Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER THESIS

Linkage between Exchange Rate and Foreign Direct Investments: Empirical evidence from Developing Countries

Author: **Bc. Martin Hnath**

Supervisor: **Doc. PhDr. Adam Geršl, Ph.D.**

Academic Year: **2013/2014**

Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, January 6, 2014

Signature

Acknowledgments

I would like to thank my supervisor, Doc. PhDr. Adam Geršl, Ph.D., for his guidance and support. I would also like to thank Prof. Ing. Evžen Kočenda, Ph.D. and PhDr. Jozef Baruník, Ph.D. for their valuable comments in performing my empirical part.

Abstract

In this thesis we provide an updated empirical evidence on the linkage between an exchange rate and foreign direct investments (FDI). On the sample of 40 developing countries receiving FDI flows from five developed OECD economies, we analyse how the strength of exchange rates, exchange rate volatility and currency regime affect FDI. Applying the Hausman-Taylor instrumental variable approach over the analysed period from 1991 to 2010, we have not found unanimous support on the role of exchange rates in influencing FDI. In the thesis, we document that over the last two decades, bilateral exchange rate volatility decreased and this can be assigned to its less-likely influence on FDI. In addition, based on the results of the analysis, we cannot confirm the wealth effect hypothesis that supposes an increase of FDI after real depreciation of developing country's currency. We ascribe this outcome to the development of average real exchange rates of developing countries that exhibited considerable strenghtening during the analysed period. We also find that de facto bilateral fixing of the currencies might be beneficial for FDI flows. The reasoning might lie in the reduction of transaction costs that is linked to credible exchange rates.

JEL Classification	F21, F23, F31
Keywords	exchange rate, foreign direct investments, developing countries

Author's e-mail	martin.hnath@gmail.com
Supervisor's e-mail	adam.gersl@gmail.com

Abstrakt

Táto diplomová práca poskytuje aktualizované odhady spojitosti medzi výmenným kurzom a priamymi zahraničnými investíciami (PZI). Na vzorke 40 rozvojových krajín prijímajúcich PZI z piatich rozvinutých OECD krajín skúmame, ako úroveň menového kurzu, kurzová volatilita a režim menového kurzu ovplyvňujú PZI. Aplikáciou Hausman-Taylorovej metódy inštrumentálnych premenných medzi rokmi 1991-2010 sme nedospeli k jednoznačnej roli vplyvu výmenných kurzov na PZI. V práci dokumentujeme, že za posledné dve desaťročia došlo k zníženiu volatility výmenných kurzov rozvojových krajín, čo mohlo mať za následok jej menej pravdepodobný dopad na PZI. Taktiež na základe výsledkov analýzy nepotvrdzujeme hypotézu zvýšeného bohatstva investorov, ktorá predpokladá nárast PZI po reálnej depreciácii meny rozvojovej krajiny. Tento výsledok pripisujeme vývoju reálnych menových kurzov rozvojových krajín, ktoré v analyzovanom období zaznamenali v priemere značné posilnenie. V práci taktiež evidujeme pozitívny vplyv de facto bilaterálnej fixácie mien na toky PZI. Odôvodnenie možno nájsť v znížení transakčných nákladov, ktoré je spojené s dôveryhodnými výmennými kurzami.

Klasifikácia JEL	F21, F23, F31
Kľúčová slová	výmenný kurz, priame zahraničné investície, rozvojové krajiny

E-mail autora	martin.hnath@gmail.com
E-mail vedúceho práce	adam.gersl@gmail.com

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Acronyms

IMF International Monetary Fund

FDI Foreign Direct Investments

MNE Multinational Enterprise

OECD Organisation for Economic Co-operation and Development

OLS Ordinary Least Squares

UNCTAD United Nations Conference on Trade and Development

US United States

Master Thesis Proposal

Author	Bc. Martin Hnath
Supervisor	Doc. PhDr. Adam Geršl, Ph.D.
Proposed topic	Linkage between Exchange Rate and Foreign Direct Investments: Empirical evidence from Developing Countries

Topic characteristics Foreign direct investments (Foreign Direct Investments (FDI)) have become the inherent part of almost every economy all over the world. As a consequence of their inevitable role there have raised incentives to study deeply the determinants, effects and spillovers of these type of investments. In my thesis I would like to examine in more detail one of the location specific determinant of FDI - the exchange rate. Since there are number of determinants potentially affecting FDIs the purpose of the thesis would be to appropriately handle the data in order to discern the true impact of exchange rate on foreign direct investments. Specifically, I will analyze if and how FDI inflows respond to the exchange rate level, exchange rate uncertainty and exchange rate regimes in the recipient countries. The main contribution of this thesis is, to the best of my knowledge, that it would be the first comprehensive analysis particularly dealing with all of the aforementioned variables. Moreover, as the empirical literature contains mixed results about how FDIs react on proposed variables this thesis will also contribute to a limited amount of papers dealing with this issue. I will apply the study on developing countries and in order to correctly investigate the specified hypotheses I will use the data from the statistics provided by United Nations Conference on Trade and Development (UNCTAD).

Hypotheses Hypothesis #1: FDI inflows respond to the exchange rate level. Hypothesis #2: Exchange rate uncertainty is a determinant of FDI inflows. Hypothesis #3: Exchange rate regime is a determinant of FDI inflows.

Methodology With regard to analyse the specified topic properly I will use the standard econometric methodology that best fit testing the hypotheses and the dataset used. I will use not only standard determinants of FDI inflows that occur in the economic literature but I will also add variables determining exchange rate level, exchange rate uncertainty and exchange rate regime to the estimated equation in order to check for the hypotheses. Special attention will be devoted to the variable of exchange rate uncertainty which I would like to model as volatility of exchange rate using GARCH methodology. Moreover I will take the potential endogeneity problem into considerations that could arise from two-way influence between exchange rate volatility and FDI inflows. Econometric part of the thesis will be performed in an appropriate statistical software.

Outline

1. Introduction
2. Literature Review
3. Background
4. Data and Methodology Description
5. Empirical Results
6. Policy Implications
7. Conclusion

Core bibliography

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Chapter 1

Introduction

Over the last two decades developing countries experienced substantial increases of foreign direct investments (FDI). Inward FDI stock of developing countries rose from 514 US$ billion in 1990 to 6514 US$ billion in 2010, according to the United Nations Conference on Trade and Development (UNCTAD). It is thus legitimate that such surges of capital flows boosted research on their determinants, effects and spillovers.

The collapse of Bretton-Woods system in the early 1970s induced countries to higher flexibility in maintaining their exchange rates. While in advanced economies this transition was rapid, the decline of hard pegs in developing and emerging countries was more gradual (Rogoff *et al.* 2003). Exchange rates thus became more flexible, which promoted studies about their effects on macroeconomic indicators. Depreciations of the US$ in 1970s and 1980s, together with surges of US FDI inflows iniciated the seminal analyses examining the role of the strength of currency on these capital flows. One of the pioneers of such research were Alexander & Murphy (1975), Caves (1988) and Froot & Stein (1991), who found that the relative strength of US$ dollar was an important factor for localizing FDI in the US.

Various theories about the proposed relationship of exchange rate levels and FDI strived to provide the explanation based on capital market imperfections. While the theories presented by Froot & Stein (1991) or Bloningen (1997) have their underpinnings, further empirical works however do not give them unanimous support. Yet, it was not only the strength of currency that started to occur in the analyses after the Bretton-Woods breakup. With no less occurence the role of exchange rate volatility on FDI flows has been promoted. Consistent with the outcomes of the research on exchange rate levels, the ambiguity is by and large confirmed by volatility studies as well. This is theoretically predicted by Cushman (1985), who argued that the final impact

of exchange rate volatility on FDI depends on where the production and sales are localized.

Exchange rate levels and volatility of exchange rates have numerous representantion in studies attempting to clarify their impact on FDI. However, much less attention has been devoted to the analyses of the effect of currency regimes on FDI flows. The impact of exchange rate regimes might go beyond just the reduction of volatility. This statement has been confirmed by Schiavo (2007), who suggested that the significant european monetary union effect on FDI flows might also lie in cut of "transactional and informational barriers that evidently plays a major role in shaping international investment decisions" (Schiavo 2007, p. 545).

Despite the evidence presented above, the literature on FDI-inducing properties of exchange rates in developing countries is rather scarce. We are aware of only three comprehensive studies related to that topic. Recent empirical evidence has been provided by Abbott *et al.* (2012) who found that de facto fixed or intermediate currency regimes of developing countries outperform the floating option. However, such result is questionable because of aggregate flows used as their dependent variable. They also propose that a solution may lie in examining "the impact of country-pairs' combinations of exchange rate regimes on bilateral FDI flows" (Abbott *et al.* 2012, p. 104). In this thesis we eliminate this shortcoming with the use of bilateral data. While the remaining two studies (Bénassy-Quéré *et al.* (2001) and Busse *et al.* (2010)) based their analysis on bilateral FDI flows, there are other disadvantages in their approach. Firstly, data on bilateral FDI flows to developing countries were in 1980s and 1990s not adequately reported. Since the latest observable year in the aforementioned papers is 2004 (2001 in Bénassy-Quéré *et al.* (2001)), the implications derived from their analyses may be challenged. Secondly, the study of Busse *et al.* (2010) suffers from not accounting for bilateral exchange rates. In fact, only the rates vis-à-vis US$ are employed which may provide imprecise results. In our thesis we overcome the problem by applying bilateral real exchange rates. Finally, Bénassy-Quéré *et al.* (2001) do not account for exchange rate regimes explicitly, since they employ only exchange rate levels and volatility.

In our thesis we provide an updated evidence on the role of exchange rates on FDI flows to developing countries. With the use of bilateral data we investigate the link on the sample of five advanced economies as senders and 40 developing countries as receivers of FDI over the 1991-2010 period. In particular, we analyse how exchange rate levels, exchange rate volatility and the choice of currency regime affect FDI flows to developing countries. Regard-

ing the classification of currency regimes of particular developing countries we utilize both de jure and de facto exchange rate regime classification schemes. The contribution is twofold. First, we are not aware of any study examining presented linkage with the use of bilateral data on FDI flows and bilateral exchange rates as well. Second, to the best of our knowledge, it is the first study analysing the role of currency regime on FDI flows that apart from IMF methodology utilize also a recently compiled classification provided by Ilzetzki *et al.* (2011).

The thesis is structured as follows. In chapter two we provide background information on FDI and exchange rates. Subsequently, in chapter three we discuss current knowledge about the analysed linkage by providing the literature review. In chapter four we describe the data for our main variables. Our methodology is then presented in chapter five. Chapter six and seven contain the empirical analysis and robustness check, respectively. The summary of our research is given in chapter eight.

Chapter 2

Background

This chapter provides background information about foreign direct investments and systems by which exchange rates can be maintained. In the first section the basic definition of FDI is given together with the description of recent development of this type of investments in the world and in the developing economies. Thereafter, we briefly summarize the main effects and traditional determinants of FDI. Finally, we provide insight into the exchange rate systems and their statistical distribution in the developing countries.

2.1 Foreign Direct Investments in the World and in Developing Economies

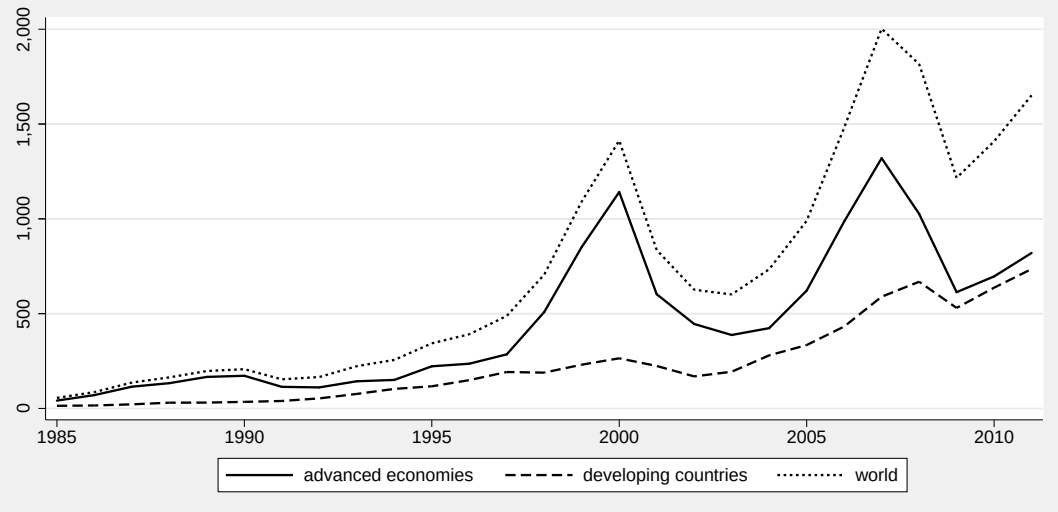
According to the OECD definition, FDI stand for long-term cross-border investments of entity from one economy in an enterprise of another economy, with gaining at least 10% of the voting power in invested firm. Depending on the gained voting power in direct investment enterprises we may differentiate among:

- subsidiaries with voting power over 50%
- associates with voting power between 10% and 50%
- branches which are 100% owned

Following the OECD definition, FDI flows capture equity, debt, reinvestment of earnings and additional income flows as income on debt, dividends and distributed branch profits. They represent one of the key transmitting channels of the international economic integration, also known as globalization process. In addition, they allow the transfers of intangible assets and technology between the economies all over the world. FDI are a subset of capital flows that further consist of portfolio investments and loans and credits provisions. There is a boosting relevance of these cross-borders capital flows over time. Being

depictured on Figure 2.1, an increasing trend in global FDI inflows may be noticed and, especially, developing countries played substantial role in recent growth.

Figure 2.1: Global FDI inflows over 1985-2011 in current US$ million and current exchange rates



Source: Author's processing based on UNCTAD data

Despite the rise of FDI flows in the recent decades, economic recessions affected negatively resulting figures. Dramatic downturn in FDI flows between 2001 and 2003 was ascribed mainly to the economic crisis, when particularly developed countries were hit substantially. During the crisis years especially developed countries suffered from lowering of M&A investments that were associated with reduced stock markets sentiments and business cycle. In 2004, global FDI flows started to recover and in 2006 they have returned back to their 2000 levels (UNCTAD 2007). But again, recent economic turmoil resulted in a huge drop of global FDI flows. This downturn has been driven mostly by developed countries and it seems that developing economies are to some extent crisis resistant.

In 2011, global FDI flows reached 1,524 US$ billion.[1] Nearly half of that flows were devoted to the developing countries. In the last years, the increasing amount of FDI flows to developing countries can be assigned mainly to Asia, Latin America and the Caribbean region. On the other hand, outflows from developed countries surged by 25% last year, driven by North America, Japan and the European Union (UNCTAD 2012).

To stress the importance of FDI in developing countries, measure of FDI as a percentage of GDP can be provided. According to statistics provided

[1] According to the statistics provided by UNCTAD.

by UNCTAD, in 2011 FDI inward stock of African developing economies accounted to 30,2% GDP, that was by 5,7% more than in Asia. The highest FDI inward stock could be observed in developing countries of Oceania that accumulated to almost 47% GDP.

Previous figures showed the presence of uneven distribution of FDI flows in the developing countries. In the past decades, Asia and Pacific region have been attracting around two thirds of total FDI flows to developing countries. However, in terms of flows Asia dominates from early 1990s and being followed by Latin America. Although the recent economic crisis negatively affected flows of FDI, South, East and South-East Asia remained the largest recipient with the smallest decrease between 2008 and 2009 that amounted to 17% (Akinmulegun 2012).

Confirmed by previous statistical measures, FDI play an inevatibale role in developing countries. Substantial increases of these capital flows over the past two decades resulted in a stack of analyses examining their determinants, effects and spillovers.

2.2 Effects of Foreign Direct Investments

The evidence on the impact of FDI contains both positive and negative effects. In terms of host country impacts, the outcome of such an investment depends on many factors, particularly trade barriers, human resources, financial system, market protection or institutional constraints play one of the key roles.

On the one hand, there are lots of favorable effects of FDI flows into the host countries. They provide technology transfers that could not be realizable through trade or financial investments. To some extent, some types of FDI can provide also more income to the host country system as the taxation remains inside the region. Moreover, they can ensure higher development of human resources as they put their know-how into the business (Feldstein 2000). Employees trained by the established multinationals can be beneficial for host economies, as the more skilled workers are subsequently hired by local companies or they settle new firms in the area. It is also accepted that FDI can increase competition and employment in the host countries.

Positive effects of FDI can be demonstrated also on organizational changes of host country economies. As Blomström & Kokko (1998) pointed out, multinational companies can enter the industries with high sunk costs and may thus abolish the monopolistic structure of given sector.

On the other hand, although the negative effects are not prevalent in the literature, they still have to be taken into account. As Sen (1998) explains,

multinational companies may provide technologies that are not adequate to the maturity of their development. The reason of such behaviour is that they may want to keep comparative technological advantage to the local companies. Moreover, the presence of multinationals can lead to increasing unemployment, as the higher technological progress can have consequences in lower needs for human resources (OECD 2002).

Negative effects of FDI flows can be observed also in the reduction of the support of local authorities, as explained in Ford *et al.* (2008). Moreover, FDI can have harmful impacts on balance of payments, as they have stronger influence on imports rather than exports (Mencinger 2003). Although the increased competition can be considered as favorable impact of FDI, it has to be noted that the outcome can turn to be contrarious. Toughest competition may coerce the local companies to either cease production or to merge with the competitors and create environment with lower competition.

One of the major negative issues is concerned with common unpredictability or instability of FDI inflows and consequent economic policy responses. Destabilization of host country development may often take place and the impact of implemented policy measures can be harmful to the economy (Vissak & Roolaht 2005). This is also the case when sudden and sizeable FDI inflows occur with usual inflationary pressures. Moreover, as Zhang (2001) explained, multinational companies may gain strong influence in political decisions that may be not appropriate for economic growth of the host country.

2.3 Determinants of Foreign Direct Investments

Lots of theoretical and empirical studies have made an effort to explain or examine the determinants of FDI. It seems that various types of FDI react differently on proposed determinants. As Dunning (1993) states, from the perspective of multinational companies three types of FDI exist: market-seeking, resource-seeking and efficiency-seeking.

Market-seeking FDI are connected with the aim of multinationals to serve local and regional markets. Since the target of these companies is to provide local markets with their goods or services, market size plays an important role in attracting FDI. On the other hand, resource-seeking FDI usually occur when MNEs need natural resources that are not available in their home country. Despite the natural resources play significant role in this type of investments, resources such as raw materials or some appropriate characteristics of labour force are also determining. This type of FDI are generally connected with subsequent export of their products. Lastly, third type of FDI is efficiency-

seeking and these investments are provided in order to benefit from economies of scale or scope in an more efficient way.

Practically all of the empirical studies analysing determinants of FDI consider market size as a potential location determinant. Market-size hypothesis postulates that sizeable market is needed for efficient usage of resources and utilization of scale economies (Charkrabarti 2001). The size of market may be crucial in terms of local demand and therefore stands as one of the major determinants of multinational decisions. In the empirical studies, market size is usually proxied by GDP or GDP per capita.

As Blonigen & Piger (2011) pointed out, studies that used gravity models prevailingly found that bilateral FDI flows and stocks of FDI are negatively associated with distance between two countries. The reasoning lies in the advantages of locating the facilities of multinational company in the host country when the distance is low as it reduces the transportation costs for serving the local or regional markets (it thus relates to vertical FDI and complementarity of trade and FDI). On the other hand, for horizontal FDI a positive effect of distance should be found. There were also studies that have specifically accounted for island, landlocked country or common borders.

Openness of the host country, mostly proxied by import and export to GDP, should also be a significant factor in FDI decisions as these investments are made into the tradable sectors. However, various types of FDI react differently on the depth of openness. On the one hand, market-seeking FDI may react positively on lower openness of the economy. Multinational companies producing for the local market may decide to localize their facility in the host market when the barriers are of higher costs, as stated in "tariff jumping" hypothesis. On the other hand, export-oriented FDI would prefer more open economies. Existing studies have analysed also how bilateral trade agreement, bilateral investment treaties, common free trade area or customs unions affect FDI.

Growth of the host country has also been proven as a potential factor. Charkrabarti (2001) explains importance of growth hypothesis as relevant FDI determinant because of higher potential of profit-making opportunities. The empirical evidence, with a proxy of GDP growth as most often used variable, shows however controversional results.

Costs factors, including relative labor costs and productivity, often enter into the analysis of location FDI determinants. Despite the logical arguments are placed behind the argument of taking the advantage of relatively cheap labor costs, Miller (1993) points out that productivity factors and transportation costs can often exceed labor costs thus affectingthe investments decisions

in developing countries. Empirical evidence shows amibiguous effect of costs factors.

Tax issues were taken into the considerations as a potential location determinant of FDI as well. The standard hypothesis is that higher taxation should deter FDI. In the empirical literature we can find mainly negative and non-significant effects of this variable on the decisions of multinational companies. However, positive correlation was recorded by study of Swenson (1994). As discussed by Bloningen (2005) the empirical evidence shows that the resulting influence depends on types of taxes, double taxation issues, tax treatment of the countries and how FDI are measured.

There have been also studies proposing infrastructure, prevailingly proxied by number of telephone lines per 1000 inhabitants, as FDI determinant. Reasoning of why infrastructure should matter in attracting FDI lies in lowering of the operational costs. Lower accessibility or higher transportation costs may depress the willingness of multinationals to place their facilities as it can result in lower efficiency gains. However, poor infrastructure can boost FDI in particular market as there may be incentives for given multinational to participate in this sector.

Amount of studies analysed how political risk and institutions influence FDI decisions. However, empirical evidence shows rather ambiguous impact of that factors. Researchers usually mention that political instability and poor institutions may deter the profitability or even the survival of the investments. It is also hypothesized that lower quality of institutions can lead to expropriation of the investments and rise in the costs of doing business. Proxy variables like the number of violent riots, presence of war and various indices of political stability or corruption were used in order to estimate the resulting effect.

Many researches consider common language and colonial relationships as potential FDI determinants. Common language has been justified by making it easier to do business between two countries. On the other hand, historical colonial relationship is considered as a variable that should boost FDI because of presence of stronger political or business links. Again, empirical evidence shows rather mixed results about proposed relationships.

Finally, macroeconomic stability has also been stressed by many empirical studies as one of the determinant of FDI decisions, particularly because of uncertainty issues. These considerations have been addressed by the amount of external debt, height of inflation and currency issues. Higher investment risk can be a consequence of high and volatile inflation. Morevoer, as Bloningen (2005) explains, there were situations in which higher external debt was associated with loosing creditworthiness of the country and subsequent exchange

rate devaluations have taken place that could harm the investments of multinationals. We provide more information about how exchange rates affect FDI decisions in Chapter 3.

2.4 Exchange Rate Considerations

Before we proceed to the next chapters, there arise a need to define the exchange rates and state how different exchange rate regimes are managed in the developing economies.

Standard definition considers exchange rate as a price of one currency expressed in terms of another currency. There are many possibilities of how different countries may manage their exchange rates. Four commonly recognized currency regimes can be observed: floating, intermediate, hard peg and soft peg regimes (see for example Yagci (2001)). However, many differences in the classifications of subitems within the individual regimes or even the regimes themselves can be observed in the existing literature (see Bleaney & Franscisco (2004) for comparison). As Bleaney & Franscisco (2004) stress, the Asian crisis proved that exchange rate regimes in developing countries can be quite distant from those declared by countries' authorities. We have decided to follow the classification of Yagci (2001) as we believe that for the purposes of our analysis it is the best way to describe the potential exchange rate systems.

In terms of floating regimes, the demand and supply is the only factor that determines the exchange rate. The monetary authorities do not intervene or intervene occasionally in the foreign exchange markets to dampen the fluctuations in the exchange rates. This type of regime has main disadvantage in excessive short-term volatility but as Yagci (2001) explains, extemporal interventions of monetary policy may alleviate high fluctuations of currency.

The second possible system of managing exchange rates is intermediate. Yagci (2001) includes managed floating and crawling broad band into this group. The common feature of this exchange rate regime is that the monetary authorities intervene in the foreign exchange rate markets to keep the exchange rate within the desired band. The main difference between the two subitems lies in the announcement of the broad band within a central rate which is in case of managed floating only a possible unofficial way of operation. Crawling broad band is commonly adjusted periodically to differences between the target and expected inflation of main trade partners. The cons of this exchange rate regime lie in the lack of certainty because the broad bands are sometimes hard to observe and it is also sometimes not easy to predict the interventions of

authorities in managed floating regime. But, on the other hand, if the regime proves its credibility, it can reach stability and competitiveness (Yagci 2001).

The broadest variability of subtypes of exchange rate system group encompasses soft pegs regime. Yagci (2001) classifies crawling narrow band, crawling peg, peg within bands and fixed peg to belong into this group. The charateristics of this system is that the exchange rates are being kept around defined rate or pegged to another currency with allowing to make some adjustments when misalignments are not further sustainable. The regimes of pegging within bands and fixed pegs are directly binding to another currency or basket of currencies but with not such a definite power as it is the case of hard pegs. The common disadvantages of such regime lie in high foreign currency reserves or low sensitivity to shocks absorption. Moreover, fixed peg can be subject to speculative attacks (Ghosh *et al.* 2003). Pros of this system are similar to advantages of intermediate regimes.

The last type of exchange rate regime stands for hard pegs. According to Yagci (2001), the following systems are included into this type of regime: currency unions, currency boards and systems which dollarized[2] their currency. This type of regime can be described as stricter dedication to either foreign currencies or to maintain shared currency among several countries. Using this system however the country loses its features of monetary policy and also the shocks absorption is left only to real economic activity. On the other hand, this system may provide the most credible signals. However, when the credibility is not supported by underlying economic fundamentals or the institutional quality, the credibility and corresponding advantages may be reduced (Macedo & Reisen 2003).

Since various authors use different classification schemes, the following distribution of exchange rate regimes may be in disputes with other sources. However, it can provide an insight into our analysis of how different exchange rate regimes are managed in the world. Fisher (2001) showed that the prevailing exchange rate regime of developing and emerging economies in 1991 was soft peg, used by 83 out of 137 countries in the sample. In 1999, the number of developing and emerging economies using this type of regime decreased, when only 62 out of 164 countries came into consideration.

Currently, geographical distribution of exchange rates regimes shows high diversity. On Table 2.1 we provide an overview of exchange rate regimes managed in the developing countries around the globe classified by region and IMF methodology. Presented summary demonstrates that the hard pegs are

[2]Dollarization is commonly used not only to describe countries which use dollars as their legal tender but also another currencies can be used, e.g. Franc.

prevailing in the developing economies as more than 40% of the sample of developing countries uses this type of exchange rate system. The most apparent utilization of hard pegs is in the region of Africa and Oceania. In terms of Africa, it is given mainly by participation of the countries in the monetary areas. There is a zone of countries using CFA Franc that is composed of two currency unions pegged to euro, namely West African Economic and Monetary Union and the Central African Economic and Monetary Community. Moreover, couple of countries participate in the currency union with South Africa through the Common Monetary Area.

Table 2.1: Exchange Rate Regimes in the Developing Countries in 2011, by region

	No. of countries	Hard pegs	Soft pegs	Floating	Other
Africa	53	23	7	13	10
Asia	37	12	9	10	6
Europe	17	7	1	7	2
Latin America	14	3	5	5	1
Central America & Caribbean	17	10	5	1	1
Oceania	10	8			2

Note: Hard pegs comprise exchange rate regimes with no separate legal tender and currency board arrangements. Soft pegs capture conventional pegged arrangements, pegged exchange rates within horizontal bands, crawling pegs, stabilized arrangements, and crawl-like arrangements. Floating stand for managed floating and free floating. The category Other captures residual regimes, e.g an emergence of black market in Belarus with substantial activity.

Source: Author's processing based on IMF (2012)

In terms of Oceania, countries prevailingly determine their exchange rates according to the basket of currencies or use currencies of different countries as their legal tender, e.g US dollar or Australian dollar.

Chapter 3

Exchange Rate as a Determinant of FDI

3.1 Strength of the Currency and its Impact on FDI

Examining the relationship between exchange rate movements and FDI implies to contradict the purchasing power parity (PPP). According to PPP, changes in the exchange rate should offset relative inflation in order to keep earnings in the home currency unchanged. Testing the exchange rate as a determinant of FDI indicates that there may be long-run deviations from PPP (Black 1977; Wihlborg 1978).

According to the literature, relationship between exchange rate levels and FDI remains ambiguous. In one of the initial studies, Mundell (1968) rejected the proposed connection justifying that appreciations or depreciations of exchange rates cannot grant, under the perfect capital mobility, systematic cost-of-capital advantages to either foreign or domestic companies. As Froot & Stein (1991) explain, traditional view considers the currency decline under its long-term equilibrium value to be accompanied by falling returns of the assets denominated in that currency and therefore price of those assets will rise. Hence, in the mobile capital framework, risk-adjusted expected returns on all international assets should be equalized. However, as a response, a stream of studies showing that some link exists, emerged.

Froot & Stein (1991) constructed a theoretical model showing that in the occurrence of informational imperfections in the capital markets, depreciation of domestic currency can support FDI as relative wealth of foreign investors increases. Since foreigners hold more of their wealth denominated in the currency different from the domestic one, devaluation of domestic currency in-

creases their relative wealth position and therefore lowers their cost of capital. This assumption has been endorsed by Klein & Rosengren (1992), who found an evidence that changes in relative wealth of foreigners significantly affected FDI inflows to the United States. Consistent with these studies, Alexander & Murphy (1975) derived the theoretical model examining the internal rate of return of alternative investments. The results supported the presumption that devaluations of US dollar attracted FDI inflows. In addition to this, Kohlhagen (1977) constructed model and showed empirically that currency depreciation in host countries is followed by increases of production capacities by MNEs for serving their domestic market. Caves (1988) found that the strength of a country's currency relative to the U.S. dollar was an important explanatory variable for FDI into the U.S. On the other hand, Stevens (1998) questioned the results of Froot & Stein (1991) showing that exchange rate is significant variable affecting FDI flows only at certain time periods.

Another theoretical underpinnings explanining connection between the exchange rate and FDI was presented by Bloningen (1997). Following Froot & Stein (1991), this model was based on capital market imperfections as well. However, the theory is applicable only to FDI acquisitions that involve firm-specific assets.[1] Author's argument standing behind the exclusive inclusion of this type of assets is that they can generate returns in different markets without involving any foreign currency transactions. Testing this model on data of Japanese acquisitions across US industries over the 1975 to 1992 period showed that real US$ depreciation increased foreign acquisitions of Japanese companies in the U.S. industries which have more likely firm-specific assets.

In the seminal empirical works, a depreciation of US dollar in connection with increasing FDI was examined. Nonetheless, Japanese FDI were also subject of several analyses. According to Sazanami *et al.* (2003), appreciation of Japanese Yen was one of the determinant of Japanese FDI outflows to machinery industries in the East Asian region between 1978 and 1999 (see also XING (2006)). Takagi & Shi (2011) found that Japanese FDI flows to nine Asian countries declined with a depreciation of the yen using tha data from 1987 to 2008 (see also Baek & Okawa (2001)).

On the contrary, couple of studies (see Schmidt & Broll (2009) or Campa (1993)) evaluated empirically that appreciation of the host currency increase FDI into the host country. Campa (1993) assumed positive relationship between exchange rate levels and FDI given that appreciations of host currency will increase expectations about future profits from investments into the host

[1] Firm-specific assets can include process technology, product innovation, and managerial skills (Bloningen 1997).

country. However, the list of empirical studies confirming negative relationship between exchange rate levels and FDI is prevailing.

In the empirical literature we are able to find studies showing insignificant influence of exchange rate movements on FDI. De Vita & Abbott (2008) analysed FDI inflows to United Kingdom over the period 1975 to 2001. After controlling for endogeneity of regressors, real exchange rate was not found to be a determinant of these capital inflows.

3.2 Exchange Rate Volatility and FDI

Theoretical literature describing impact of exchange rate volatility on FDI can be divided into two approaches, regarding the consequences of exchange rate volatility in various time periods (Brzozowski 2003).

First path presented by Aizenman (1992), Darby *et al.* (1999) and Sung & Lapan (2000) focuses on production flexibility in the long run. As Brzozowski (2003) explains, impacts of exchange rate volatility in these models "generally depend on sunk costs in capacity, competitive structure and the convexity of the profit function in prices." Proposed models work with the assumption that decisions of MNEs about the placement of foreign and domestic facilities are made ex ante when the producers do not know production costs precisely and the structure of future orders, while employment decisions are made after the nominal or real shocks materialize.

Aizenman (1992) works with the presumption that in order to make the production flexible, companies may diversify on the international level in such a way that they can rearrange their portfolio towards more efficient localities. This study comes into the conclusion that in case of either real or nominal shock, fixed exchange rate outperform flexible exchange rate in attracting FDI. In case of monetary shocks, fixed exchange rates are able to better disentangle real wages and production from these movements, and therefore resulting higher expected income induces FDI. On the other hand, in case of positive productivity shock, fixed exchange rate does not experience nominal appreciation and hence, employment has tendency to increase. This factor has positive effect on expected earnings and therefore higher FDI can be estimated.

Darby *et al.* (1999) presented modified model of Dixit & Pindyck (1994) for varying degrees of uncertainty and more specifically for the case when uncertainty is caused by exchange rate volatility. Using option framework to invest now or later he came into the conclusion that it is impossible to say theoretically that lower exchange rate volatility induces more investments.

Darby *et al.* (1999) found conditions under which exchange rate volatility will induce or deter FDI.

Basing the theory also on Dixit & Pindyck (1994), Sung & Lapan (2000) explore risk neutral multinational company which may open its facility on domestic or foreign market. In this model, the impact of the exchange rate volatility on FDI depends mainly on the height of sunk costs and their difference across the facilities. According to the cost assumptions defined by Sung & Lapan (2000), low exchange rate volatility results in domestic facility in operation. While considering big and similar sunk costs for each plant an increasing exchange rate volatility causes the foreign plant to operate instead of the domestic one. However, an increasing exchange rate volatility with relatively low sunk costs leads to opening of plant in both home and foreign country. Thus, in this model, increasing variability of exchange rates induces FDI.

On the other hand, the second strand of literature represented by Cushman (1985), Goldberg & Kolstad (1995) and Bénassy-Quéré *et al.* (2001) pays attention to risk aversion in the short run. Since certainty equivalent exchange rate levels are used in the expected profit functions of companies, higher volatility of exchange rates can deter FDI as this certainty equivalent will be subsequently harmed. This stream of literature was created as a criticism of production flexibility argument, since it is less likely that it concerns about short term volatility in exchange rates, as it si needed to consider certain time horizon before the shock realization to adjust the production ex post. As Goldberg & Kolstad (1995) note, differentiation between short-term exchange rate volatility and long-term exchange rates misalignments is essential when assessing the impact of exchange rate volatility on real variables. The major message of that study is that in presence of nonnegative correlation between export demand and shocks in exchange rates, MNEs will locate part of the production abroad and this foreign capacity increases with rising volatility of exchange rates.

Empirical studies does not provide distinct message on the effects of exchange rate volatility on FDI. Cushman (1985) found positive impact of exchange rate volatility on annual FDI flows from the United States to 5 selected countries over 1963 to 1978. However, when contemporaneous error correlation was assumed, volatility impact has given insignificant results. In the later study, Cushman (1988) showed that US FDI inflows were prevailingly negatively affected by increased exchange rate volatility. Again, since results for US FDI outflows do not show unambiguous pattern, we can not make any definite conclusions. Goldberg & Kolstad (1995) after analysing the quarterly US bilateral FDI flows to four countries over the period from 1978 to 1991 came into conclusion that exchange rate volatility tended to increase FDI.

Dhakal *et al.* (2010) found that exchange rate volatility has a positive effect on FDI, using a sample of East Asian countries. On the contrary, Bénassy-Quéré *et al.* (2001) showed on a panel of 42 developing countries experiencing FDI inflows from 17 countries that nominal exchange rate volatility growth deteriorates FDI. Similar observation can be found in a study of De Vita & Abbott (2008) which analysed FDI inflows into the United Kingdom. Modeling exchange rate volatility using GARCH methodology on FDI inflows into Nigeria and South Africa by Ogunleye (2008) also shows negative impact on direct investments into these countries. Moreover, presented analysis shows that the volatility of exchange rates was mainly pushed by inflation and nominal shocks or shocks in foreign currency reserves.

3.3 Exchange Rate Regime and FDI

Despite the high occurence of studies analysing exchange rate impacts on FDI, relationship between exchange rate regimes and foreign direct investments is not as much covered.

There are couple of studies dealing with the effect of European Monetary Union on FDI. However, many of them suffer from not adequate time-span as the EMU data were analysed in short time period. Positive effect of the currency union on FDI was found by Schiavo (2007) using augmented log-linear gravity-model approach and covering 25 OECD countries between 1980 and 2001. Applying OLS and Tobit framework in different specifications the author found that EMU has positive impact on FDI not only for intra trades but also in FDI with non-members. Schiavo (2007) focused not only on reduced exchange rate volatility that stems from the currency union membership but that there are also other effects of exchange regimes on FDI.

FDI increases after creation of EMU were recorded also by Petroulas (2007), who used panel data of unilateral FDI flows among 18 developed countries over the period 1992-2001. The author shows that inward FDI within the Euro area increased by 16% and FDI to non-members by 11%. On the other hand, Jeanneret (2005) performed a study on 28 OECD countries in a time-span 1982-2002 using OLS estimation technique and found that EMU has not significant impact on attracting the FDI. In addition, Dinga & Dingová (2011) found that the euro impact on FDI flows becomes significant only on the subset of EU countries, while in general no significant effect has been detected.

Remarkable results were presented by Busse *et al.* (2010) who found positive impact of fixed exchange rate regime on FDI in developed countries. However, their results show that for developing countries hard pegs do not mean

higher FDI inflows. According to the authors, the main argument behind this behaviour are less credible fixed rates in developing economies.

Another study devoted to the examination of proposed relationship was performed by Abbott & De Vita (2011). On the panel of 27 high-income non-OECD and OECD countries they used instrumental variable estimation of a dynamic panel model within a system generalised methods of moments over the period 1980 to 2003. Unlike the other studies, this paper was devoted to the examination of total bilateral FDI flows between each country-pair calculated as the sum of inward and outward FDI flows. This approach made it possible to assess the impact of exchange rate regimes on FDI rather than to state whether exchange rate regime affects attractiveness of countries to FDI inflows. Abbott & De Vita (2011) found that currency union is the most proper policy framework in attracting FDI not only with other union members but also with partners maintaining floating exchange rate regimes. [2] On the other hand, FDI between countries with the fixed exchange rate and floating regime or currency union members proved not to outperform double floating combinations.

Abbott *et al.* (2012) analysed how exchange rate regimes are related to the FDI on the sample of 70 developing countries. Using system generalized methods of moments estimation for the period 1985–2004 they found that developing countries with de facto fixed or intermediate regimes significantly outperform floating exchange rate system in attracting FDI flows. This study however suffers from not using bilateral FDI flows as the dependent variable. The results could therefore be biased as fixed exchange rate in relation to one country does not generally mean fixing with another.

[2] Abbott & De Vita (2011) used data enabling it to analyse only one currency union - European Monetary Union

Chapter 4

Sample Description

4.1 FDI Sample and Development

In Chapter 3 we have provided literature survey that entitles us to examine the linkage between exchange rates and FDI. As described, empirical evidence showed mixed results about the proposed relationship and for that reason we want to shed more light on this problem. Previous studies were devoted to its investigation either in terms of one country or group of countries. Our aim is though to provide more complex view while examining the broadest possible set of developing economies, given the availability of data. Distinguishing point from the majority of previous analyses is the utilization of bilateral foreign direct investments dataset, a source highly desirable given the nature of our analysis. We employ the only available thorough database (at the time of writing this thesis[1]) provided by OECD *International Direct Investment Statistics*. For United States and Japan we enrich the original dataset with the use of data provided by *US Bureau of Economic Analysis* and *Japan External Trade Oraganization*, respectively. We checked for possible differences of those sources by comparing them with OECD dataset and we did not find any discrepancies.

Following the classification of developed and developing countries by International Monetary Fund's *World Economic Outlook Report* from the year 2012, we are then able to investigate the pattern of bilateral flows among 5 developed OECD countries(United States, United Kingdom, Japan, France and Germany) as source economies and 40 developing countries as recipients, using annual bilateral data between 1991 and 2010. This can be considered as one of the contributions to empirical analyses devoted to elucidate the exchange rate

[1]We could have also utilized dataset provided by UNCTAD. However, the service that operated upon request was suspended. Morever, bilateral FDI flows are also reported by Eurostat but with substantially lower amount of observable flows.

- FDI link as, to the best of our knowledge, it will be the first study exploring such a broad set of developing economies, with the use of bilateral FDI data and applying it to recent years as well. At this point we want to stress that the inclusion of provided set of countries was a consequence of insufficient data coverage for remaining countries. Complete list of countries included into our analysis can be found in Table A.1 in Appendix.

Our dependent variable through the whole study are gross unilateral outflows from developed OECD economy to developing countries, originally expressed in current US$ millions. We do not employ FDI stocks in our analysis since we are aware of potential drawbacks that could arise especially when valuation changes or adjustments like write-offs are present. Yet, we are able to investigate the pattern on 200 country-pairs with the total number of observations amounting to 3780, from which 18.3% are missing.

Presented variety of countries brings along implicit differences in the FDI outflows patterns across the economies. Heterogeneity in income, area, population, economic integration or political situation of either investor or recipient should have impact on the observed investment flows.[2] On Table 4.1 we outline these differences on the basic characteristics given by minimum, maximum, mean and standard deviation of outflows from particular country.

Table 4.1: Summary of FDI outflows in US$ million from five OECD economies to 40 developing countries between 1991 and 2010

Country	**Min.**	**Max.**	**Mean**	**Std. Dev.**	**Freq.**
France	-7532.6	12918.1	208.1	860.7	599
Germany	-1254.4	9950.7	193.7	685.2	744
Japan	-282.4	5250.9	242.3	598.9	594
United Kingdom	-2871.5	7940.4	312.1	831.1	458
United States	-3548.0	8829.0	365.6	962.0	694

Source: Author's processing

In order to outline variability in FDI outflows by destination, we separated recipient countries by particular regions. In fact, we analyse 7 countries from Europe, 11 countries from Africa, 15 economies from Latin America and 7 economies from Asia.[3] Basic characteristics of our sample are demonstrated on Table 4.2. Europe and Asia represent regions with the smallest portion of

[2] As demonstrated also in Chapter 3 where we discussed potential determinants of FDI flows.

[3] We included Turkey and Russian Federation into Europe, while we merged countries of Central America and South America into Latin America region.

total and missing observations, while we have relatively highest observations for Latin America.

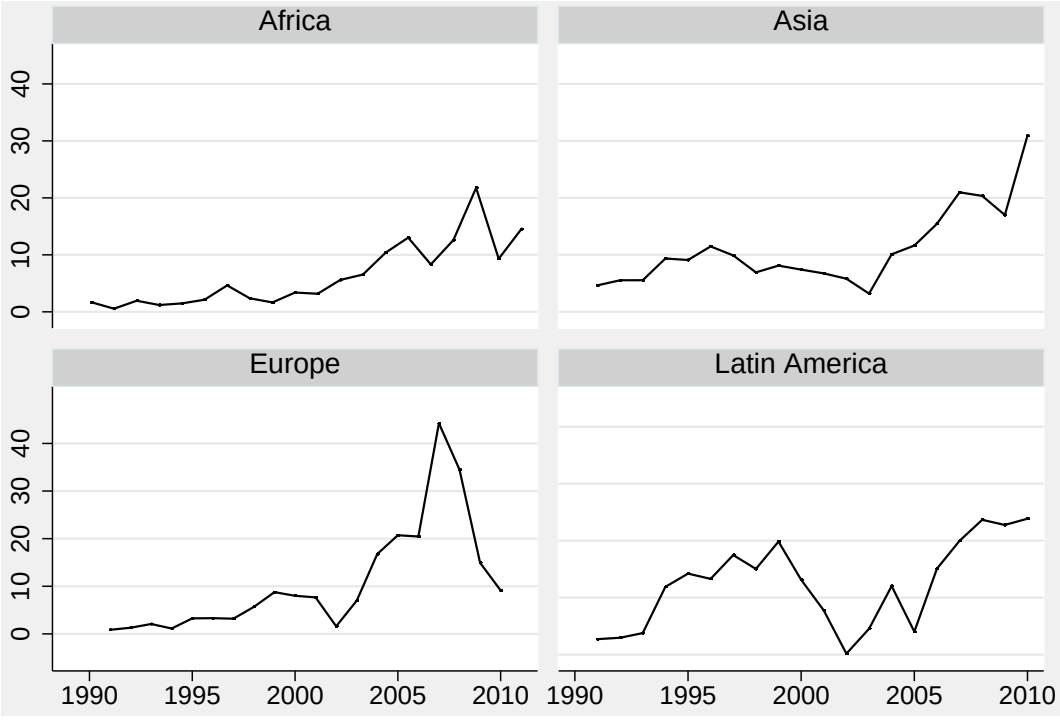
Table 4.2: Characteristics of the Sample of FDI Outflows to Developing Countries, Sorted by Regions

Region	**Obs.**	**Missing**	**Negative**	**Zero**	**Positive**
Africa	1100	219	173	165	543
Asia	635	55	83	25	527
Europe	542	46	54	11	429
Latin America	1450	371	195	133	751

Source: Author's processing

To describe how FDI outflows to these regions evolved in time we present Figure 4.1. The development of FDI flows to all of the regions experienced periods of upturns and declines. Recent global financial crisis affected negatively preceding buoyant times in all of the regions with particular magnitude. Except for our European sample, this drop was absorbed and FDI outflows to those developing regions surged in 2010.

Figure 4.1: Total FDI Outflows from five OECD Economies to 40 Developing Countries According to Region, in US$ billion



Source: Author's processing

We briefly describe the development of FDI ouflows in terms of particular recipient regions, provided by statistics from UNCTAD. FDI to developing economies in South America experienced deviation from the increasing trend in 2000. Economic crises in Brazil and Argentina that occured on the turn of millennium affected the FDI figures in this region. Difference between the sum of flows to both of these countries in the period from 1998 to 2002 amounted to more than 12 US$ billion in absolute terms. However, year 2004 was the time of rebound when strong economic growth of majority of the countries in the region resulted in the beginning of FDI expansion. Higher demand for commodities increased FDI that were oriented to natural resources (UNCTAD 2005). Despite the interruption of the surge of FDI flows with the arrival of financial crisis in 2009, the figure reached its historical peak in 2010.

Regarding African region, significant changes occured after turbulent 1970s and 1980s as governments made efforts to establish business-friendly environment. Promotional activities and investments that were driven mainly by natural resources resulted into more than sixfold larger FDI outflows, when comparing the figures in 2000 and 2008. However, contraction of global demand and slump in commodity prices due to financial crisis hit this region with such a magnitude that in 2009 FDI outflows fell by 57 percent on year-on-year basis. Egypt, Nigeria and South Africa sustained their long-term position as one of the highest FDI outflows recipients. In 2010, their share on total region's flows represented 79.4 percent. Uneven distribution is thus characteristic for this region.

Relatively smooth growth of FDI outflows for Asian region in the preceding years was disrupted by Asian financial crisis in 1997-1998 that caused slump of the figure by 39.6 percent, when compared with pre-crisis year 1996. Turbulent period forced majority of governments to put effort in attracting FDI by sectoral liberalization and strengthening of competition policies (UNCTAD 2001). India, the largest Asian recipient of FDI in our sample, gained its momentum in 2003 and became an economy that was driving the FDI figures. Drop in greenfield investment and cross-borders mergers and acquistions in 2009 resulted in FDI outflows decrease by more than 3 US$ billion on year-on-year basis. In 2010, Asia put itself on the recovery path driven mainly by countries in East, South-East and South Asia by proactive policy efforts of the governments (UNCTAD 2011). This upturn was particularly powered by India and Malaysia that together doubled their FDI figures from the previous year.

Regarding the European region, presented figures were driven mainly by the Russian Federation that experienced eight years of FDI growth between

2000 and 2008, although interrupted in 2005, so that FDI outflow figures from G-5 countries increased 42-fold. Since majority of the foreign investments were directed to natural resources, stagnating demand and therefore distorted cross-borders acquisitions by European countries as the major investors in the country caused downfall by about 20 US$ billion in 2009. Hungary, the second largest FDI recipient in our European sample, experienced its ups and downs as well. On the millennium turn and early 2000s Hungary attracted investments mainly to manufacturing sector but loss of the wage competitiveness deaden the Hungarian upturn (UNCTAD 2002). However, in spite of existing fluctuations, promoting investments also into the service sector resulted into incresing trend in the years preceding financial crisis. Strong economic growth and ameliorated business environment made Europe the largest FDI recipient in 2008, given the countries in our sample.

4.2 Exchange Rates Data and Linkage Evidence

Before we connect the FDI data with exchange rates we need to introduce our sources for exchange rate variables. In our analysis we use monthly real bilateral exchange rates, indexed to 100 in January 2005, that were constructed from the original dataset provided by IMF *International Financial Statistics*. Since the original data are expressed in nominal terms vis-à-vis US$ we transformed the series using following formula:

$$\mathrm{rer}_{ij,t} = \frac{\mathrm{CPI}_{i,t}}{\mathrm{CPI}_{j,t}} \times \frac{\mathrm{ner}_{j\$,t}}{(\mathrm{ner}_{i\$,t})^{-1}},$$

where $\mathrm{rer}_{ij,t}$ is the real bilateral exchange rate between country i and j at time t. $\mathrm{CPI}_{i,t}$ and $\mathrm{CPI}_{j,t}$ stand for monthly consumer price index originally taken from IMF *International Financial Statistics* (2005=100) at time t in developed and developing country, respectively. Variables $\mathrm{ner}_{j\$,t}$ and $\mathrm{ner}_{i\$,t}$ express nominal exchange rates vis-à-vis US$ of countries j and i at particular month. In order to remove technical misalignments in time series, caused by the arrival of euro in France and Germany, we divided the foregoing US$ bilateral rates by particular conversion rates. Similarly, we transformed the series of our sample countries from the CFA Franc zone with the use of franc-euro rate as well. The summary is given in Table 4.3.

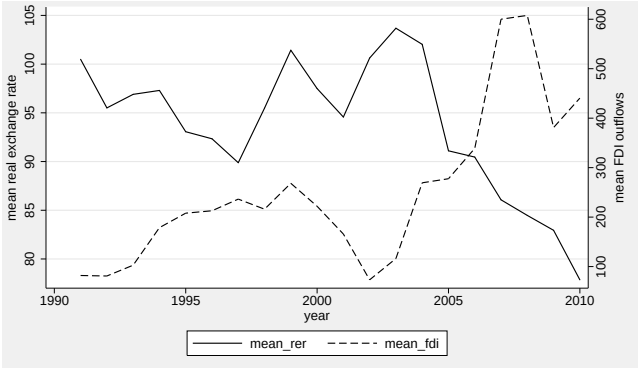
The resulting real bilateral exchange rate series can then be interpreted from the investor's perspective by asking the question, how much in host currency an investor will get for one unit of home currency in real terms. However, it is more convenient to look at the development of this index in time rather

Table 4.3: Treatment of New Legal Tenders

country	Germany	France, Cameroon, Gabon
conversion rate	1.95583	6.55957
applied to series	before 1999	before 1999

than observing the absolute number at given point. An increase of real exchange rate then represents appreciation of investor's currency, since she can buy more in host country, given the changes in inflation in both economies. In spite of nominal exchange rates, they are flexible even under bilateral fixed currency regimes because of relative changes in price levels. Resulting real exchange rate series for each country-pair were transformed in order to be equal to 100 in December 2005.

Figure 4.2: Mean Real Exchange Rates and Mean FDI Outflows in US$ million



Source: Author's processing

In the history we can find examples of large devaluations of currencies. Mexico in 1994, Brazil in 1999, Argentina in 2002, but mainly Asian financial crisis with Korea in 1997 and Thailand in 1997 elicited the attention to examination of exchange rate as factor affecting investments. From the opportunity theory, surges in FDI flows should occur after large devaluations because of exploitation of the benefits associated with low-valued currency. Empirical analyses however show indistinct results about proposed attitude.

Simple visual inspection of mean FDI flows and mean exchange rates is depicted on Figure 4.2. In spite of observed decreasing trend in mean real exchange rates across 1991-2010, we can note two patterns in the mutual development of the series. From 1998 to 2004 the behavior is in accordance with mentioned opportunity theory, while up to 2008 it converts into opposite direction.

4.2.1 Volatility of Exchange Rates and FDI

To pursue our goal we introduce the volatility of real exchange rates series that were constructed from the dataset described in the previous section. In the literature we can find several methods of volatility modeling that can be divided into the ones using modifications of standard deviations and those applying generalized autoregressive conditional heteroskedasticity GARCH or its extensions. From the reasons presented below, we employ only unconditional volatility measure that we modeled using sample standard deviation of the monthly percentage changes in rer. For given country-pair i and j, and time t it takes the following form:

$$\mathrm{Vol}_{ij,t} = \sqrt{\frac{1}{n-1}\sum_{k=1}^{n}(\ln \mathrm{rer}_{ij,t} - \ln \mathrm{rer}_{ij,t-k})^2}$$

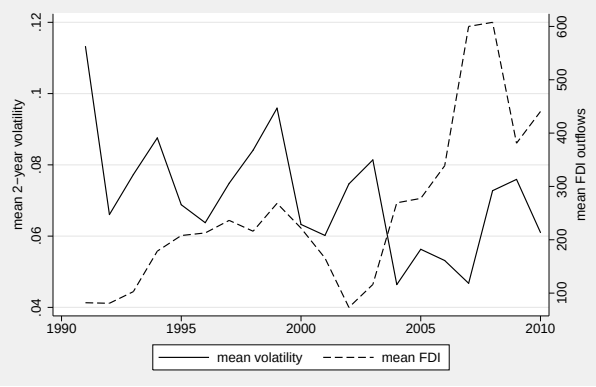
As final measures we chose $n = 24$ months rolling window capturing short-run volatility and $n = 60$ months window for long-run volatility. Additionally, we could follow the stream of literature devoted to the conditional variance modeled using GARCH methodology. It was built on the drawbacks of standard historical measures that assign equal weights to all observations and rather artibrarily chosen time horizon. Despite the existence of some extensions like exponentially weighted moving averages that gives lower weights to more distant observations, they still do not mitigate the problem of arbitrariness of chosen period. However, GARCH uses long-run variance, prediction from the previous period and new information that is captured by previous squared residual into the estimation to produce volatility measure. Despite the GARCH measure can be considered as superior, given the mentioned characteristics, we do not employ this methodology into our consideration, since it is not our primary concern in this thesis. Moreover, estimating 200 equations is computationally demanding, having in mind that conventional GARCH(1,1) did not provide the best fit to the number of exchange rate series what exhorted to employ more advanced techniques. In addition, the survey of various volatility specifications provided by Carruth *et al.* (2000) shows that the outcome of our analysis should not be affected by the particular choice. Basic characteristics of our volatility measures are given in Table 4.4.

Table 4.4: Characteristics of Volatility Measures

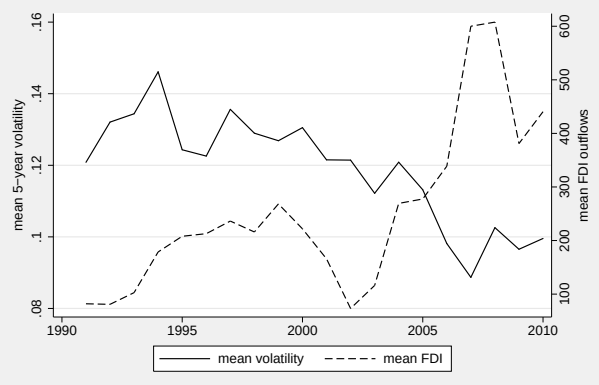
	Observations	Mean	Std. Dev.	Min	Max
Short-run volatility	3734	0.0725275	0.0584265	0.003427	0.5985693
Long-run volatility	3552	0.1190735	0.0847062	0.0083163	0.7115179

Since we are interested in the link of those variables to FDI flows we present some examples from our dataset to show the relative performance. To avoid the selection bias we calculated a one year average of standard deviation measures in each year. In 4.3 we demonstrate the development of average FDI outflows and our volatility variables.

Figure 4.3: Mean FDI outflows in US$ million and mean exchange rate volatility development



(a) 2-year volatility



(b) 5-year volatility

Source: Author's processing

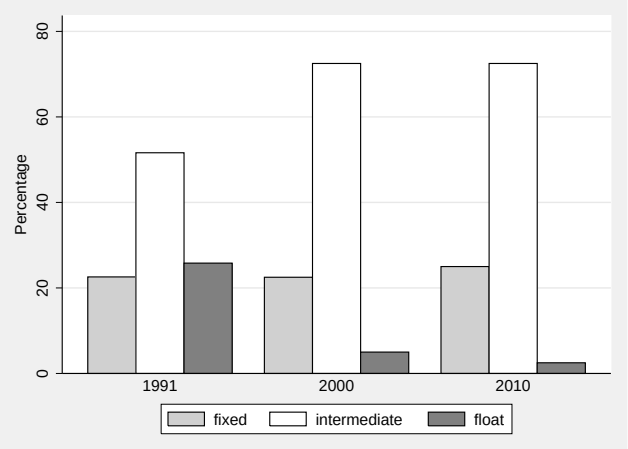
There is an evidence that volatility of exchange rates tend to decrease over time while in the period of recent financial crisis a step-up can be noticed. It can be noted that the instable macroeconomic environment affected the real exchange rate levels of the developing economies. Observed behavior of both series however shows some pattern, as from 2002 onwards an increasing trend in FDI is present in the data whereas the volatility of exchange rates followed decreasing path what is in line with the risk aversion theory. On the other hand, in the late 1990s we can observe converse behavior as volatility of exchange rates were descending while FDI declined as well.

4.2.2 Exchange Rates Regimes and FDI

In terms of exchange rate regimes classifications, we follow two comprehensive sources that allow us to investigate the relationship of this variable on FDI flows to huge amount of countries. The first source of our data are various issues of IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER). Methodology of these yearly publications followed officially announced *de jure* currency regime till the late 1990s whereas *de facto* classification was used afterwards. On the other hand, only de facto regimes are employed in our second source Ilzetzki *et al.* (2011) who created their dataset from not only AREAERs but various annual issues were combined with national sources as well. This can be considered as our further contribution to empirical literature since to the best of our knowledge it will be the first empirical study examining relationship between exchange rates and FDI employing this dataset. In the following sections we refer to this dataset with abbreviation IRR.

Neither classification is without its drawbacks. *De jure* assessment relies purely on the itentions of monetary officials that could diverge in practice. Conversely, *de facto* classification depends on past observations and does not take into account future intentions of central banks. In case of *de facto* regimes, credibility of authorities can be therefore substantially lowered and as Ghosh *et al.* (2003) point out, they can assess currency policy imperfectly.

Figure 4.4: Development of Exchange Rate Regimes According to our Categorization from IRR



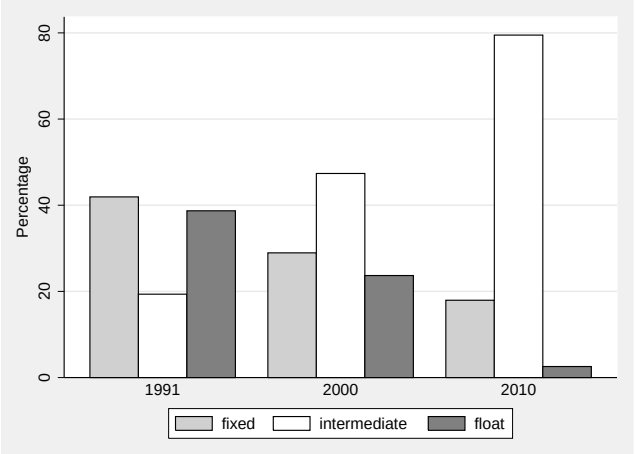
Source: Author's processing based on Ilzetzki *et al.* (2011)

Differences between our sources of exchange rate regimes classifications are outlined in Figures 4.4 and 4.5. We separated various regimes into three

categories: fixed, intermediate and float.[4] From the theoretical point of view, after the beginning of de facto regime considerations in case of AREAER, one should observe convergence of both datasets. For our sample of countries the convergence is relatively fulfilled in year 2010, although small differences in fixed and intermediate categorization can be observed.

Despite the contrast in the evolution of fixed regime categorization across our time span when different methodology is used, we can observe relatively similar ascending trend in intermediate regime utilization. Moreover, common feature of both sources is decreasing number of floating regimes that is more apparent when using IRR methodology. This is in accordance with "fear of floating" phenomenom and analyses confirming that only few developing countries that committed themselves to rather more flexible policy follow this path actually (Calvo & Reinhart 2002).

Figure 4.5: Development of Exchange Rate Regimes According to our Categorization from AREAER



Source: Author's processing based on various issues of IMF's AREAER

Different exchange rate regimes attract different FDI flows. Table 4.5 reports average FDI outflows as percentage of GDP across exchange rate regimes in various regions. On average, fixed regime allures the highest flows in our sample that is in total 0,63% and 0,74% GDP using AREAER and IRR methodology, respectively. However, the results are driven by countries of Central America that attract relatively huge flows compared with the largeness of their economies. Regarding the other regions, fixed regime rivets the highest flows in Europe, but only using IRR methodology. Floating alternative appears to be the most engaging for Africa and Asia, while intermediate regime accounts for the highest flows in Europe using the IRR methodology.

[4]See appendix for details.

This is however only a brief depiction of how different regimes attract FDI flows. We have to take into account especially the fact that only a minor percentage of our observations falls into floating category that could distort presented figures.

Table 4.5: Average of FDI outflows as percentage of GDP according to exchange rate regime and methodology, 1991-2010

		Classification of currency regime		
		Fixed	Intermediate	Floating
AREAER	*World*	*0.627*	*0.179*	*0.218*
	Africa	0.185	0.176	0.252
	Asia	0.160	0.191	0.192
	Europe	0.349	0.240	0.140
	Latin America	1.606	0.143	0.225
IRR	*World*	*0.737*	*0.190*	*0.206*
	Africa	0.231	0.167	0.239
	Asia	0.179	0.185	0.296
	Europe	0.256	0.295	0.110
	Latin America	1.661	0.169	0.231

Note: Based on our sample of 5 OECD developed countries and 40 developing economies, list of countries in Appendix
Source: Author's computation

4.3 Baseline Research Questions

According to the literature review and preceding investigation of our major variables we formulated three basic hypotheses we want to test in our analysis. Our first hypothesis should provide more insight into a way how investors react to exchange rates fluctuations. It follows considerations about capital market imperfections based on Froot & Stein (1991) that after depreciation of destination currency, relative wealth of home country investors increases and thus they are able to bid more aggressively for the investments abroad. Thus we will test whether the depreciation of host country currency is associated with the increase in FDI.

The second baseline hypothesis concerns the relationship between exchange rate volatility and FDI. According to the risk aversion theory, increasing volatility of exchange rates should decrease certainty equivalent expected exchange rate that is a variable of expected profit functions of the companies and thus result in lower amount of FDI (Goldberg & Kolstad 1995). On the other hand, production flexibility argument assumes that increasing volatility

induces FDI as companies can adjust its variable factor following the real or nominal shock (Aizenman 1992). Based on the contradictory arguments from both of the aforementioned theories we will test whether the exchange rate volatility has any significant influence on FDI.

Our third hypothesis deals with consequences of the choice of exchange rate regimes. Since foreign direct investments are in general long-term projects, investors are expected to behave according to long-term currency issues. This hypothesis follows the provided examination in the previous section which concluded that, on average, countries with fixed exchange rate regime attract more FDI flows. Hence, in the baseline regression we will test whether the fixed exchange rate has positive influence on FDI. In the extended part we will also test whether this effect is stronger when we consider only bilateral fixing of currencies between the source and host country currency.

Chapter 5

Data & Methodology Description

5.1 Empirical Model

We estimated panel regressions that were designed to clarify the relationship between the exchange rate variables and foreign direct investment flows. In terms of building our model we could follow two streams presented in the literature. The prevalent option, though not employed in this analysis, is to derive the model from the essence of gravity equation. Pioneered by Tinbergen (1962), gravity model has become one of the dominant work tool in explaining international trade and recently foreign direct investments as well. Analogously to Newton's law of universal gravitation, trade between two countries will be proportionate to their economic masses and with increasing distance trade becomes smaller. Despite the fact that there are no theoretical foundations behind employing other than fundamental variables into the gravity equations, using other variables became common practice in studies presented in Chapter 3. However, since the analysis is mainly empirical in nature, we did not follow any existing model, but rather examined broad set of available variables that could play a significant role in determining the amount of bilateral investment outflows to countries of our interest.

The relationship we are interested in is summarized by the following equation:

$$\text{fdi}_{ij,t} = \alpha + X'_{ij,t}\beta + \text{RER}_{ij,t}\delta + \text{VolShort}_{ij,t}\zeta + \text{VolLong}_{ij,t}\eta + \text{Fix}_{j,t}\lambda + \epsilon_{ij,t} \quad (5.1)$$

where $\text{fdi}_{ij,t}$ is bilateral FDI outflow from developed OECD country i to developing country j. β is a vector of order $K \times 1$, where K is a number of explanatory variables, that in our case equals 11. X is a vector of independent variables containing eventual FDI determinants discussed in Chapter 2. Specifically, we include: once-lagged logarithmic product of GDP of both countries,

real GDP growth of country i, real GDP growth of country j, once-lagged bilateral trade between countries i and j, real GDP per capita difference of source and host country, regional trade agreement dummy of country j, the existence of bilateral investment treaty between countries i and j, financial development of country j, macroeconomic stability of country j, distance and common language. Their choice was based on information criteria, adjusted R squared and significance in particular regressions.

Variable $\text{RER}_{ij,t}$ captures logarithmic bilateral real exchange rate between G-5 country i and developing economy j on year-on-year basis, given by the average of monthly figures in particular year. According to our hypothesis we expect positive sign of assigned coefficient δ, since it would mean that, *ceteris paribus*, with higher real exchange rate investor could buy relatively more assets in the developing country. Volatility of bilateral real exchange rates is included into our equation with the use of two variables $\text{VolShort}_{ij,t}$ and $\text{VolLong}_{ij,t}$. Hence, we distinguish between short-term and long-term volatility that are modelled using 2-year and 5-year moving average standard deviation of monthly time series, respectively. Here we also averaged monthly volatility figures in particular year to avoid selection bias. In both cases we expect negative sign of their coefficients ζ and η. The last exchange rate variable $\text{Fix}_{j,t}$ represents fixed currency regime dummy of developing country j constructed by either IMF or IRR methodology. Consistently with the signaling hypothesis introduced in the preceding Chapter, we assume positive sign of its coefficient λ. In Chapter 4 we provide more information about the exchange rate variables in choice. Finally, α is a scalar and $\epsilon_{ij,t}$ denotes the error term.

As a dependent variable we use absolute FDI outflows rather than FDI outflow as a percentage of host country's GDP because the latter would not account for changes in outbond FDI but for changes in the relative importance of FDI to recipient country (Neumayer & Spess 2005). In addition, FDI time series were converted to constant 2005 US$ using US GDP deflator.[1] However, the crucial issue concerns expressing the dependent variable. With the introduction of our data source for this variable in the chapter 4 we reported that it also cointains negative values. Natural way to deal with our dependent variable is to express it as natural logarithm because of skewness present in FDI data. Given that representation we are able to interpret the coefficients by our logarithmic regressors as elasticities and it is also a convenient tool of dealing with outliers Dinga & Dingová (2011). Moreover, getting robust standard errors is then more probable (Bloningen & Davies 2004). Nevertheless,

[1]The choice of US GDP deflator is a consequence of difficult assessment which country's GDP deflator to employ (Schiavo 2007).

logarithm is defined only when the underlying variable is positive. In this case the transformation $\ln \mathrm{FDI}_{ij,t} = \ln(x + \mathrm{FDI}_{ij,t})$, where x is positive scalar, is commonly utilized. Based on the reasoning presented in Dinga & Dingová (2011) we use following transformation that retains negative FDI outflows in the form of zero investments:[2]

$$\ln \mathrm{FDI}_{ij,t} = \begin{cases} 0 & \text{if } \mathrm{FDI}_{ij,t} \leq 0 \\ \ln(1 + \mathrm{FDI}_{ij,t}) & \text{if } \mathrm{FDI}_{ij,t} > 0 \end{cases} \tag{5.2}$$

For the rest of our thesis we will refer to Equation 5.1 as our baseline equation.

5.1.1 Estimation Methodology

There are several possibilities how to estimate our baseline equation 5.1. Basic distinction concerns the dynamics of the dependent variable and thus employing models with lagged dependent variable as regressor. These concerns are legitimate as we may suppose that foreign direct investments adjust slowly to changes in the explanatory variables or that past FDI outflows may indicate the relationship establishment between countries. In such cases the method presented by Arellano & Bover (1995) and Blundell & Bond (1998) is standardly utilized. However, we tested for the dynamics by using autoregressive process and it was found statistically insignificant. Moreover, the magnitude of estimated coefficient by once-lagged dependent variable was only 0.01. Presented results pointed out that employing such dynamics is not justified. Distinguishing point is that we use bilateral FDI flows, having pattern more fluctuating in comparison to stocks or aggregate flows that are analysed in studies applying dynamic equation.

Based on the reasoning above, in this thesis we opt for static character of our model. Static models have numerous representations in the literature (see Jeanneret (2005) or Busse *et al.* (2010)). Nevertheless, there still arises a need to adopt a proper estimation technique. Regressing our dependent variable on the control variables, while ignoring the panel data structure is one of the option we may exploit. However, this so-called pooled OLS cannot address problems arising from unobserved heterogeneity among the sample of countries and thus results can be severely biased.

[2]This transformation was also utilized by Neumayer & Spess (2005), Schiavo (2007) or Busse *et al.* (2010).

Standard procedure to tackle the heterogeneity is to allow the error term $\epsilon_{ij,t}$ from the baseline Equation 5.1 to consist of two components:

$$\epsilon_{ij,t} = \mu_{ij} + \nu_{ij,t} \tag{5.3}$$

where μ_{ij} is an unobserved individual specific effect[3] and $\nu_{ij,t}$ denotes random disturbance with zero mean and variance σ_v^2.

Based on the assumptions imposed on the individual specific effect μ_{ij}, we may differentiate between fixed effects and random effects estimators. If the individual specific effects are assumed to be fixed parameters then the fixed effects estimator is used. In this case, the within estimator is a common method employed in number of studies examining the exchange rate linkage to FDI flows. Within estimator firstly uses deviations from means across the individuals and after that applies OLS to produce the estimates. In particular, when we consider the general model:

$$y_{ij,t} = \alpha + x_{ij,t}\beta + \mu_{ij} + \nu_{ij,t} \tag{5.4}$$

and denote $\overline{y}_{ij} = \frac{1}{T}\sum_{t=1}^{T} y_{ij,t}$ ($\overline{x}_{ij}$ and $\overline{\nu}_{ij}$ similarly), the within estimator applies pooled OLS on the following transformed equation:

$$(y_{ij,t} - \overline{y}_{ij}) = (x_{ij,t} - \overline{x}_{ij})\beta + (\nu_{ij,t} - \overline{\nu}_{ij}) \tag{5.5}$$

which we get by subtracting mean of each variable from its corresponding variable in Equation 5.4. Time-invariant variables are thus not estimable since they are wiped out by the within transformation.

On the contrary, random effects assumes individual specific effects with zero mean and constant variance σ_μ^2. Moreover, the most important difference between both methods lies in the assumption of uncorrelated individual effects with explanatory variables. Random effects uses generalized least squares estimation, which is pooled OLS technique performed on the quasi-demeaned variables with the use of the estimate of θ as a function of σ_μ^2 and σ_ν^2. In spite of its strong assumptions, random effects has considerable advantage in providing the estimates of time-invariant variables.

The crucial issue here is that using the within transformation in fixed effects model we might absorb much of the influence of rarely changing variables. In our analysis the problem arises due to currency regime dummies that either change slowly or for some individuals do not change at all. In this case "the fixed effects will make it hard for such variables to appear either substantively

[3] In our case it is unobserved country-pair specific effect.

or statistically significant" (Beck 2001, p. 285). From this perspective, random effects is preferable but recall the strong assumptions imposed on the error term. In the presence of correlation of unit effects and regressors, random effects model is biased and inconsistent (Plümper & Troeger 2007).

Specification test to choose between the two presented methods is provided by Hausman (1978). Hausman test is based on the null hypothesis of uncorrelated individual specific effects with control variables. The underlying idea behind the test is that fixed effects estimator is consistent independently of mentioned correlation but in presence of uncorrelation it is less efficient because of relying only on within variation. The test statistic is defined as:

$$m = \widehat{q}'[\text{var}(\widehat{q})]^{-1}\widehat{q} \tag{5.6}$$

where $\widehat{q} = \widetilde{\beta}_{FE} - \widetilde{\beta}_{RE}$ captures difference between both estimators and $\text{var}(\widehat{q}) = \text{var}(\widetilde{\beta}_{FE}) - \text{var}(\widetilde{\beta}_{RE})$ stands for the difference in variances of estimators. The test statistic is distributed as χ^2.

We argue that in our case it is more feasible to adopt the random effects model because of specific nature of exchange rate regime dummies. However, recall that it produces biased and inconsistent estimates when the correlation between unit effects and regressors exists. As a solution, we opt for Hausman-Taylor (HT) procedure of Hausman & Taylor (1981) that is an instrumental variable aprroach which allows some of the regressors to be correlated with the unit effects. Assume an equation:[4]

$$y_{i,t} = X_{1i,t}\beta_1 + X_{2i,t}\beta_2 + Z_{1i}\gamma_1 + Z_{2i}\gamma_2 + \mu_i + \nu_{i,t} \quad i = 1, \ldots, N \quad t = 1, \ldots, T \tag{5.7}$$

where μ_i is $IID(0, \sigma_\mu^2)$, $\nu_{i,t}$ is $IID(0, \sigma_\nu^2)$, $X_{1i,t}$ and $X_{2i,t}$ are $1 \times k_1$ and $1 \times k_2$ vectors of time-variant variables, respectively, Z_{1i} and Z_{2i} are $1 \times g_1$ and $1 \times g_2$ vectors of time-invariant variables, respectively. In HT estimation we further assume that $X_{1i,t}$ and Z_{1i} are exogenous and uncorrelated with μ_i and $\nu_{i,t}$, while $X_{2i,t}$ and Z_{2i} are endogenous and correlated with μ_i, but uncorrelated with $\nu_{i,t}$.

HT is in fact a 2-step estimator. Firstly, it runs the within estimator on Equation 5.7 by which we get the estimates of β_1 and β_2.[5] Thereafter, HT regresses obtained within residuals on Z_{1i} and Z_{2i}, applying the 2SLS proce-

[4] In the context of currency regimes, HT approach has been recently applied in a study of Qureshi & Tsangarides (2012) that analysed the impact of hard and soft pegs on trade flows.

[5] Vectors Z_{1i} and Z_{2i} are wiped out through the within transformation.

dure with the use of $X_{1i,t}$ and Z_{1i} as instruments. Here, the order conditions $k_1 \geq g_2$ for the identification have to be fulfilled together with the presence of correlation between the instruments and Z_{2i} to avoid problems linked to weak instruments. The final estimation of coefficients is obtained via instrumental variable regression of GLS transformed variables:[6]

$$\breve{y}_{i,t} = \breve{X}_{1i,t}\beta_1 + \breve{X}_{2i,t}\beta_2 + \breve{Z}_{1i}\gamma_1 + \breve{Z}_{2i}\gamma_2 + \breve{\mu}_i + \breve{\nu}_{i,t} \tag{5.8}$$

using the means of $X_{1i,t}$ and $X_{2i,t}$ and also their within transformations, together with Z_{1i} as instruments. The classification of variables falling into endogenous or exogenous group "has to be done on the grounds of plausible a priori hypotheses and checked in a sensitivity analysis." (Egger & Pfaffermayr 2004, p. 235). The suitability of chosen instruments is then verified with the use of overidentification test. In the HT regressions we treat distance between two countries as endogenous, given the reasoning provided by Egger & Pfaffermayr (2004) that distance is likely to be correlated with some time-invariant characteristics (geographical proximity) of country-pairs. Moreover, according to the outcome of overidentification tests, the endogenous group further consists of economic growth of host country, once-lagged logarithmic product of GDP of both countries, once-lagged bilateral trade between country-pair and the level of real exchange rate.

In our empirical part we will firstly estimate the baseline regression by pooled OLS. Subsequently, fixed effects model will be estimated while applying F-test for fixed effects with the following F-statistic:

$$F = \frac{\left(ESS_R - ESS_U\right)/(N-1)}{ESS_U/\left((T-1)\,N - K\right)},$$

where ESS_R denotes the residual sum of squares under the null hypothesis of joint significance of the slope coefficients for particular country-pairs in the regression and ESS_U stands for the residual sum of squares under the alternative. The null hypothesis considers the OLS model $y_{ij,t} = \alpha + \beta' X_{ij,t} + \nu_{ij,t}$, whereas the alternative the fixed effects model: $y_{ij,t} = \alpha + \beta' X_{ij,t} + \mu_{ij} + \nu_{ij,t}$.

Afterwards, we will employ both random effects and HT estimator, and compare the results to that obtained from fixed effects estimator. Hausman test will be performed to distinguish between the random and fixed effects estimators. Our preferred technique in the estimation process is HT approach becuase of reasoning presented above. Since the estimators use at some point least squares, some assumptions about residuals (particularly the homoskedas-

[6] $\breve{y}_{i,t}$ denotes the GLS transformation of $y_{i,t}$.

ticity and no autocorrelation) have to be made in order to obtain reliable values of t statistics of estimated coefficients. However, to tackle this issue we use heteroskedasticity robust standard errors that are clustered with respect to individual country-pairs, an approach standardly utilized in the literature.

Nevertheless, there is still a potential shortcoming in our approach that might arise due to eventual bidirectional relationship of exchange rate variables with FDI flows. This possible endogeneity bias is not so much elaborated in the empirical studies presented in our overview. However, it might also be a consequence of ambiguity of final effect of FDI inflows on real exchange rate levels, since it may depend on many circumstances (for example on the exchange rate system of particular developing country). Bénassy-Quéré *et al.* (2001) work explicitly with the assumption that FDI flows to developing countries do not affect bilateral exchange rates. Standard procedure to mitigate the reverse causality lies in finding the proper instrument that should be correlated with the particular regressor and not affected by endogeneity bias. However, this bias can practically be present in each of the explanatory variables, thus finding the suitable instruments might be cumbersome. A solution that has been used in couple of studies (see for example Abbott *et al.* (2012)) consisted of suitable replacement of endogeneous variables with their lagged observations in GMM framework. In our analysis we will deal with endogeneity issues with the use of once-lagged variables, an approach also undertaken by Neumayer & Spess (2005).[7] The regression with instrumental variables will be then compared to that from our baseline regression to check whether the results are robust, while keeping in mind that by substituting real exchange rate level with its past observation might mean testing another link not present in the original equation.

5.2 Data

The dataset contains data from five developed OECD economies (France, Germany, Japan, United Kingdom and United States) and 40 developing countries.[8] First observations are dated in 1991 and last in 2010, thus we capture the recent financial crisis as well. Our variables were constructed from monthly and yearly data, but only annual observations are used in the regressions. Potentially, we have 200 country-pairs across 4000 observations but since our dataset is unbalanced, smaller portion is entering the regressions.

[7]Note that in instrumental regressions we will keep the variables that are once-lagged in the baseline regression unchanged. It concerns financial development and logarithmic product of GDP of both countries.

[8]List of countries in Appendix.

Our principal variables were introduced in Chapter 4. To sum up, gross FDI outflows in USD million come from OECD *Direct Investments Database*. Bilateral real exchange rate and volatility of real exchange rates were constructed combining monthly data on nominal exchange rates vis-a-vis USD and consumer price indices (2005 = 100) from IMF *International Financial Statistics*. For fixed exchange rate regime we constructed two dummies based on particular data source. Thus either methodology of IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* or Ilzetzki *et al.* (2011) were utilized.

Although the main interest in our thesis centers on establishing whether exchange rate variables have any impact upon FDI flows to developing countries, we control for other variables that might exert influence over FDI. Consistent with hypothesis that economic growth promotes FDI, we adopted a measure of real GDP growth of both source and developing countries. For that variables data come from World Bank and are based on constant 2005 USD.

Similarly to Dinga & Dingová (2011), economic size is proxied by the product of real GDP of source and host country. Additionally, we control for the vertical FDI determinants by employing the difference of real GDP per capita between both countries. This variable was constructed as a difference of GDP per capita in constant 2005 USD, for which data come from World Bank.

We also account for bilateral trade between countries i and j. Data for this variable comes from the United Nations *COMTRADE* database and are originally expressed in current USD million but we deflated the series using US GDP deflator (2005=100). Bilateral trade is employed in regressions since this variable can capture complementarity between trade and FDI, as trade might increase familiarity of both countries (Dabla-Norris *et al.* 2010). Hypothesized positive sign of its coefficient is thus reasonable. However, it can also work in opposite direction since we may think of trade and FDI as substitutes.

Regional trade agreement is a dummy variable that proxies the existence of economic integration of host country. For that regressor we use data from World Trade Organization and we set this dummy to be equal one if developing country signed free trade arrangements, or participated in customs unions or is a member of European Union in particular year. Additionaly, we also consider the existence of bilateral investment treaties between both countries. For this variable we use data from UNCTAD and anticipate positive sign of its coefficient.

Macroeconomic stability of host country is proxied by logarithm of annual inflation. As a measure we opt for consumer price index, for which data comes from the World Bank *World Development Indicators*. As higher infla-

tion implies increased macroeconomic uncertainty, we hypothesize its negative influence on FDI. Moreover, we control for the financial development of host country by including the amount of private credit deflated by GDP of developing country. Data for this variable come from the World Bank.

One of the distinctions between fixed and random effects model is the capability of the former to account for any time-invariant variables that are constant for individuals. However, in random effects model we have to include them separately. In particular, we included logarithmic distance between capitals of country-pairs, measured in kilometres, as a proxy of transaction and information costs. Cost reduction foundations are also behind employing the variable common language that represents dummy taking value of one when both countries share common official language and zero otherwise. For both measures we utilize the dataset obtainable at Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) website.[9]

Before the estimation we checked for the presence of unwelcome correlation patterns in our sample by estimating a correlation matrix.[10] Since none of the estimated coefficients was exceeding 0.70 in absolute numbers, we could not refer to any serious multicollinearity problem (Abbott & De Vita 2011).

[9]For more details about construction of the database see Mayer & Zignago (2011).
[10]See the correlation matrix in Appendix (Table A.3).

Chapter 6

Empirical Analysis

6.1 Baseline Results

Our initial analysis consisted of including both measures of exchange rate volatility, the variable of bilateral real exchange rate and fixed exchange rate regime dummy into our regression to check for our hypothesis that fixing the currency of developing country should have positive signalling effect on FDI flows. At first, we estimated the standard pooled OLS model with the inclusion of 40 developing countries. The results pointed out that fixed exchange rate regime is statistically significant only when IRR methodology is considered. It can be interpreted that countries using fixed exchange rate regime attract by 30.2% more FDI flows than their intermediate and floating counterparts.[1] Nevertheless, both exchange rate volatility and real exchange rate levels are statistically insignificant. As noted in the methodology section, pooled OLS cannot properly address problems arising from unobserved heterogeneity among the sample of countries and thus results can be severely biased. As a further step we therefore estimated fixed effects model using within estimator and we applied F-test for joint significance of country-pair effects. Since F-statistic in both of our specifications has value 3.8, we reject the null hypothesis that all country-pair effects are jointly equal to zero. This result indicates that estimated coefficients from fixed effects estimator should be considered superior to that from pooled OLS.

Estimated coefficients from within estimator altered the view presented by pooled OLS, since dummy variables capturing fixed currency regime are not significant under both methodologies. In terms of other exchange rate variables, none of them is found statistically significant as well. However, estimated negative sign of exchange rate levels variable is again contradicting our hypoth-

[1] Coefficient ζ of dummy variable is interpreted as $\Delta = 100 * (exp(\zeta) - 1)$, when the dependent variable is in logarithm (Dinga & Dingová 2011).

esis. We estimated also a random effects model that should be preferable for the estimation of regime dummies, while imposing strong assumption about uncorrelation of country-specific effects with the explanatory variables.[2] In the presence of mentioned correlation it might provide misleading inference from the model. We therefore performed Hausman test on both of our specifications.[3] According to the associated test statistics we reject the null hypothesis that there is zero correlation of explanatory variables and the unobserved effect at 5% level of significance. In this case, random effects cannot provide consistent estimates of our explanatory variables (Egger & Pfaffermayr 2004). Our baseline equation was subsequently estimated using HT approach which is our preferred technique that relaxes the assumption of uncorrelated unit effects with explanatory variables, using the instrumental variable approach. In both HT and FE models we also tested the significance of time-specific effects with the use of F-test, where the null hypothesis was that year dummies are all equal to zero. According to the test statistics (see Table 6.1) we reject the null at 1% level of significance and we are thus suggested to keep time-specific dummies in our regressions.

Table 6.1: Test for time-specific effects

specification	IMF		IRR	
method	FE	HT	FE	HT
F or χ^2	3.67	75.67	3.63	73.32
p-value	0.00	0.00	0.00	0.00

The estimates from HT model resemble those from the fixed effects estimator (see Table 6.2). Although all of our exchange rate variables are found statistically insignificant, the negative sign of real exchange rate level is worth highlighting. According to its negative sign, real depreciation of source country currencies, indicated by rise in our exchange rate variable, could be associated with an increase of FDI outflows from developed country. This is at odds with theoretical predictions in Froot & Stein (1991) or most of the empirical findings presented in the literature review. However, similar results were reported in Busse *et al.* (2010), Schmidt & Broll (2009) or Görg & Wakelin (2002). Nevertheless, we cannot infer any causality on FDI flows because of its statistical insignificance. Similar outcome of analysis was documented in Abbott *et al.* (2012), thus it seems that exchange rate movements do not play significant role in affecting the FDI outflows to developing countries.

Although our primary interest centers on the interpretation of exchange

[2]Estimates in Table B.3 in Appendix.

[3]The outcome of Hausman test is provided in Table B.5 in Appendix.

Table 6.2: Baseline Results: FE and HT Estimates

	FE	FE	HT	HT
lagged economic size	0.7756	0.8166	0.6815***	0.6750***
	(0.7030)	(0.7019)	(0.1455)	(0.1460)
economic growth of i	0.1197***	0.1201***	0.1181***	0.1177***
	(0.0404)	(0.0403)	(0.0376)	(0.0377)
economic growth of j	0.0327**	0.0331**	0.0371***	0.0369***
	(0.0142)	(0.0143)	(0.0122)	(0.0122)
lagged bilateral trade	0.2292	0.2211	0.2911**	0.2851**
	(0.1475)	(0.1482)	(0.0304)	(0.0307)
difference of real GDPpc†	-0.0140	-0.0137	0.0009	0.0007
	(0.0142)	(0.0143)	(0.0038)	(0.0038)
bilateral investment treaties	0.2915	0.2990	0.2817*	0.2713
	(0.2415)	(0.2420)	(0.1640)	(0.1431)
inflation of host country	-0.1012	-0.1029	-0.0904	-0.0896
	(0.0689)	(0.0696)	(0.0661)	(0.0669)
lagged financial development	0.0099**	0.0101**	0.0103***	0.0104***
	(0.0038)	(0.0039)	(0.0027)	(0.0027)
regional trade agreements	0.4099	0.4009	0.3794	0.3536
	(0.3697)	(0.3723)	(0.3346)	(0.3373)
common language	-	-	0.7745**	0.7763**
	-	-	(0.3015)	(0.2971)
distance	-	-	-0.4036	-0.4644*
	-	-	(0.2568	(0.2570)
real exchange rate	-0.4734	-0.4854	-0.5223	-0.5067
	(0.3482)	(0.3460)	(0.3240)	(0.3228)
short-term volatility	-0.7942	-0.8269	-0.7236	-0.7319
	(0.9433)	(0.9475)	(0.9265)	(0.9362)
long-term volatility	-0.4810	-0.4879	-0.4478	-0.4342
	(0.3202)	(0.3185)	(0.3141)	(0.3145)
fixed dummy, IMF methodology	0.1082	-	0.0522	-
	(0.1991)	-	(0.1674)	-
fixed dummy, IRR methodology	-	0.0550	-	0.1225
	-	(0.1836)	-	(0.1490)
constant	-27.05	-28.54	-20.54***	-19.80***
	(27.848)	(27.834)	(5.278)	(5.386)
Time-specific effects	yes	yes	yes	yes
Observations	2209	2209	2209	2209
F(for FE) or χ^2(for HT) statistic:	5.29	5.26	789.21	783.02
Over-identification $\chi^2(26)$:	-	-	19.579	21.523
R^2 (within)	0.087	0.087	-	-
R^2 (overall)	0.378	0.378	-	-

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses. *, ** and *** denote significance on 10%, 5% and 1% level, respectively.† GDPpc is an abbreviation of GDP per capita. In HT model, following variables are considered endogenous according to the outcome of over-identification test: economic growth of j, lagged economic size, lagged bilateral trade and real exchange rate.

rate variables, it is worth noting that some of the other variables are consistently significant across the model specifications. Real GDP growth of G-5 and economic growth of host countries is positively and significantly associated with FDI flows to developing economies. Financial development of host countries is significant in each of our specifications with positive sign of corresponding coefficient. Moreover, the economic size proxied by product of real GDP of both countries is found statistically significant, though only when HT technique is applied. In terms of other determinants, we find some evidence for lagged bilateral trade and bilateral investment treaties, but the significance depends on estimation method and particular specification. Regarding the time-invariant variables included in HT specifications, common language is found statistically significant, whereas the causality leading from distance to FDI flows is confirmed only in one specification (though only at 10% level of significance). It might stem from the fact that since we account for bilateral trade between countries separately, it may also capture the information included in distance and thus making it statistically insignificant.

6.1.1 Instrumental Variable Estimation

In order to derive robust conclusion we checked whether our estimated coefficients are not subject to endogeneity bias. By using the methodology that was described in Subsection 5.1.1, we present the outcome only for the variables of our main interest in Table 6.3.

Table 6.3: Regressions with Instrumental Variables

	Applied method			
Variable	FE	FE	HT	HT
real exchange rate	-0.1720	-0.1882	-0.1572	-0.1931
	(0.2929)	(0.2941)	(0.2807)	(0.2808)
short-term volatility	-0.5874	-0.5919	-0.6648	-0.6596
	(0.5228)	(0.5216)	(0.5105)	(0.5110)
long-term volatility	-0.0826	-0.0880	-0.0849	-0.0800
	(0.2462)	(0.2423)	(0.2486)	(0.2478)
fixed dummy, IMF methodology	0.1676	-	0.1798	-
	(0.1900)	-	(0.1498)	-
fixed dummy, IRR methodology	-	0.1361	-	0.1144
	-	(0.1855)	-	(0.1433)

Note: Except for *common language*, *distance*, *financial development* and *product of GDP of both countries*, all variables were instrumented with the use of their once-lagged observations. Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.

Generally, the results resemble those from the baseline equation, so we cannot accept the hypothesis of endogeneity of our exchange rate variables. There are changes in the magnitude of estimated coefficients, but the statistical insignificance persists. Moreover, we have to keep in mind that using the lagged values may practically mean testing another hypotheses. For the strength of currency, we would anticipate that past appreciation of source country currencies is tied up with increases in FDI flows in the subsequent period. However, the outcome of our instrumental variable approach did not support this idea. Furthermore, volatility of real exchange rates and fixed currency dummy are again found insignificant, thus confirming the inference from FE and HT models without employing instrumental variables. In terms of other explanatory variables, only slight changes in the estimates are present so we treat the results from our baseline regression as unbiased and consistent.

6.2 Volatility Treshold Effects?

In the analysis above the volatility of exchange rates has proven not to be significant factor influencing FDI flows to developing countries. This result reflects the ambiguity presented in the literature review. However, in what follows, we introduce another framework for analysing the role of exchange rate volatility. We apply the approach similar to that underataken by Servén (2003) and study if there are treshold effects that might change the perception about significance of real exchange rate volatility in the analysed equation.

Firstly, we calculated the average volatility for both of our measures in the median developing country. In particular, we averaged 2-year and 5-year volatility of real exchange rates for each of the recipients in our sample.[4] Thereafter, according to the level of observed volatility, we created dummy variables for high(low) volatility if the observed values were above(below) the average of median recipient country. In this case we test the hypothesis that FDI outflows will decrease(increase), if volatility exceeds(does not reach) a treshold given by the average volatility of median recipient country.

The inclusion of high volatility dummy into baseline regression did not change the perception that volatility of real exchange rates is not a determinant of FDI flows. Also, emloying the low volatility dummy, by which we anticipated increased FDI outflows, did not alter the view. In this case, no treshold effects were found.

As an alternative, we calculated the average volatility for both measures in

[4]Note that we were required to average five time series for each recipient as we have five developed countries as donors.

the median developing country, but we allow the median developing country to vary across the years in our sample period. This excercise might provide more information since it detects developing countries with volatility of exchange rates above or below the median country in a given year and not in the entire time period. However, none of the dummies were found significant in our regressions, so we conclude that there are no treshold effects in volatility of bilateral exchange rates, given by the median developing country.[5]

6.3 Impact of Bilateral Fixing on FDI Flows

Our initial analysis considered fixed exchange rate regime dummy being equal one when developing country fixes its currency generally to some of the other currencies. In neither of our model specifications this variable has proven to be significant. Here, as an alternative, we set this dummy equal to one only if the currency of host country is fixed relative to the country of FDI flow origin. In this setting, we test the hypothesis that mutual fixing of the currency has significant impact on bilateral FDI flows.Here we want to stress that by bilateral fixing we also mean the participation in currency union or dollarization of currencies.

In all of our model specifications, bilateral fixed currency regime has positive sign but is statistically significant only in HT model when IRR methodology is applied. The estimated coefficient implies that, *ceteris paribus*, FDI outflows to countries with fixed currency regime are by 63% higher compared with alternatives. Estimated magnitude is comparable with that documented by Abbott *et al.* (2012), though they report significance of fixed regime dummy when the currency of developing country is fixed generally to some of the other currency. However, they used aggregate flows as dependent variable, hence they were not able to investigate how fixing the currency works in bilateral context. In this thesis, it is crucial to distinguish both cases, since it may be argued that from the investor's perspective it is decisive if the host currency is fixed relatively to that of source economy.

As explained in the methodology part, fixed effects method can wipe out much of the influence of variables with sluggish within variation. Presented difference in significance of bilateral fixed currency dummy under IRR methodology can be then justified by the sample of countries we have at disposal. In fact, some of the countries have not jumped from fixed to another exchange rate regime category over the whole examined period, thus the outcome from fixed effects model might be misleading. On the other hand, HT method can

[5]Results for high volatility dummies are in Table B.6 in Appendix.

be, in this case, considered superior since it combines between and within variation in the variables.

Following the reasoning of Abbott *et al.* (2012), the insignificance of fixed regime under IMF methodology can be explained simply by different statistical distribution (recall Figure 4.4 and Figure 4.5 from Chapter 4). Additional justification might be that exchange rate regimes may capture differences in institutional quality. Alesina & Wagner (2006) documented that countries that float exchange rates *de jure* but then deviate from this policy *de facto* have relatively good institutions. On the other hand, countries announcing fixing of their exchange rates, but are not able to defend it *de facto*, often tend to have bad political institutions.

Table 6.4: Impact of Bilateral Fixed Currency Regime on FDI flows

	Classification of currency regime	
Applied method	IMF	IRR
Fixed effects	0.1121	0.3208
	(0.3515)	(0.2754)
Hausman-Taylor	0.2543	**0.4902****
	(0.2985)	(0.2583)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.

6.4 Floating Regime and FDI Flows

So far, we have considered the performance of fixed exchange rate regime against their floating and intermediate counterparts. Now we change the framework and evaluate if floating exchange rate regime has unfavourable effect on FDI flows. In particular, we substituted the fixed dummy with floating dummy in our baseline regression. If the estimated coefficient is found to be negative and significant, we would be able to come into conclusion that floating currency regime of developing countries is detrimental to FDI flows compared with alternatives.

For the sake of clarity we report the estimates only for currency dummies (see Table 6.5). While the sign of estimated coefficients is in line with our expectations, the statistically significant evidence is only found when the floating dummy is classified using IMF methodology. According to the results from our preferred HT model, FDI outflows to countries with floating currency regime are by 26% lower compared with alternatives. Although we control separately for volatility of exchange rates, this measure is likely to be imperfect, hence

Table 6.5: Impact of Floating Currency Regime on FDI Flows

	Classification of currency regime	
Applied method	IMF	IRR
Fixed effects	**-0.3744****	-0.3332
	(0.1451)	(0.2286)
Hausman-Taylor	**-0.2986****	-0.3694
	(0.1402)	(0.2174)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.

floating dummy might still proxy part of volatility effects. This may explain the significance of IMF floating dummy in the regression, since IRR classification is based solely on de facto behavior of exchange rates.

6.5 Implications

In our empirical analysis the ambiguity of the impact of exchange rates on FDI has been, by and large, confirmed. For developing countries, the influence of real exchange rate levels on FDI seems to contradict the wealth effect hypothesis. In particular, we have not found statistically significant link that the real depreciation of host country currency is beneficial for FDI inflows to developing economies. In fact, the estimated sign is negative, which may reflect an increase of competitiveness captured by the appreciation of real exchange rates in developing countries. This statement is conditional on the rise of productivity of given host country, that is sensible given the differences in average real gdp growth of advanced and developing economies over the analysed period (see Figure B.1 in Appendix). However, from the outcome of our analysis it seems that the strength of the currency does not have impact on FDI to developing countries.

Neither short-term nor long-term volatility of bilateral real exchange rates play significant role in affecting FDI flows to developing countries. This outcome may reflect the considerable development in financial markets, especially FOREX market is important in this case. Jeanneret (2005) elaborates further on the idea that volatility of exchange rates might not be a factor affecting the overseas investments, given the widely available hedging opportunities of multinationals. An alternative explanation might lie in the decreasing volatility of exchange rates over time (recall Figure 4.3). The waiting strategy captured by the option theory may thus lose its relevance over the analysed period. In ad-

dition, the insignificance of exchange rate volatility in the regressions might be a consequence of competing theoretical predictions occuring in the literature.

From the outcome of our regressions, the impact of currency regimes on attracting the FDI flows to developing countries is inconclusive. The results pointed to insignificant role of exchange rates maintenance in general context.[6] However, we found some evidence that de facto bilateral fixing of currencies is beneficial for FDI flows. Since we explicitly control for the exchange rate volatility in the regressions, the significant effect of bilateral fixing might capture more than just the reduction of exchange rate volatility. Providing the reasoning similar to Schiavo (2007) or Busse *et al.* (2010), there might be other channels through which bilateral fixed exchange rates affect FDI, especially the signaling effect or cost-reduction link. Alternatively, in a spirit similar to Alesina & Wagner (2006) we may assume that de facto fixing is accompanied with relatively good institutions of the developing countries which may stimulate FDI flows. On the other hand, we found some evidence that floating the currency may be detrimental to FDI flows. However, we ascribe this result to possible imperfections in capturing the exchange rate volatility, that could be assigned to significance of IMF floating dummy in the regressions.

To sum up, the relevance of the exchange rate stabilization policies aimed at attracting FDI has not been unanimously confirmed. The design of particular exchange rate system in the developing countries should, however, be considered in a wider macroeconomic context. FDI inevitably play important role in the developing countries, however recall that the effects on particular economy might be from some perspective not always positive (see Section 2.2).

[6] By *general* we mean that country fixes its currency to some other currency and thus ,in this setting, we do not control for bilateral fixing directly.

Chapter 7

Robustness Check

The definition of dependent variable together with the choice of explanatory variables and analysed time span raise concerns about the implications from Chapter 6. In this section we therefore provide additional robustness check and sensitivity analysis.

Firstly, there might be specific factors linked to particular time periods. As an example we may consider the recent financial crisis in 2008-2010 when preceding buoyant times were interrupted by sudden investment cuts. Time-specific dummies included into the regressions might not provide sufficient treatment of such periods. To reveal potential structural break we reestimated the regressions using the sample without the inclusion of 2008-2010 period. The estimates are given in Appendix (see Table B.4). They do not confirm concerns about changes in magnitude of coefficients our exchange rate variables so the outcome of our analysis is robust to the exclusion of 2008-2010 period.

The second concern is also linked to specific time periods, but relates only to particular group of countries. The inclusion of transition countries into our sample might be connected with data-reliability problem. During the first years of transformation process those countries were put to macroeconomic stabilization and the data we have at hand may not correspond to the true values. To mitigate this, we reestimated the regressions excluding the observations prior to 1995 for transition countries. Estimated coefficients for main variables are listed in Table B.7. Since no important changes in our estimates occured, our results cannot be blamed for inadequate inclusion of those observations into the regressions.

7.1 The Role of Influential Observations

Sensitivity of OLS to influential observations gives raise to another source of potential obstacles. In what follows, we dropped the observations for which

gross FDI outflows exceeded a treshold of 7 US$ million in absolute terms and rerun the regressions using modified sample. Here, we report only the estimates of main variables, complete results can be found in Appendix.

Table 7.1: Regressions Excluding Influential Observations

	Applied method			
Variable	FE	FE	HT	HT
real exchange rate	-0.4498	-0.4619	-0.5030	-0.4870
	(0.3482)	(0.3460)	(0.3246)	(0.3234)
short-term volatility	-0.8202	-0.8551	-0.7332	-0.7450
	(0.9446)	(0.9487)	(0.9270)	(0.9267)
long-term volatility	-0.5005	-0.5069	-0.4658	-0.4519
	(0.3159)	(0.3144)	(0.3088)	(0.3092)
fixed dummy, IMF methodology	0.1158	-	0.0600	-
	(0.1992)	-	(0.1673)	-
fixed dummy, IRR methodology	-	0.0656	-	0.1323
	-	(0.1837)	-	(0.1490)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.** denote significance on 5% level.

Presented estimates from Table 7.1 points out that eliminating the influential observations had only a minor effect on our exchange rate variables. Also, the estimated magnitudes resemble those from the baseline regression. In fact, applying the F-test for each of our exchange rate variable with restrictions set to values from our baseline regression reveal that we cannot reject the null hypothesis of equal coefficients at any conventional levels of significance. The results reported in the preceding chapter are thus robust to exclusion of influential observations.

7.2 Choice of Dependent Variable and Estimation Technique

The construction of the dependent variable we use in our regressions impose additional concerns about the outcome of our analysis. Replacing the negative values with zero and thus making disinvestments equal to no investments may lead to loss of intrinsic information when reverse investments are present. Nevertheless, in our analysis we utilize the common transformation that at least keep disinvestments in the regression, albeit they equal zero no matter how large the reverse is. In the following part we employ another transformation

that was used by Yeyati *et al.* (2007):

$$\ln \text{FDI} = \text{sign}(\text{FDI}) \ln(1 + |\text{FDI}|) \tag{7.1}$$

By using this transformation we will not only retain disinvestments in the regressions but also keep their negative sign. In this section we thus check if the outcome of our analysis is not susceptible to the utilization of different dependent variable. Reestimating the regressions with the dependent variable described above however reveal that such concerns were not confirmed.

Table 7.2: Regressions Using Modified Dependent Variable

	Applied method			
Variable	FE	FE	HT	HT
Real exchange rate	-0.4565	-0.4731	-0.4834	-0.4385
	(0.6184)	(0.6157)	(0.5437)	(0.5420)
Short-term volatility	-1.6216	-1.6966	-1.5478	-1.5263
	(1.7095)	(1.7144)	(1.6812)	(1.6756)
Long-term volatility	-0.5923	-0.5956	-0.4627	-0.4274
	(0.4599)	(0.4583)	(0.4469)	(0.4489)
Fixed dummy, IMF methodology	0.2534	-	0.0375	-
	(0.3335)	-	(0.2165)	-
Fixed dummy, IRR methodology	-	0.2291	-	0.2661
	-	(0.3057)	-	(0.2118)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.

Since by using this modification we are only interested how our main variables were affected, we do not report estimates for the other explanatory variables as no important changes were found. Table 7.2 provides the outcome of employing modified dependent variable. The estimates resemble those obtained in our baseline regression, albeit short-term volatility has now much larger magnitude. However, since it is found statistically insignificant we cannot confirm that our results are susceptible to the choice of explained variable.

The next concern in our analysis deals with the choice of the estimation technique. In the empirical part so far we have used fixed effects and HT models. In the following section, we utilize an alternative estimator that can tackle the nature of our dependent variable. By definition, it cannot be lower than zero and it is thus censored from the left. In this case Tobit gives consistent estimates (Dinga & Dingová 2011).

We applied Tobit with random effects to our baseline regression. Moreover, we also estimated specifications in which fixed dummy was replaced with bilateral fixed dummy under both of the methodologies (IMF or IRR). Again,

in Table 7.3 we report only the estimates for our main variables. Complete results can be found in Appendix (Table B.9).

Table 7.3: Tobit Estimates

	Fixed dummy			
Variable	General		Bilateral	
real exchange rate	-0.4695	-0.4594	-0.4482	-0.4354
	(0.2763)	(0.2758)	(0.2761)	(0.2757)
short-term volatility	-1.1013	-0.9925	-0.8893	-0.8585
	(1.1159)	(1.1113)	(1.1176)	(1.1114)
long-term volatility	-0.3690	-0.3545	-0.3602	-0.3496
	(0.3024)	(0.3025)	(0.3021)	(0.3020)
fixed dummy, IMF methodology	-0.0448	-	0.3186	-
	(0.1899)	-	(0.3007)	-
fixed dummy, IRR methodology	-	0.1575	-	0.6800**
	-	(0.2048)	-	(0.3200)

Note: Asterisks ** denote significance on 5% level.

Tobit estimates resemble those obtained by random effects model. Statistically significant is only the bilateral fixed currency dummy under IRR methodology. Tobit estimation thus revealed that our results derived in the previous chapter are robust to the alternative estimation technique.

7.3 The Role of Additional Explanatory Variables

Finally, we subjected our model to number of variations. Firstly, we included once-lagged logarithmic sum of real GDP of both countries, as a substitute for logarithmic product of GDP which proxies economic size, and logarithmic inflation measured as annual GDP deflator instead of consumer price index, as a proxy for macroeconomic stability. Reestimated regressions however did not show significant variations in the estimates of our main exchange rate variables (see Table B.8 in Appendix).

Furthermore, our analysis is enriched with the inclusion of additional variables into both fixed and HT models to check for omitted variable bias. We subsequently added Chinn-Ito index (*KAOPEN*), a measure of *capital account openness* developed by Chinn & Ito (2006). Based on various issues of AREAER, this index uses binary values that evaluate restrictions on cross-border financial transactions. Higher values mean better financial environment for international transactions. Next, as a measure of availability of *natural resources* we included fuel exports as percentage of merchandise exports in the developing country, for which data come from World Bank. We also employed

the variable *trade openness* of recipient country, that stands for logaritmic sum of imports and exports in US $ million. Data come from IMF Direction of Trade Statistics. Following Asiedu (2002), we also control for infrastructure quality which we proxy by the number of telephone lines per 100 population. Here we again utilize the World Bank dataset.

Table 7.4: Regressions Using Additional Variables

	Applied method			
Variable	FE	FE	HT	HT
real exchange rate	-0.5776	-0.5922	-0.6339	-0.6250
	(0.3238)	(0.3149)	(0.3778)	(0.3755)
short-term volatility	-0.5669	-0.6589	-1.3051	-1.3211
	(1.0178)	(1.0270)	(1.0129)	(1.0162)
long-term volatility	-0.5392	-0.5514	-0.4588	-0.4528
	(0.3147)	(0.3124)	(0.3116)	(0.3112)
fixed dummy, IMF methodology	0.2668	-	0.0087	-
	(0.2151)	-	(0.1693)	-
fixed dummy, IRR methodology	-	0.0762	-	0.0083
	-	(0.1905)	-	(0.1546)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.** denote significance on 5% level.

The outcome for our main variables is provided in Table 7.4.[1] It is worth highlighting that none of the additional variables is significant at 5% level of significance. Moreover, in fixed effects models, the overall R squared decreased which can be considered as that models with additional variables perform worse in comparison to our baseline equation. Regarding the exchange rate variables, no difference was found in their significance or sign of associated coefficients. Thus, the estimates are robust to inclusion of additional time-variant variables.

Finally, our robustness check is concluded with the inclusion of two governance indices in a spirit similar to Abbott *et al.* (2012). In particular, we account for recipient-country political risk by using the index of *political stability and absence of violence*, which measures the likelihood of government destabilization. The second index *regulatory quality* measures government realizations of policies and regulations targeted to private sector. Both indices come from the Worldwide Governance Indicators of World Bank and are in the range from -2.5 to 2.5, while higher scores stand for stronger governance performance. However, the shortcoming of this approach is data availability since the first observations are dated in 1996 and till 2002 they are accessible only on biennial basis. Although we partially overcome the problem with

[1] For complete results see Table B.10 in Appendix.

the use of linear interpolation for 1996-2002 period, there is still considerable decrease of observations entering the regressions.

The outcome of modified regressions can be found in Appendix (Table B.11). For the exchange rate variables no differences in terms of their significance or sign of the associated coefficients were found.

Chapter 8

Conclusion

In this thesis we provide an updated evidence on the role of exchange rates in determining FDI. On the sample of 40 developing countries receiving FDI from five advanced economies (France, Germany, Japan, United Kingdom and United States) over the 1991-2010 period we studied how the strength of exchange rates, exchange rate volatility and currency regime affect bilateral FDI flows. In our analysis we utilized bilateral data what distinguishes us from majority of studies presented in the literature review.

We documented that during the analysed period, the real exchange rates of developing countries with five advanced economies experienced, on average, considerable strengthening. This strengthening might be a consequence of the differences in economic development since the average real GDP growth of developing countries was, during the 1991-2010 period, higher than in five advanced economies used in our analysis. The fact that the currencies appreciated over the analysed period can be reason why we were not able to confirm the wealth effect hypothesis that supposes increases of FDI after depreciations of host country currencies which is described in Froot & Stein (1991). From the outcome of our regression analysis it seems that currency movements do not play significant role in affecting FDI to developing countries in our sample.

On the contrary, we did not find that volatility of bilateral exchange rates affect FDI inflows to developing countries. This outcome may reflect the development in financial markets over past decades. Jeanneret (2005) also supports this idea while emphasizing the wider availability of hedging opportunities for multinationals. Alternative reasoning might lie in the decreasing trend the volatility of exchange rates experienced over the past twenty years. Given that observation, it may be argued that it is less likely for the volatility of exchange rates to have substantial influence on FDI.

In addition, we found some evidence that de facto bilateral fixing of currencies is beneficial for FDI flows. Since we control for exchange rate volatility in

our regressions, there might be other channels through which bilateral fixing works. Providing the similar reasoning as Schiavo (2007) or Busse *et al.* (2010), bilateral fixing of currencies might provide signalling effect or there might be some cost-reduction foundations linked with international transactions. Moreover, de facto fixing of currencies may be accompanied with relatively good institutions in individual developing countries.

Nevertheless, the design of particular exchange rate system in the developing countries should be considered in a wider macroeconomic context. The exchange rate regime in given developing country is often a consequence of underlying economic conditions (Abbott *et al.* 2012). Moreover, we have to be cautious when discussing the exchange rate stabilization policies aimed to support the FDI flows. Eventhough the FDI plays an important role for many developing countries they can also have negative effects for receiving country, as discussed in Chapter 2.

The research can further be extended for the inclusion of other countries, given the availability of data. Furthermore, it would be interesting to analyse how exchange rates affect FDI to particular industries. However, the data availability still constitutes substantial obstacle to perform such a study.

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Appendix A

Data

Table A.1: List of Developing countries

Europe	Bulgaria, Hungary, Poland, Romania, Russian Federation, Turkey, Ukraine
Africa	Algeria, Egypt, Morocco, Tunisia, Cameroon, Gabon, Kenya, Malawi, Nigeria, South Africa, Togo
Latin America	Costa Rica, El Salvador, Guatemala, Honduras, Jamaica, Panama, Trinidad and Tobago, Argentina, Bolivia, Brazil, Colombia, Guyana, Paraguay, Peru, Uruguay
Asia	Bangladesh, Indonesia, India, Malaysia, Philippines, Sri Lanka, Thailand

Table A.2: List of Developed countries

France, Germany, Japan, United Kingdom, United States

Table A.3: Correlation Matrix

	fdi	GDP prod.	growth of i	growth of j	bil. trade	RTA	comlan	distance	bit	inflation
fdi	1.0000									
GDP prod.	0.5224	1.0000								
growth of i	0.0516	-0.0140	1.0000							
growth of j	0.0801	0.0776	0.2355	1.0000						
bil. trade	0.6422	0.6904	-0.0526	0.0673	1.0000					
RTA	0.2020	0.0589	-0.0669	-0.0559	0.2592	1.0000				
comlan	0.1290	-0.0085	0.0855	0.0144	0.1366	0.0098	1.0000			
distance	-0.2388	-0.0119	-0.0323	0.0070	-0.3450	-0.6121	-0.0340	1.0000		
bit	0.0871	-0.0235	0.0140	0.0610	0.0443	0.2833	-0.0452	-0.3062	1.0000	
inflation	-0.0376	0.0336	0.0551	-0.0234	-0.0282	-0.0429	-0.0616	-0.0484	-0.0515	1.0000
fin. dev	0.2413	0.1511	-0.0651	-0.0804	0.2918	0.1106	-0.0035	0.0718	0.0518	-0.2270
diff GDPpc	-0.2338	-0.2963	0.0436	0.0633	-0.3065	-0.2255	0.1467	0.1693	-0.1803	0.1134
RER	-0.1047	0.0060	0.0085	-0.0014	-0.0749	0.0831	-0.0527	-0.0804	-0.1146	0.2317
ShortVol	-0.0493	0.0798	-0.0615	-0.2108	-0.0577	-0.1066	-0.0563	0.1892	-0.0929	0.3036
LongVol	0.0266	0.1397	0.0118	-0.0379	0.0201	-0.1039	-0.0426	0.1228	-0.0415	0.2669
FixIMF	-0.1321	-0.2826	0.0410	0.0421	-0.2201	-0.0076	0.0358	-0.0550	0.0536	-0.3573
FixIRR	-0.0868	-0.2658	0.0042	0.0247	-0.2140	-0.0657	0.0068	-0.0044	0.0347	-0.2575

	fin. dev	diff GDPpc	RER	ShortVol	LongVol	FixIMF	FixIRR
fin. dev	1.0000						
diff GDPpc	-0.2648	1.0000					
RER	-0.0819	-0.0151	1.0000				
ShortVol	-0.0361	0.1163	0.1845	1.0000			
LongVol	-0.0671	0.0002	-0.0225	0.3160	1.0000		
FixIMF	0.0402	-0.0390	-0.0761	-0.1848	-0.1187	1.0000	
FixIRR	0.0355	-0.0002	-0.0537	-0.1032	-0.0827	0.7071	1.0000

Note: fdi denotes logarithmic FDI, GDP prod. denotes GDP product of i and j, growth of i denotes economic growth of i, growth of j denotes economic growth of j, bil. trade denotes bilateral trade between countries i and j, RTA denotes dummy for regional trade agreement, comlan denotes common language, distance denotes distance between i and j, bit denotes dummy for bilateral investment treaty, inflation denotes inflation of j, fin. dev denotes financial development of j, diff GDPpc denotes difference in real GDP per capita of country-pair , RER denotes real exchange rate, ShortVol denotes short-term volatility, LongVol denotes long-term volatility, FixIMF denotes fixed regime dummy under IMF methodology and FixIRR denotes fixed regime dummy under IRR methodology.

Table A.4: Classification of IMF exchange rate regimes

IMF classification	Our categorization
No separate legal tender	Fixed
Currency board	Fixed
(Conventional) peg to single currency	Fixed
(Conventional) peg to currency basket	Fixed
Stabilized arrangement	Intermediate
Crawling peg	Intermediate
Crawl-like arrangement	Intermediate
Pegged exchange rate within horizontal bands	Intermediate
Other managed arrangement	Intermediate
Limited flexibility with respect to single currency	Intermediate
Limited flexibility with respect to cooperative arrangement	Intermediate
Adjusted according to set of indicators	Intermediate
Managed floating with no predetermined path for exchange rate	Intermediate
Floating	Float
Free floating	Float

Source: Author's categorization of exchange rate regimes using various annual issues of IMF's AREAER

Table A.5: Classification of IRR exchange rate regimes

IRR classification	Our categorization
Exchange rate arrangement with no separate legal tender	Fixed
Currency board	Fixed
Peg to single currency	Fixed
De facto peg to single currency	Fixed
De facto crawling peg to single currency	Intermediate
De facto moving peg to single currency	Intermediate
De Facto crawling band	Intermediate
Pre–Announced crawling band	Intermediate
De facto band	Intermediate
Managed floating	Intermediate
Freely falling	Float
Freely floating	Float

Note: No categorization in presence of Dual market or Multiple rates.
Source: Author's categorization of exchange rate regimes using Ilzetzki *et al.* (2011)

In our analysis we utilize both de facto and de jure classification schemes provided by Ilzetzki *et al.* (2011) and IMF. It is worth noting that in 1999 IMF changed the methodology and started to classify countries according to actual (de facto) behavior of exchange rates. However, there are still discrepancies between both approaches since the resulting classification differs in some cases. In the following table we show the countries that are sorted as fixed according to the IMF methodology, while we show also how particular countries are classified using the methodology of Ilzetzki *et al.* (2011).

Table A.6: Classification of fixed xchange rate regimes in our sample

General fixing to some currency according to IMF	Time period	Classification of Ilzetzki *et al.* (2011)	Bilateral fixing partner according to IMF
Algeria	91-93	**x**	France
Argentina	91-00, 06-07	92-01	US
Bangladesh	93-02	07-10	US
Bolivia	91-92	09-10	US
Bulgaria	97-10	97-10	France (99-), Germany
Cameroon	91-10	91-10	France, Germany (99-)
Egypt	05-07	**x**	US
El Salvador	98-10	91-10	US
Gabon	91-10	91-10	France, Germany (99-)
Guyana	05-07	**x**	US
Honduras	05-07	06-10	US
Hungary	91-94	**x**	Germany
Kenya	91-92	**x**	US
Malawi	91-92	95-96	US
Malaysia	98-04	99-05	US
Morocco	91-10	**x**	France, Germany (99-)
Nigeria	94-96, 06-07	**x**	US
Panama	91-10	91-10	US
Thailand	91-97	91-97	US
Togo	91-10	91-10	France, Germany (99-)
T. and Tobago†	91, 99-07	**x**	US
Ukraine	02-07	00-10	US

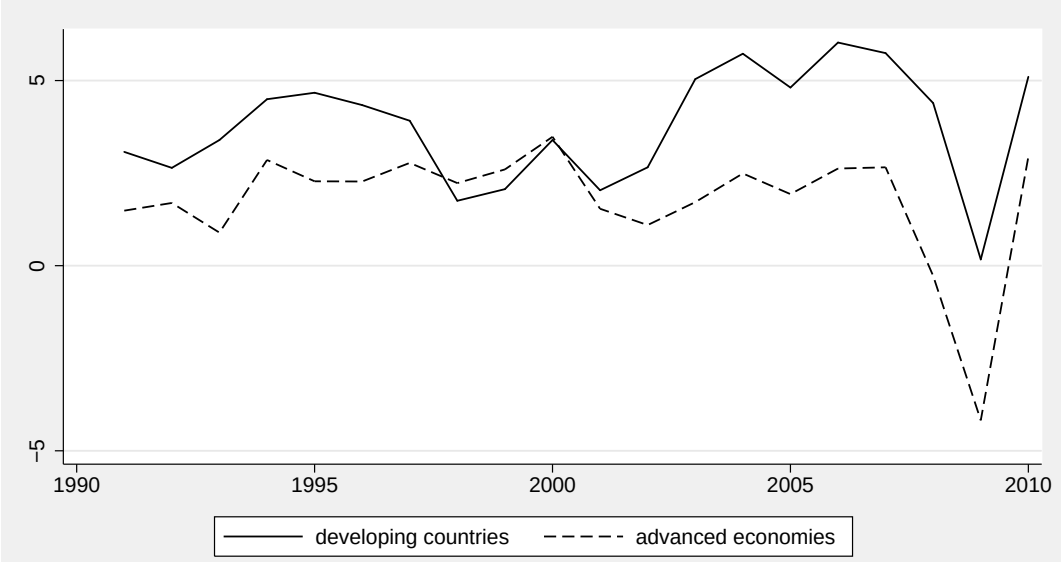
Note: **x** denotes no particular classification according to the methodology of Ilzetzki *et al.* (2011).
† Trinidad and Tobago.

Source: Author's processing

Appendix B

Graphs & Tables

Figure B.1: Average real GDP growth in advanced and developing countries, in percentage



Source: Author's processing based on data from World Bank

Table B.1: Static baseline model: Pooled OLS estimates

	Specification					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
lagged economic size	0.0736^{c}	0.0868^{b}	0.1064^{b}	0.1369^{a}	0.1615^{a}	0.1892^{a}
	(0.0431)	(0.0426)	(0.0430)	(0.0447)	(0.0447)	(0.0512)
economic growth of i	0.1495^{a}	0.1488^{a}	0.1501^{a}	0.1546^{a}	0.1367^{a}	0.1339^{a}
	(0.0374)	(0.0374)	(0.0488)	(0.0372)	(0.0378)	(0.0380)
economic growth of j	0.0258^{b}	0.0237^{c}	0.0284^{a}	0.0311^{b}	0.0319^{b}	0.0322^{b}
	(0.0127)	(0.0128)	(0.0127)	(0.0128)	(0.0127)	(0.0128)
lagged bilateral trade	0.8521^{a}	0.8445^{a}	0.8102^{a}	0.7734^{a}	0.7406^{a}	0.7076^{a}
	(0.038)	(0.0379)	(0.0394)	(0.0427)	(0.0435)	(0.0537)
difference of real GDPpc†	-0.0027^{b}	-0.0021^{c}	-0.0012	-0.0005	-0.0013	-0.0011
	(0.0013)	(0.0013)	(0.0013)	(0.0012)	(0.0013)	(0.0013)
bilateral inv treaties	0.3535^{a}	0.3658^{a}	0.3671^{a}	0.3114^{a}	0.3229^{a}	0.3003^{a}
	(0.0932)	(0.0932)	(0.0930)	(0.0951)	(0.0946)	(0.0955)
inflation of host country		-0.1286^{a}	-0.0893^{c}	-0.0931^{c}	-0.0796^{c}	-0.0837^{c}
		(0.0488)	(0.0494)	(0.0495)	(0.0495)	(0.0496)
lagged financial development			0.0056^{a}	0.0058^{a}	0.0061^{a}	0.0067^{a}
			(0.0016)	(0.0016)	(0.0016)	(0.0017)
regional trade agreements				0.3639^{a}	0.3745	0.2819^{c}
				(0.1418)	(0.1407)	(0.1699)
common language					0.4162^{a}	0.4336^{a}
					(0.1376)	(0.1382)
distance						-0.1037
						(0.1000)
constant	-6.1771^{a}	-6.3328^{a}	-8.1802^{a}	-8.1920^{a}	-8.9739^{a}	-8.9366^{a}
	(1.5726)	(1.5550)	(2.9294)	(1.6199)	(1.6171)	(1.6283)
Time effects	yes	yes	yes	yes	yes	yes
Country-pair effects	no	no	no	no	no	no
Observations	2209	2209	2209	2209	2209	2209
F statistic:	84.82	82.88	82.02	80.58	78.61	76.58
R^2	0.438	0.440	0.442	0.444	0.447	0.448

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.^{a}, ^{b} and ^{c} denote significance on 1%, 5% and 10% level, respectively. † GDPpc is an abbreviation of GDP per capita.

Table B.2: Static baseline model: Pooled OLS estimates with exchange rate variables and time-specific effects

	Specification	
Variable	(1)	(2)
lagged economic size	0.1998***	0.2138***
	(0.0535)	(0.0525)
economic growth of i	0.1228***	0.1208***
	(0.0389)	(0.0388)
economic growth of j	0.0357***	0.0340**
	(0.0129)	(0.0129)
lagged bilateral trade	0.6764***	0.6930***
	(0.0574)	(0.0562)
difference of real GDPpc†	-0.0017	-0.0014
	(0.0013)	(0.0013)
bilateral investment treaties	0.2435**	0.2325***
	(0.0968)	(0.0967)
inflation of host country	-0.0789	-0.0118
	(0.0586)	(0.0570)
lagged financial development	0.0072***	0.0069**
	(0.0017)	(0.0017)
regional trade agreements	0.3105*	0.3657**
	(0.1705)	(0.1709)
common language	0.4559***	0.4452***
	(0.1387)	(0.1385)
distance	-0.1635	-0.1257
	(0.1052)	(0.1036)
real exchange rate	-0.6199***	-0.6513***
	(0.2120)	(0.2106)
short-term volatility	0.3600	0.3115
	(1.0031)	(1.0031)
long-term volatility	0.1494	0.1372
	(0.2912)	(0.2915)
fixed regime, IMF methodology	-0.1334	-
	(0.1100)	-
fixed regime, IRR methodology	-	0.2646**
	-	(0.1035)
constant	-5.7385***	-6.8585***
	(1.8673)	(1.8403)
Time-specific effects	yes	yes
Country-pair effects	no	no
Observations	2209	2209
F statistic:	70.08	68.67
R^2	0.450	0.451

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.***, ** and * denote significance on 1%, 5% and 10% level, respectively. † GDPpc is an abbreviation of GDP per capita.

Table B.3: Random Effects Estimates

	Fixed dummy			
	General		Bilateral	
lagged economic size	0.3146***	0.3175***	0.3221***	0.3240***
	(0.1128)	(0.1103)	(0.1145)	(0.1134)
economic growth of i	0.1238***	0.1238***	0.1245***	0.1240***
	(0.0372)	(0.0372)	(0.0372)	(0.0373)
economic growth of j	0.0347***	0.0343***	0.0348***	0.0352***
	(0.0116)	(0.0117)	(0.0116)	(0.0116)
lagged bilateral trade	0.5331***	0.5407***	0.5332***	0.5362***
	(0.1135)	(0.1121)	(0.1121)	(0.1120)
difference of real GDPpc†	-0.0013	-0.0012	-0.0013	-0.0014
	(0.0029)	(0.0029)	(0.0029)	(0.0029)
bilateral investment treaties	0.2514*	0.2484*	0.2511*	0.2521*
	(0.1413)	(0.1407)	(0.1405)	(0.1389)
inflation of host country	-0.0773	-0.0659	-0.0689	-0.0649
	(0.0624)	(0.0634)	(0.0626)	(0.0633)
lagged financial development	0.0082***	0.0081***	0.0082***	0.0082***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
regional trade agreements	0.3568	0.3634	0.3427	0.3452
	(0.2650)	(0.2644)	(0.2647)	(0.2626)
common language	0.5441**	0.5855**	0.5569**	0.5499**
	(0.2399)	(0.2603)	(0.2574)	(0.2508)
distance	-0.2410	-0.2293	-0.2254	-0.2138
	(0.1889)	(0.1862)	(0.1843)	(0.1836)
real exchange rate	-0.6160**	-0.6071**	-0.6013**	-0.5911**
	(0.2971)	(0.2947)	(0.2954)	(0.2933)
short-term volatility	-0.3671	-0.3571	-0.2740	-0.2501
	(0.9086)	(0.9085)	(0.8952)	(0.8967)
long-term volatility	-0.3049	-0.2932	-0.2924	-0.2817
	(0.3165)	(0.3169)	(0.3167)	(0.3155)
fixed dummy, IMF methodology	0.0327	-	0.2423	-
	(0.1588)	-	(0.2695)	-
fixed dummy, IRR methodology	-	0.1059	-	0.4943**
	-	(0.1423)	-	(0.2236)
constant	-8.575**	-8.955***	-9.141***	-9.445***
	(3.5621)	(3.4697)	(3.6358)	(3.5396)
Time-specific effects	yes	yes	yes	yes
Observations	2209	2209	2209	2209
$\chi^2(33)$ statistic:	879.57	863.27	865.84	878.15
R^2 (within)	0.082	0.082	0.083	0.083
R^2 (overall)	0.446	0.447	0.447	0.449

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses. Asterisks *, ** and *** denote significance on 10%, 5% and 1% level, respectively. † GDPpc is an abbreviation of GDP per capita.

Table B.4: Regressions without the Inclusion of 2008-2010 Period

	FE	FE	HT	HT
lagged economic size	0.3412	0.4143	0.6807***	0.6696***
	(0.8677)	(0.8664)	(0.1587)	(0.1609)
economic growth of i	0.1461***	0.1466***	0.1545***	0.1542***
	(0.0503)	(0.0502)	(0.0431)	(0.0429)
economic growth of j	0.0245**	0.0251**	0.0252*	0.0246*
	(0.0153)	(0.0154)	(0.0135)	(0.0135)
lagged bilateral trade	0.2217	0.2118	0.2831*	0.2873*
	(0.1806)	(0.1811)	(0.1496)	(0.1485)
difference of real GDPpc†	-0.0031	-0.0024	0.0021	0.0019
	(0.0163)	(0.0164)	(0.0028)	(0.0028)
bilateral investment treaties	0.3637	0.3739	0.3289*	0.3180*
	(0.2749)	(0.2752)	(0.1824)	(0.1797)
inflation of host country	-0.1073	-0.1109	-0.0914	-0.0876
	(0.0806)	(0.0810)	(0.0751)	(0.0753)
lagged financial development	0.0122***	0.0126***	0.0103***	0.0103***
	(0.0043)	(0.0042)	(0.0031)	(0.0030)
regional trade agreements	0.7002*	0.7021*	0.6593*	0.6260*
	(0.4156)	(0.4162)	(0.3655)	(0.3687)
common language	-	-	0.5874*	0.5779*
	-	-	(0.3205)	(0.3136)
distance	-	-	-0.1554	-0.2038
	-	-	(0.2823)	(0.2804)
real exchange rate	-0.5138	-0.5334	-0.5421	-0.5187
	(0.3905)	(0.3887)	(0.3656)	(0.3621)
short-term volatility	-1.0894	-1.1359	-0.9779	-0.9978
	(1.0051)	(1.0175)	(0.9678)	(0.9720)
long-term volatility	-0.4579	-0.4783	-0.3963	-0.3748
	(0.3384)	(0.3354)	(0.3293)	(0.3399)
fixed dummy, IMF methodology	0.1128	-	0.0734	-
	(0.1909)	-	(0.1646)	-
fixed dummy, IRR methodology	-	0.0169	-	0.1706
	-	(0.2042)	-	(0.1616)
constant	-27.0529	-12.9111	-22.67***	-21.97***
	(27.8475)	(34.0747)	(5.73)	(5.92)
Time-specific effects	yes	yes	yes	yes
Observations	1800	1800	1800	1800
F or χ^2 statistic:	5.01	5.01	789.21	783.02
Over-identification $\chi^2(26)$:	-	-	14.076	18.878
R^2 (within)	0.090	0.090	-	-
R^2 (overall)	0.388	0.394	-	-

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses. Asterisks *, ** and *** denote significance on 10%, 5% and 1% level, respectively. In HT model, following variables are considered endogenous according to the outcome of over-identification test: economic growth of j, lagged economic size, lagged bilateral trade and real exchange rate.

Table B.5: Hausman Specification Tests: Baseline Regression

	Fixed dummy			
	General		Bilateral	
	IMF	IRR	IMF	IRR
$\chi^2(31)$	50.92	63.00	98.79	109.90
p-value	0.0135	0.0006	0.0000	0.0000

Note: Hausman test applied to test the difference between FE and RE.

Table B.6: Volatility Treshold Effects

	Median country constant		Median country varies	
Variable	FE	HT	FE	HT
High short-term volatility	-0.0883	-0.0707	-0.0646	-0.0231
	(0.0957)	(0.0921)	(0.0847)	(0.0935)
High long-term volatility	-0.0536	-0.0494	-0.0079	-0.0230
	(0.0889)	(0.0915)	(0.0856)	(0.0921)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses. We excluded currency regime dummies from the regressions and studied if the volatility exerts an influence on FDI when it surpasses a treshold volatility given by the median developing country in our sample. We included the dummies into regressions individually, so that only one dummy is entering the regression.

Table B.7: Regressions excluding the period prior to 1995 for transition countries

	Applied method			
Variable	FE	FE	HT	HT
real exchange rate	-0.4541	-0.4606	-0.5518**	-0.5302**
	(0.2929)	(0.3528)	(0.2912)	(0.3280)
short-term volatility	-0.9112	-0.9383	-0.6551	-0.6450
	(0.9261)	(0.9279)	(0.9390)	(0.9370)
long-term volatility	-0.4595	-0.4571	-0.4295	-0.4085
	(0.3223)	(0.3207)	(0.3115)	(0.3120)
fixed dummy, IMF methodology	0.1000	-	0.0169	-
	(0.2051)	-	(0.1622)	-
fixed dummy, IRR methodology	-	0.1129	-	0.1420
	-	(0.1801)	-	(0.1467)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.** denote significance on 5% level. No important changes in other variables occured.

Table B.8: Regressions with Substituted Variables

	Applied method			
Variable	FE	FE	HT	HT
real exchange rate	-0.5014	-0.5287	-0.5520	-0.5650
	(0.3427)	(0.3424)	(0.2265)	(0.2257)
short-term volatility	-0.9665	-1.0494	-0.7270	-0.7487
	(0.9396)	(0.9535)	(0.8465)	(0.8708)
long-term volatility	-0.5105	-0.5262	-0.4129	-0.4181
	(0.3289)	(0.3278)	(0.2317)	(0.2319)
fixed dummy, IMF methodology	0.1700	-	0.0727	-
	(0.2017)	-	(0.1617)	-
fixed dummy, IRR methodology	-	0.0858	-	0.1355
	-	(0.1874)	-	(0.1309)

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.** denote significance on 5% level. We substituted *sum of real GDP* for *product of real GDP*, and inflation measured as *GDP deflator* for *CPI-measured inflation*.

Table B.9: Tobit Estimates: Complete Results

	Fixed dummy			
Variable	General		Bilateral	
lagged economic size	0.3934***	0.3994***	0.4068***	0.4114***
	(0.1135)	(0.1135)	(0.1138)	(0.1129)
economic growth i	0.1616***	0.1617***	0.1622***	0.1616***
	(0.0518)	(0.0518)	(0.0518)	(0.0517)
economic growth j	0.0531***	0.0524***	0.0529***	0.0534***
	(0.0173)	(0.0173)	(0.0172)	(0.0173)
lagged bilateral trade	0.6372***	0.6463***	0.6334***	0.6356***
	(0.1102)	(0.1099)	(0.1096)	(0.1089)
difference of real GDPpc	-0.0039	-0.0037	-0.0038	-0.0038
	(0.0036)	(0.0035)	(0.0036)	(0.0035)
bilateral investment treaties	0.4790**	0.4743**	0.4784**	0.4805**
	(0.1844)	(0.1844)	(0.1841)	(0.1836)
inflation of host country	-0.0643	-0.0300	-0.0539	-0.0477
	(0.0851)	(0.0850)	(0.0838)	(0.0837)
lagged financial development	0.0087***	0.0085**	0.0088***	0.0089***
	(0.0032)	(0.0032)	(0.0032)	(0.0032)
regional trade agreements	0.3965	0.4122	0.3788	0.3801
	(0.2589)	(0.2581)	(0.2591)	(0.2578)
common language	0.8546***	0.8462**	0.8108**	0.8003**
	(0.3165)	(0.3159)	(0.3175)	(0.3142)
distance	-0.2724	-0.2637	-0.2547	-0.2391
	(0.1925)	(0.1911)	(0.1915)	(0.1906)
real exchange rate	-0.4695	-0.4594	-0.4482	-0.4354
	(0.2763)	(0.2758)	(0.2761)	(0.2757)
short-term volatility	-1.1013	-0.9925	-0.8893	-0.8585
	(1.1159)	(1.1113)	(1.1176)	(1.1114)
long-term volatility	-0.3690	-0.3545	-0.3602	-0.3496
	(0.3024)	(0.3025)	(0.3021)	(0.3020)
fixed dummy, IMF methodology	-0.0448	-	0.3186	-
	(0.1899)	-	(0.3007)	-
fixed dummy, IRR methodology	-	0.1575	-	0.6800**
	-	(0.2048)	-	(0.3200)
constant	-13.43***	-11.74***	-14.27***	-14.76***
	(3.846)	(3.844)	(3.845)	(3.813)
Time-specific effects	yes	yes	yes	yes
Observations	2209	2209	2209	2209
$\chi^2(33)$ statistic:	571.43	572.31	574.08	582.17
R^2 (pseudo)	0.4344	0.4350	0.4350	0.4370

Note: Asterisks *, ** and *** denote significance on 10%, 5% and 1% level, respectively. The pseudo R squared is given by the sample correlation coefficient between the dependent variable and its fitted values.

Table B.10: Regressions with Additional Variables

	FE	FE	HT	HT
lagged economic size	0.9047	1.0157	0.5604***	0.5658***
	(0.7075)	(0.7103)	(0.1619)	(0.1614)
economic growth of i	0.1256***	0.1269***	0.1151***	0.1145***
	(0.0400)	(0.0399)	(0.0396)	(0.0397)
economic growth of j	0.0281**	0.0301**	0.0439***	0.0441***
	(0.0144)	(0.0147)	(0.0132)	(0.0133)
lagged bilateral trade	0.2201	0.2030	0.2800**	0.2678*
	(0.1474)	(0.1482)	(0.1392)	(0.1390)
difference of real GDPpc	-0.0131	-0.0126	-0.0014	-0.0006
	(0.0135)	(0.0137)	(0.0051)	(0.0051)
bilateral investment treaties	0.2704	0.2936	0.2908	0.2825
	(0.2426)	(0.2428)	(0.1759)	(0.1775)
inflation of host country	-0.1073*	-0.1177*	-0.1090*	-0.1120*
	(0.0806)	(0.0658)	(0.0650)	(0.0659)
lagged financial development	0.0096**	0.0099**	0.0110***	0.0112***
	(0.0038)	(0.0038)	(0.0029)	(0.0025)
regional trade agreements	0.4473	0.4313	0.4486	0.4346
	(0.3894)	(0.3939)	(0.3416)	(0.3429)
common language	-	-	0.7009**	0.7288**
	-	-	(0.3222)	(0.3240)
distance	-	-	-0.3420	-0.3704
	-	-	(0.2568)	(0.2560)
capital account openness	0.0074	0.0153	0.0447	0.0511
	(0.0659)	(0.0658)	(0.0724)	(0.0724)
trade openness	0.3705	0.3503	-0.0959	-0.1007
	(0.3416)	(0.3469)	(0.2761)	(0.2776)
informational infrastructure	-0.0308	-0.0312	-0.0184	0.0286
	(0.0202)	(0.4162)	(0.1978)	(0.2032)
natural resources	0.0087	0.0084	0.0735	0.0767
	(0.0062)	(0.0063)	(0.0707)	(0.0718)
real exchange rate	-0.5776	-0.5922	-0.6339	-0.6250
	(0.3238)	(0.3149)	(0.3778)	(0.3755)
short-term volatility	-0.5669	-0.6589	-1.3051	-1.3211
	(1.0178)	(1.0270)	(1.0129)	(1.0162)
long-term volatility	-0.5392	-0.5514	-0.4588	-0.4528
	(0.3147)	(0.3124)	(0.3116)	(0.3112)
fixed dummy, IMF methodology	0.2668	-	0.0087	-
	(0.2151)	-	(0.1693)	-
fixed dummy, IRR methodology	-	0.0762	-	0.0083
	-	(0.1905)	-	(0.1546)
constant	-32.977	-36.988	-15.47**	-15.48**
	(27.9293)	(28.0870)	(6.22)	(6.21)
Time-specific effects	yes	yes	yes	yes
Observations	2164	2164	2164	2164
Over-identification $\chi^2(26)$:			25.301	26.005
F(in FE) or χ^2(in HT) statistic:	5.30	5.27	944.28	949.67
R^2 (within)	0.091	0.090	-	-
R^2 (overall)	0.354	0.354	-	-

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.*, ** and *** denote significance on 10%, 5% and 1% level, respectively. In HT model, following variables are considered endogenous according to the outcome of over-identification test: economic growth of j, lagged economic size, lagged bilateral trade and real exchange rate.

Table B.11: Regressions with Governance Indices

	FE	FE	HT	HT
lagged economic size	1.0592	1.1251	0.5853***	0.5619***
	(0.1401)	(0.8972)	(0.1759)	(0.1781)
economic growth of i	0.1401***	0.1406***	0.1306***	0.1299***
	(0.0414)	(0.0415)	(0.0386)	(0.0387)
economic growth of j	0.0464***	0.0477***	0.0456***	0.0462***
	(0.0157)	(0.0159)	(0.0137)	(0.0139)
lagged bilateral trade	0.3694**	0.3627**	0.3279**	0.3243**
	(0.1736)	(0.1747)	(0.1522)	(0.1550)
ln diff real GDPpc	-0.0052	-0.0045	0.0034	0.0030
	(0.0159)	(0.0159)	(0.0038)	(0.0038)
bilateral investment treaties	0.1011	0.1076	0.1865	0.1734
	(0.2875)	(0.2900)	(0.1828)	(0.1884)
inflation of host country	-0.0546	-0.0648	-0.0300	-0.0327
	(0.0726)	(0.0755)	(0.0676)	(0.0699)
lagged financial development	0.0115**	0.0119**	0.0097**	0.0100**
	(0.0048)	(0.0049)	(0.0026)	(0.0026)
regional trade agreements	0.1372	0.1348	0.0958	0.0799
	(0.4449)	(0.4481)	(0.3889)	(0.3945)
common language	-	-	0.8797**	0.8835***
	-	-	(0.3371)	(0.3330)
distance	-	-	-0.4531	-0.4948*
	-	-	(0.2811)	(0.2826)
regulatory quality	0.3378	0.3469	0.5078**	0.5143**
	(0.2989)	(0.3000)	(0.2078)	(0.2106)
political stability	-0.1048	-0.1012	-0.0285	-0.0442
	(0.1874)	(0.1875)	(0.1412)	(0.1431)
real exchange rate	-0.4756	-0.4740	-0.5317	-0.5191
	(0.3733)	(0.3736)	(0.3477)	(0.3486)
short-term volatility	-0.1313	-0.1762	-0.0365	-0.0589
	(1.0982)	(1.0939)	(1.0954)	(1.0883)
long-term volatility	-0.0437	-0.1269	-0.0311	-0.0376
	(0.4885)	(0.5081)	(0.4742)	(0.4856)
fixed dummy, IMF methodology	0.1214	-	0.0746	-
	(0.2804)	-	(0.2266)	-
fixed dummy, IRR methodology	-	0.1125	-	0.0851
	-	(0.3311)	-	(0.2189)
constant	-39.482	-42.016	-16.74***	-15.47**
	(35.3724)	(35.7285)	(6.24)	(6.27)
Time-specific effects	yes	yes	yes	yes
Observations	1894	1894	1894	1894
Over-identification $\chi^2(26)$:	-	-	9.345	8.876
F or χ^2 statistic:	4.86	4.88	639.87	641.31
R^2 (within)	0.085	0.085	-	-
R^2 (overall)	0.371	0.368	-	-

Note: Heteroskedasticity-robust standard errors clustered around country-pairs in parentheses.*, ** and *** denote significance on 10%, 5% and 1% level, respectively. In HT model, following variables are considered endogenous according to the outcome of over-identification test: economic growth of j, lagged economic size, lagged bilateral trade and real exchange rate.