummies	No		No		Yes		Yes	
Observations	3,966		3,966		3,966		3,966	
			1,141	censor.			1,141	censor.
R-2	adj.	0.356	pseudo	0.083	overall	0.301	pseudo	0.147

Note: The dependent variable is the logarithm of FDI flow from originating to recipient country. Time and country-pair dummies are not reported. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 9: The impact of the euro on FDI inflow for EMU countries: matching

Model	Matching algorithm	NN3 Euro	Kernel Euro	Radius Euro
Unrestricted	coef	0.354*	0.155	0.238*
	std	(0.18)	(0.15)	(0.14)
	% impact	42.5*	16.8	26.9*
Restricted	coef	0.311*	0.134	0.234
	std	(0.17)	(0.15)	(0.20)
	% impact	36.5*	14.3	26.4

Note: The table contains results of the Tobit estimation on the dataset containing EU countries during 1997-2008. The dependent variable is the logarithm of FDI flow from originating to recipient country. Alternative PSM algorithms are used: NN1 - nearest neighbor, NN3 - nearest three neighbors, kernel-matching, radius matching. The impact of the euro on FDI flows in percentages is calculated as 100*(exp(coef)-1). Unrestricted specification performs matching of country-pair/year to a country-pair/year, i.e., allows different control country-pairs for different years. Restricted specification matches a country-pair with a different country-pair (based on observables from 1998 – prior to euro adoption) and uses this match for the whole period 1997-2008. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 10: The impact of the euro on FDI inflow: matching by time period

Model	PSM algorithm	NN3	Kernel	Radius
1997-2003	coef	0.280	0.213	0.432*
	std	(0.24)	(0.20)	(0.26)
	% impact	32.3	23.7	54.1
1997-2008	coef	0.024	0.071	-0.058
	std	(0.17)	(0.15)	(0.21)
	% impact	2.5	7.4	-5.6

Note: The table contains results of the Tobit estimation with the logarithm of FDI flow from originating to recipient country as a dependent variable. Alternative PSM algorithms are used: NN1 - nearest neighbor, NN3 - nearest three neighbors, kernel-matching, radius matching. The impact of the euro on FDI flows in percentages is calculated as 100*(exp(coef)-1). The specification matches a country-pair with a different country-pair (based on observables from 1998 – prior to euro adoption) and uses this match for the whole period. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.