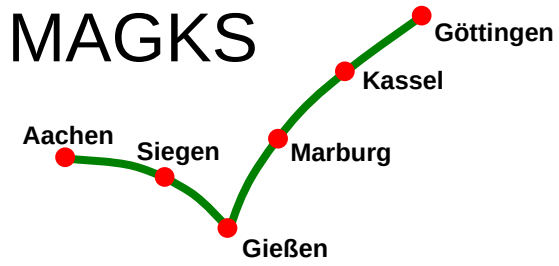

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Foreign Direct Investment and Exchange Rate Regimes

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Abstract

The paper uses a comprehensive data set with bilateral direct investment flows and establishes the influence of the de-facto exchange rate regime for FDI flows. We find a strong and significant effect from fixed rates on bilateral FDI flows in developed economies, but no significant effect for developing countries. There is thus no general and uniform impact of stable exchange rates on FDI. We provide several possible explanations for this difference.

Keywords: Foreign Direct Investment, Multinational Enterprises, Exchanges Rate Regimes
JEL-Classification: F21, F23, O24

1. Introduction

There exists a wide literature on the determinants and causes of foreign direct investment (FDI). One chief factor, among many others, should be the exchange rate because changes and variability in the external value of the domestic currency change the real value of an investment (when investing and when transferring revenue), which also implies that foreign investments are accompanied by higher uncertainty. This could either serve as an additional incentive to invest abroad (in the sense of optimal portfolio diversification) or it could act as a disincentive and at least delay FDI and adjustments in capital flows. Because of inconclusive theoretical predictions, the question of influence is basically an empirical one.

Accordingly, there exists a wide empirical literature that aims to decipher the influence of (real) current and expected exchange rate levels on FDI flows as well as the influence of exchange rate variability (to be reviewed in Section 2). There is very little literature so far, however, on the influence of the exchange rate regime. While exchange rate variability and the regime should be correlated, we think it is useful to explore the influence of regimes independently because the regime is defined over the nominal exchange rate and thus a fixed nominal rate does not necessarily imply a constant real rate, which should be decisive for investment. Since it is by now well known that declared (de jure) and de facto regimes can (and often do) diverge widely, we use the de-facto classification by Reinhart and Rogoff (2004) for our study.

In our view, the main additional effect that could come from a regime is the increased credibility of a consistent peg. FDI, by definition, is a long-term investment and therefore investors should base their decisions on long-term currency developments rather than short-term expectations about currency movements. While formal declarations of a particular regime may increase credibility, one would expect that investors mainly look at de-facto pegs rather than de-jure pegs. Moreover, literature on the trade effect of exchange rates regimes has also derived that regimes have an impact that goes beyond the mere observation of exchange rate variability. Rose (2000) and others have found that there is additional impact of currency union on the creation of trade that goes above and beyond the influence of fixed rates. While this work has been criticized, and the consensus now is that the effect is much smaller than first derived by Rose, it seems that the additional effect of the regime can be held up (Baldwin 2006).

Our main contribution in this paper is to combine the widely used Reinhart and Rogoff (2004) classification with a relatively new data set on annual bilateral FDI flows among developed and developing countries in a gravity-type model, based on data from 1980 to 2004. These data, based on an extensive FDI data set compiled by UNCTAD, are combined with bilateral exchange rate regime data; that is, we transform the Reinhart and Rogoff-data set to map bilateral FDI with corresponding exchange rate relations. However, we do not only include formal monetary unions but also use undeclared fixed regimes as reflecting stable currency relations.

In contrast to earlier literature on exchange rate levels and variability we find that bilateral FDI flows do not, in general, depend on whether countries have a de-facto fixed exchange rate with one another. While we find a consistent and positive effect of fixed rates on FDI among developed countries, the same is not true for developing countries. Thus, the evidence is different for different types of countries. Also, our results for levels and variability are mixed so that unambiguous statements are not possible. While we find a significant positive effect of the (real) exchange rate level for developed countries, the effect turns negative for developing countries. We cannot find any significant impact of exchange rate variability. In this respect, we cannot confirm the results found earlier when looking at bilateral investment flows. Our results thus also negate those studies that found such an influence when looking at aggregate FDI flows to or from a given country.

The paper is structured as follows. Section 2 provides a brief survey of the literature on exchange rates and FDI to be able to compare our results with those found earlier. Section 3 describes the empirical approach, introduces all variables and explains the new FDI data set used. While Section 4 presents our empirical results, the paper concludes in Section 5 with a discussion of the main results and some policy implications.

2. The Literature on FDI and Exchange Rates

The broad literature on the relation between FDI and exchange rates can be distinguished into three main strands: the influence of the current (and expected) level of the exchange rate, its variability, and a nascent literature on the question of whether a particular exchange rate

regime, such as a monetary union, influences FDI. Since there are several surveys on this literature (Pain and van Welsum 2003, Kiyota and Urata 2004, Bloningen 2005, Buch and Kleinert 2008, Becker and Hall 2009), our review is very brief and summarizes only the main arguments and findings.

Theoretically, it is not obvious that the exchange rate should have an impact on FDI decisions because costs of setting up a firm and revenues from the investment are denominated in the same currency, but most literature assumes that the real exchange rate is not constant and that it influences the domestic price of FDI and the real value of revenues transferred to the home country.

Cushman (1985), Froot and Stein (1991), Klein and Rosengreen (1994), Bloningen (1997), Caves (1989) and Kogut and Chang (1996), looking at different time periods and different source countries, all find that FDI inflows into the USA increase with a fall in the value of the dollar.[1] However, Froot and Stein find that it only holds for the manufacturing sector, and Bloningen finds that an appreciation in the bilateral US Dollar-Yen real exchange rate leads to an increase in acquisitions of high R&D firms in the manufacturing sector, whereas for non-manufacturing low R&D industries, this effect is much weaker and not significant. An explanation could be that greenfield investments do not involve any acquisition of firm-specific assets and may be thus less sensitive to exchange rate levels (Pain and Van Welsum 2003). Looking at investments in the service sector, Tomlin (2008) finds that an appreciation of the dollar leads to more capital inflows into the US service industry.

Likewise, Dewenter (1995) and Stevens (1998) find that an appreciation of the dollar leads to more inflows in general. Chakrabati and Scholnick (2002), in examining the effects of US dollar exchange rates on FDI inflows in US dollar terms from the US to OECD host countries for a sample of 20 OECD countries over the period from 1982 to 1995, find no robust effects (see also Udomkerdmonkol et al. 2006). Thus, although most studies confirm the existence of the negative correlation between the level of the dollar exchange rate and the flow of FDI into the US by looking at certain groups of countries, industries and periods of observation, it is unclear how robust these results are.

[1] They find a similar relationship for flows to West Germany, but not for the UK, Canada or Japan.

Xing (2006) and Xing and Wang (2006) stress an additional aspect by looking at the influence of exchange rate levels if production in the host country is mainly used as an export platform. They find that investment in China is positively related to the depreciation of the Yuan, diverting investment from alternative locations in Asia.

Turning to variability, theoretical arguments indicate that the relation between exchange rate volatility and FDI could go either way. Aizenman and Marion (2001) argue that vertical FDI is inhibited rather than encouraged by increasing exchange rate volatility but that horizontal FDI, which is prevalent in industrialised countries, can be encouraged by exchange rate uncertainty because it creates opportunities to shift production to countries with more advantageous exchange rates. In the case of vertical FDI, high exchange rate volatility can delay investment because there is a chance the investment can be made at a more favourable exchange rate later. Naturally, the option value of waiting increases in uncertainty (Dixit and Pindyck 1994, Rivoli and Salorio 1996, Dunning 1988, Bloningen 1997), so increasing uncertainty increases the probability that investors will choose the option of postponing investment.

Goldberg and Kolstad (1995) and Sung and Lapan (2000) as well stress that by engaging in FDI firms buy an option to shift production in response to exchange rate fluctuations and, since this option is positively correlated with the variability of the exchange rate, more volatility should actually lead to more FDI.[2] Goldberg and Kolstad (1995), looking at two-way bilateral FDI flows between the US, Canada, Japan and the United Kingdom over the period from 1978 to 1991, confirm that higher volatility has a significant positive effect on the ratio of outward FDI in four of six cases. Others who find similar results are Cushman (1985, 1988, 2001), Stokman and Vlaar (1996) and Dewenter (1995) for US related flows, and De Ménil (1999) for a broader sample of OECD countries in a gravity model of bilateral FDI flows.

Again, in line with the theoretical arguments, empirical evidence is mixed. While Campa (1993) finds a negative influence of volatility of the US Dollar on the number of non-manufacturing transactions by Japanese investors in the US, only limited effects are found by Campa and Goldberg (1999) and Lafrance and Tessier (2001) for FDI to Canada, Crowley

[2] Aizenman (1992), however, shows that in the presence of particular types of real and nominal shocks, FDI may be stimulated more by a fixed exchange rate regime than by a floating rate regime.

and Lee (2002) for bilateral flows in a panel of 18 OECD countries, and Görg and Wakelin (2002) for the level of inward and outward FDI to the US from 12 OECD countries. Russ (2007) argues that the impact of variability on investment depends on whether volatility is driven by shocks in the home or host country.

Limited evidence can also be due to non-linear reactions of investment to an increase in volatility. For periods with excessively volatile exchange rate movements, Crowley and Lee (2002) find a stronger volatility-investment relationship than for periods with moderate movements in the exchange rate, and Amuedo-Dorantes and Pozo (2001) find a significant negative short and long-run impact on inflows of FDI into the US, whereas they see no significant impact from an unconditional measure of volatility (i.e., the rolling standard deviation) on FDI. Serven (2003) instead finds that exchange rate variability only matters beyond a certain threshold level in his study for developing countries.

Interestingly, Pain (2003) reports a change in the effects of exchange rate volatility on FDI over the period from 1981 to 1999. While the high real exchange rate volatility has a significant positive influence on inward investment from Germany into other European countries during the early and late 1990s, greater exchange rate volatility discouraged FDI over the remaining periods. This could be a possible reason for the divergent results reported in various studies concerning the effect of exchange rate volatility on FDI.

Barrel et al. (2003) also provide a finer grained picture by reporting that an increase in the volatility of the Sterling-Dollar real exchange rates lowers FDI from the US to the UK relative to the Euro area, whereas greater volatility of the Euro-Dollar exchange rate increases the UK share. Furthermore, the authors find that greater Sterling-Dollar volatility has a significant positive impact on absolute amounts of FDI in the United Kingdom, while greater Euro-Dollar volatility has a significant negative impact on the absolute levels of US FDI in both the United Kingdom and the Euro area.[3]

Moreover, it seems that turning to countries other than the US and other OECD countries might influence evidence. Hubert and Pain (1999) and Udomkerdmongkolm et al. (2006), for

[3] Becker and Hall (2009) as well stress that the whole matrix of exchange rate variability should be decisive for FDI. They expect that an entry by the UK into the European Monetary Union would raise FDI from the US to the UK. An increase of euro-dollar variability instead relocates FDI from the euro area to the UK.

instance, obtain a negative relationship between nominal bilateral exchange rate volatility for FDI in developing countries and emerging markets, which is explained by Bénassy-Quéré et al. (2001) with the argument that transfer pricing is particularly sensitive to exchange rate fluctuations. Reinhart and Rogoff (2004) note that exchange rate volatility is often only an indication of deeper institutional and policy problems and therefore only indirectly causes the negative effects on FDI.[4]

Hence, it seems again that it is hard to draw general conclusions for all countries and all periods. While there is strong evidence that firms aim to mitigate exchange rate risk by establishing production plants in countries with large markets, the effect of exchange rate volatility on vertical FDI seems to be rather negative. By drawing general conclusions, one has to bear in mind this evidence is mainly based on developed countries and that results often reflect specific circumstances. Among themselves, developed countries mainly engage in horizontal investment or try to acquire R&D intensive companies with firm-specific assets. This is most likely not the prime motive for FDI flowing into developing countries.

While the literature is mainly concerned with real exchange rate variability, the question also arises if a nominal peg influences the relation independently. Clearly, nominal pegs are per se not related to real exchange rates, but most literature argues that a reduction in nominal volatility also has an impact on real exchange rates.

Only very little work so far has focused on one particular example of an extreme exchange rate regime: the European Monetary Union (EMU). One study on the effects of the EMU on FDI is by Schiavo (2007). Using data for a sample of 25 OECD countries covering the period from 1980 to 2001 in conjunction with the gravity model, he shows that fixing the bilateral exchange rates by setting up the currency union has encouraged FDI. He concludes that adopting the same currency seems to bring about more than only elimination of the exchange rate volatility. Another recent study by Petroulas (2007), using panel data of unilateral FDI flows among 18 developed countries between 1992 and 2001, shows that the creation of EMU caused an increase of FDI in various directions. Inward FDI from within the Euro area rose by 16 percent, FDI from member countries to non-member countries rose by 11 percent, whereas

[4] Of course, since FDI is driven by many additional factors such as growth, income and institutional quality. The exchange rate regime, by affecting these variables, may have an indirect effect on FDI. We discuss this in more detail below.

inward FDI from non-member countries to member countries rose by only 8 percent. It is clear, however, that both studies are based on only a few observations after the creation of EMU and should thus be interpreted with caution.

3. Empirical Approach and Data

Since theoretical predictions about the impact of the exchange rate regime on FDI flows are ambiguous and the previous literature on the link between exchange rate variables and FDI is inconclusive, we proceed with an empirical analysis as indicated. As for the empirical approach, we use a gravity-type model across countries and over time. Since we analyse the link between bilateral exchange rate regimes and bilateral FDI flows, this model is highly suitable for the empirical investigation. Our basic model specification, which includes FDI determinants that address horizontal (market-seeking) and vertical (efficiency-seeking) FDI, reads as follows:

$$\ln \mathrm{FDI}_{ijt} = \alpha_0 + \gamma' \mathrm{X}_{it} + \varphi' \mathrm{Y}_{ijt} + \alpha_1 \, \mathrm{FixRegime}_{ijt} + \lambda_t + \mu_{jt} + \varepsilon_{ijt} \qquad (1)$$

where FDI_{ijt} stands for foreign direct investment of country i in country j at period t, X_{it} represents a set of host country control variables, Y_{ijt} denotes the difference between source and host country characteristics, $FixRegime_{ijt}$ corresponds to a fixed exchange rate regime between the source and the host country, λ_t is a set of year dummies, and μ_{jt} and ε_{ijt} represent host-year effects and the error term, respectively. We use a standard (OLS) fixed-effects panel regression model, as the Hausman test indicates that this estimator would be more appropriate than a random-effects model.

As concerns the dependent variable, we use FDI flows from the source to the host country in US$ million (the variable is labelled *FDI*).[5] Importantly, the limited host country coverage of previous analyses of bilateral FDI flows is overcome by fully exploiting the (largely unpublished) data available upon request from UNCTAD's Data Extract Service (UNCTAD 2009a). We use annual bilateral FDI flows in logs to reduce the skewness of the data. Before

[5] In addition to FDI flows in absolute values, we could have used FDI as a share of the host country's GDP as another dependent variable. However, estimates for this variable are difficult to interpret due to the fact that GDP stands on both sides of the equation.

taking the natural logarithm, we set the small number of negative FDI flows equal to zero and add one to include as many observations as possible.[6]

As regards the control variables, we employ a relatively standard set of measures, including total host country GDP for market seeking FDI (*GDP*),[7] the difference in GDP per capita between the source and the host country for vertical FDI (*DiffGDPpc*), host country openness to trade (*Openness*), a dummy for the existence of a bilateral or regional trading agreement, that is, a free trade agreement or customs union (*RTA*), another dummy for a bilateral investment treaty (*BIT*), and the inflation rate of the host country to control for macroeconomic distortions (*Inflation*).[8] Finally, we include an indicator for the institutional development of host countries, proxied by political constraints on the executive branch (*PolCon*). Poor institutions may discourage FDI by giving rise to uncertainty (e.g., with respect to the protection of property rights; Lee and Mansfield 1996, Henisz 2000) and additional costs (e.g., in the case of corruption; Wei 2000). Apart from *Inflation*, we expect a positive association of all these control variables with FDI.

As noted in the introduction, the classification of Reinhart and Rogoff (2004) is used for the variable of principal interest, that is, the exchange rate regime.[9] One reason for this choice is that it is available for a long time period and for a large country sample. Moreover, their system of classification depicts the real exchange rate regime quite adequately.[10] Since we are only interested in the difference between fixed and non-fixed regimes, we use the coarse grid classification system from Reinhart and Rogoff to determine whether a pair of countries has a fixed exchange rate. More specifically, *FixRegime* represents a dummy variable, taking the value one for a fixed exchange rate regime between the source and host country and the value zero for all other exchange rate regimes. The dummy is equal to one for hard pegs, that is, for a pair of two (or more) countries without a separate legal tender, those with a pre-announced

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[6] In fact, less than 4 percent of all FDI values in our sample are negative.

[7] Note that we use nominal GDP, since there is no adequate deflator available for FDI in many developing countries. Using instead the US deflator is likely to bias the results (Baldwin and Taglioni 2006).

[8] See Busse et al. (2010) for the impact of bilateral investment treaties on FDI. Appendix A provides exact definitions and data sources for all variables; descriptive statistics can be found in Appendix B. Similar to *FDI*, we take the natural logarithm of *GDP* and *Inflation*.

[9] We extend the Reinhart and Rogoff (2004) data set to the year 2004 with data provided by Eichengreen and Razo-Garcia (2006), as they use the same classification.

[10] Alternative classifications are provided by Ghosh et al. (2002) who base their sample on official exchange rate declarations, or Levy-Yeyati and Sturzenegger (2005) who study the volatility of official exchange rate and currency reserves, while Reinhart and Rogoff (2004) look at the volatility of the relevant (possibly inofficial) exchange rate. For a discussion of these different classifications, see Harms and Kretschmann (2009).

peg or currency board arrangement, those with a horizontal band narrower than +/- 2% and those with a de facto peg.[11] We expect a positive association of a fixed exchange rate regime on FDI flows, as uncertainty about exchange rate movements would decrease and, consequently, the risk premium for foreign investors would be lower. Moreover, in the case of the developing host countries, a "disciplined" monetary policy ensuring low and stable inflation rates could be imported vis-à-vis a fixed exchange rate where monetary independence would be foregone.

The percentage of hard pegs in developed countries was zero in 1997 and increased to 52 percent in 2004 due to the introduction of the euro (Table 1). The number of intermediate regimes decreased whereas the number of floating regimes hardly changed, in particular between 1997 and 2004. With regard to emerging market economies and developing countries, the number of hard pegs remained relatively stable or increased slightly over the time period between 1990 and 2004, but the floating regimes became more prevalent. The number of countries categorised as "freely floating" decreased to 0 and around 2 percent, respectively, in these countries.

[11] See Reinhart and Rogoff (2004) for details.

Table 1: Evolution of Exchange Rate Regimes Using the Reinhart and Rogoff Natural Classification (Percentage of Members in Each Category)

	1990	1997	2004
All Countries			
Hard pegs	22.5	24.5	34.1
Intermediate	45.8	51.1	32.6
Floating	15.8	13.7	31.9
Freely falling	15.8	10.8	1.5
Total	100.0	100.0	100.0
No. of Countries	120	139	138
Developed Countries			
Hard pegs	4.4	0.0	52.2
Intermediate	73.9	65.2	13.0
Floating	21.7	34.8	34.8
Freely falling	0.0	0.0	0.0
Total	100.0	100.0	100.00
No. of Countries	23	23	23
Emerging Countries			
Hard pegs	10.0	12.5	16.1
Intermediate	60.0	53.1	41.9
Floating	10.0	18.7	41.9
Freely falling	20.0	15.6	0.0
Total	100.0	100.0	100.0
No. of Countries	30	32	31
Developing Countries			
Hard pegs	34.3	35.7	35.7
Intermediate	29.9	46.4	34.5
Floating	16.4	5.9	27.4
Freely falling	19.4	11.9	2.4
Total	100.0	100.0	100.0
No. of Countries	67	84	84

Source: Eichengreen and Razo-Garcia (2006).

As further control variables, we use the real exchange rate vs. the US Dollar (*ExchangeRateReal*) and its standard deviation (*ExchangeRateVolatility*). Whereas higher values for *ExchangeRateVolatility* indicate an increase in the volatility of the (real) exchange rate, measured by the standard deviation, an increase in *ExchangeRateReal* refers to a depreciation of the host country currency. As the survey of previous empirical studies in Section 2 has shown, the signs for both *ExchangeRateVolatility* and *ExchangeRateReal* are unclear.

Our analysis covers the period 1980-2004. UNCTAD's Data Extract Service provides FDI data since 1970, but very few countries report FDI flows for the 1970s at a bilateral level. To avoid any biases arising from an extremely small sample of reporting countries, we start with 1980. We include the maximum number of source and host countries for which bilateral FDI flows are available, except financial offshore centres, such as Panama, The Bahamas, or the

Cayman Islands.[12] Extending the sample to include a large number of poor developing host countries is crucial to avoid a sample selection bias and to assess the chances of these countries becoming more attractive to FDI. Overall, our sample consists of 102 developed and developing host countries. By covering 31 source countries of FDI, including various non-OECD source countries, we at least partly capture the recent surge of FDI flows from developing countries to other developing countries.[13]

4. Empirical Results

Following the model specification and the introduction of the variables, we now turn to the empirical results. Columns (1) to (3) in Table 2 report the results for the full sample of host countries. The first estimation (Model I) includes all control variables introduced before, except for *RTA*, *BIT* and *PolCon* since provisions in regional/bilateral treaties or institutional quality might have a similar effect on FDI flows as the exchange rate regime. In Models II and III, we then add these further control variables.

Almost all control variables have the expected sign and are statistically significant at the 10 percent level or better. The strongly positive coefficient of the host countries' GDP (*GDP*) reveal that FDI flows to the sample countries are driven by market-seeking motives. Whereas the difference between the GDP per capita does not seem to matter for the full sample, *DiffGDPpc* has the expected positive coefficient and is highly significant as we focus on subsamples later on. The importance of vertical FDI is also stressed by the significantly positive coefficients of *Openness* and *RTA*; greater openness to trade reflected in these two variables improves the host countries' attractiveness to FDI involving the relocation of particular segments of the value chain and the offshoring of intermediate production.

Also in line with our expectations, macroeconomic distortions, proxied by the inflation rate, are associated with lower bilateral FDI flows. While the ratification of a bilateral investment treaty is associated with higher FDI flows, *PolCon* remains insignificant. As noted in Section 3, *PolCon* refers to political discretion of the executive branch, which might not

[12] The FDI data for financial offshore centers are highly likely to be biased. We exclude all countries that are on the list of offshore financial centers as reported by Eurostat (2005).
[13] See Appendix C and Appendix D for the source and host country sample.

involve strong risks for foreign investors. More precise measures for political risk are unfortunately not available for the extended period under consideration. The overall fit of the three models is reasonable, taking into account that we include some 45,500 observations and slightly more than 3,000 bilateral (sometimes quite heterogeneous) country pairs.

Turning to the exchange rate-related determinants of FDI for the full sample, our results show that the real exchange rate level is negatively associated with FDI, that is, an appreciation of the real exchange rate attracts more FDI. However, the estimated coefficients do not reach the conventional 10 percent threshold level. As we split the total sample into two subsamples, that is, into developing and developed host countries, reported in columns 4 to 9, we observe a negative impact for developing and a positive impact for developed countries. Still, for both subsamples *ExchangeRateReal* is not a significant determinant of bilateral foreign investment. Our results with respect to this variable are thus in line with the inconclusive evidence reported by previous studies (see Section 2). For the exchange rate volatility, we find a positive and weakly significant link with FDI flows for the total host country sample. Yet the coefficients for *ExchangeRateVolatility* are not significant in most model specifications for both subsamples.

Regarding the variable of principle interest, we find that a fixed exchange rate regime is strongly positively associated with FDI flows. The coefficients for *FixRegime* are highly significant at the 1 percent level in all three model specifications. The quantitative effect of having a fixed exchange rate on FDI inflows is considerable. Taking the estimated coefficient on *FixRegime* for the full sample of host countries and all control variables (0.585) at face value, the switch from a floating to a hard peg is associated with an increase in FDI inflows by some 76.6%.[14] Hence, the impact of a fixed exchange rate is not only quite sizeable, it is larger than the effects of both ratifying a regional trade agreement or a bilateral investment treaty.

Looking again at the disaggregated results for developing and developed host countries, the coefficients for *FixRegime* are always positive but only significant for developed countries,

[14] As pointed out by Kennedy (1981), the percentage change in the dependent variable due to the change in a dummy variable from zero to one in a semi-logarithmic specification amounts to 100x{exp[estimated coefficient of dummy variable – ½(estimated variance of coefficient)]-1}.

not for developing countries.[15] Obviously, the results for developed countries are influenced by the introduction of the euro in 1999 which seems to be associated with an increase in FDI flows. This outcome is in line with the results reported by Schiavo (2007) and Petroulas (2007) who both find a positive impact of the introduction of the euro on FDI inflows. Note, however, that *FixRegime* goes beyond EMU, as it measures various fixed exchange rate regimes for EMU countries before 1999 (and for non-EMU countries, such as the UK and Denmark) and for several countries with hard pegs vis-à-vis the US dollar for diverging years in the period under consideration (see Reinhart and Rogoff 2004).

[15] Since Canada, Ireland and Norway do not report FDI outflows for developing countries at a bilateral level, we had to exclude them from the set of reporter countries in those regressions that focus on developing host countries only.

Table 2: FDI and Fixed Exchange Rate Regimes, OLS Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Country Group	All Countries			Developing Countries			Developed Countries		
Model	I	II	III	I	II	III	I	II	III
ln GDP	0.274***	0.257***	0.251***	0.319***	0.301***	0.293***	0.434**	0.434**	0.429*
	(6.915)	(6.621)	(6.450)	(7.563)	(7.350)	(7.171)	(1.979)	(1.970)	(1.936)
DiffGDPpc	-0.00424	-0.00562	-0.00565	0.0414***	0.0406***	0.0394***	0.0484***	0.0484***	0.0471***
	(-0.644)	(-0.857)	(-0.863)	(4.389)	(4.371)	(4.217)	(2.846)	(2.837)	(2.759)
Openness	0.00239***	0.00224***	0.00223***	0.00248***	0.00228***	0.00228***	0.0173***	0.0172***	0.0172***
	(3.782)	(3.592)	(3.553)	(3.798)	(3.552)	(3.561)	(3.473)	(3.463)	(3.446)
ln Inflation	-0.0173***	-0.0148**	-0.0141**	-0.0211***	-0.0186***	-0.0167***	-0.0195	-0.0195	-0.0221
	(-2.988)	(-2.564)	(-2.399)	(-3.360)	(-2.963)	(-2.601)	(-0.841)	(-0.838)	(-0.981)
RTA		0.474***	0.446***		0.657***	0.600***		-0.0156	-0.00203
		(5.732)	(5.517)		(6.449)	(6.010)		(-0.118)	(-0.0154)
BIT			0.146***			0.237***			-0.114
			(2.872)			(3.968)			(-1.242)
PolCon			-0.0539			0.0921			-0.457
			(-0.816)			(1.398)			(-0.667)
FixRegime	0.577***	0.581***	0.585***	0.208	0.167	0.142	0.397**	0.396**	0.389**
	(4.088)	(4.108)	(4.122)	(1.054)	(0.850)	(0.715)	(2.244)	(2.237)	(2.191)
ExchangeRateReal	-0.000016	-0.000015	-0.000016	-0.000037	-0.000027	-0.000030	0.000131	0.000126	0.000086
	(-1.040)	(-1.005)	(-1.101)	(-0.219)	(-0.164)	(-0.185)	(0.183)	(0.177)	(0.120)
ExchangeRateVolatility	0.161*	0.152*	0.149*	0.159*	0.147	0.134	1.500	1.510	1.874
	(1.914)	(1.803)	(1.758)	(1.716)	(1.583)	(1.437)	(0.711)	(0.715)	(0.869)
Observations	45,529	45,529	45,454	31,324	31,324	31,273	11,178	11,178	11,160
Country pairs	3,030	3,030	3,029	2,096	2,096	2,096	701	701	700
R^2	0.21	0.24	0.24	0.16	0.18	0.19	0.13	0.13	0.13

Notes: t-values, reported in parentheses, are corrected for heteroskedasticity; due to space constraints, the coefficients for the year dummies are not shown; *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table 3: FDI and Fixed Exchange Rate Regimes, PPML Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Country Group	All Countries			Developing Countries			Developed Countries		
Model	I	II	III	I	II	III	I	II	III
ln GDP	0.321***	0.303***	0.284***	0.284***	0.272***	0.271***	0.231***	0.236***	0.212***
	(10.82)	(10.11)	(9.460)	(7.540)	(7.202)	(7.172)	(3.503)	(3.564)	(3.170)
DiffGDPpc	0.0139***	0.0130***	0.00899***	0.0147*	0.00906	0.00605	-0.00191	-0.00182	-0.00227
	(4.594)	(4.282)	(2.915)	(1.773)	(1.079)	(0.718)	(-0.432)	(-0.410)	(-0.511)
Openness	0.00198***	0.00180***	0.00175***	0.00009	0.000022	0.000168	0.00444***	0.00448***	0.00434***
	(3.770)	(3.397)	(3.297)	(0.148)	(0.0355)	(0.271)	(3.293)	(3.319)	(3.207)
ln Inflation	-0.0105*	-0.00978*	-0.00720	-0.0123*	-0.0136**	-0.0126*	-0.00939	-0.0105	-0.0116
	(-1.918)	(-1.792)	(-1.310)	(-1.801)	(-1.988)	(-1.840)	(-0.883)	(-0.983)	(-1.068)
RTA		0.131***	0.102***		0.150***	0.140***		-0.0676	-0.0749
		(4.248)	(3.274)		(4.124)	(3.848)		(-1.005)	(-1.113)
BIT			0.159***			0.102***			0.327***
			(5.942)			(3.360)			(4.545)
PolCon			0.190***			0.0400			-0.152
			(3.560)			(0.655)			(-1.023)
FixRegime	-0.00735	-0.00258	0.00756	-0.0180	-0.0132	-0.0250	0.0712**	0.0710**	0.0747**
	(-0.284)	(-0.0996)	(0.292)	(-0.280)	(-0.206)	(-0.387)	(2.422)	(2.416)	(2.544)
ExchangeRateReal	-0.000016	-0.000015	-0.000017	-0.000022**	-0.000021**	-0.000021**	0.00076***	0.00075***	0.00066***
	(-1.615)	(-1.585)	(-1.792)	(-2.287)	(-2.184)	(-2.201)	(3.131)	(3.099)	(2.714)
ExchangeRateVolatility	0.0671	0.0632	0.0490	0.0710	0.0686	0.0639	0.904	0.922	1.054*
	(1.344)	(1.267)	(0.981)	(1.398)	(1.351)	(1.259)	(1.509)	(1.538)	(1.707)
Observations	45,529	45,529	45,454	31,324	31,324	31,273	11,178	11,178	11,160
Country pairs	3,030	3,030	3,029	2,096	2,096	2,096	701	701	700

Notes: See Table 2 for notes; *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

5. Robustness Checks and Extensions

Subsequently, we run various further regressions to investigate whether these results hold up. To begin with, we use the Poisson Pseudo-Maximum Likelihood (PPML) estimator suggested by Silva and Tenreyo (2006). Since our dependent variable has a large portion of zeros, that is, in the full sample some 34,500 out of 45,500 are zeros, OLS results could be biased. Also, as shown by Silva and Tenreyo the PPML estimator can be used even in the presence of heteroskedasticity. Similar to the OLS approach, we use the PPML fixed-effects estimator and the same three model specifications.

Looking at the results for the full sample of host countries, reported in columns 1 to 3 in Table 3, all control variables have the expected sign and are significant at the 10 percent level or better (apart from the inflation rate in the third model specification). In comparison to the OLS results, now the difference between reporter and host country GDP per capita income has the expected positive sign and is highly significant at the 1 percent level. Also, the coefficient for constraints on the political executive is positive and highly significant.

For all three exchange rate variables, however, we do not obtain any significant results in the full sample. This outcome changes as we turn to the two subsamples. While a depreciation of the real exchange rate has a positive impact on FDI flows in developing countries (columns 4 to 6), we obtain the opposite results for developed countries (columns 7 to 9). In line with the OLS results, we obtain no significant (or no robust) results for the exchange rate variability in both sub-samples. Importantly, the positive and significant impact of having a fixed exchange rate on FDI holds up for the developed host country sample (though no longer for the full sample). For developing countries, again we do not obtain any significant results for *FixRegime*. Overall, the PPML regressions are roughly in line with the OLS estimates in respect of our exchange rate variables.

Next, we further investigate the impact of the fixed exchange rate in developing countries. We replicate our estimations for various sub-samples of host and source countries. In view of space constraints, we show only the results for the variable of principal interest in the present

context and the PPML estimator.[16] To alleviate comparison, the results for *FixRegime* for developing countries from Table 3 are listed again in the first row of Table 4.

As a start, we divide the group of developing host countries into middle- and low-income countries (according to the World Bank's classification). The argument is that the large group of developing countries is fairly heterogeneous and the disaggregation could offer additional insights. Yet the outcome of this further sample split does not matter much. While the impact of a fixed-exchange rate regime on FDI is still negative (and not significant) when considering only middle-income countries, the estimated coefficients are somewhat smaller in comparison to low-income countries.[17] Next, we check whether the impact of a fixed exchange rate regime changes if we exclude developing source countries. It could be argued that South-South FDI might differ from North-South FDI, due to difference in motives and the sort of foreign investment undertaken. Yet the outcome does not change much.

Finally, we replicate the estimations and exclude certain developing host countries from the analysis: First, we exclude resource-intensive host countries, as the motives for investing in these countries are likely to differ from the other developing countries. Then, we leave out transition countries as a number of these countries received considerable FDI inflows since the early 1990s which might not be related to exchange rates policies. Third, we include transition countries only. While the coefficients for *FixRegime* turn positive in the first and third set of regressions, we still could not establish a statistically significant link between a hard peg and FDI flows in developing countries.

[16] For OLS estimations, the outcome is very similar.
[17] For low-income countries, the coefficients for Models I and II are identical as there are no RTAs between these countries and the FDI source countries included in our analysis.

Table 4: Robustness Checks and Extensions, Developing Countries, PPML Fixed Effects

Model:	I	II	III
Full Developing Host Country Sample (as reported in Table 3)	-0.0180 (-0.280)	-0.0132 (-0.206)	-0.0250 (-0.387)
Middle-income Countries	-0.00840 (-0.124)	-0.00202 (-0.0298)	-0.0142 (-0.208)
Low-income Host Countries	-0.113 (-0.529)	-0.113 (-0.529)	-0.108 (-0.506)
Developed Source Countries	-0.00294 (-0.0457)	0.000989 (0.0154)	-0.0110 (-0.170)
Excl. Resource-intensive Host Countries[1]	0.0353 (0.516)	0.0382 (0.558)	0.0291 (0.422)
Excl. Transition Host Countries	-0.0678 (-0.909)	-0.0646 (-0.865)	-0.0688 (-0.918)
Transition Host Countries only	0.136 (1.064)	0.130 (1.012)	0.120 (0.920)

Notes: Due to space constraints, we only report the results for the fixed exchange rate regime variable; see Table 2 for further notes. [1]Algeria, Bolivia, China, Republic of Congo, Ecuador, Egypt, Guyana, Indonesia, Nigeria, Oman, Papua New Guinea, Syrian Arab Republic, Trinidad and Tobago, Venezuela, Zambia.

6. Interpretation of the Results and Policy Implications

The present paper has reviewed the influence of the exchange rate regime on bilateral FDI flows between countries, with mixed results: while we find a positive and significant influence of a fixed exchange rate regime for FDI in developed countries, developing countries do not receive higher FDI inflows if they employ a hard peg of their currency as a policy option.

There are several possible reasons for this. One reason might be that exchange rates are highly correlated with other variables, such as macroeconomic stability, trade, growth or institutional quality, which all influence FDI. In developing countries, these factors may outweigh the influence of fixed exchange rates per se and thus explain our inconsistent findings for different county groups. Moreover, it might be that regime changes are faster and more frequent in this group of countries. Our main argument for the regime to matter was that fixed rates have to do with credibility. If fixed rates in developing countries are less credible than in developed countries this could explain that their effect is rather weak in these countries.

Another reason could be that real exchange rate stability is not as strongly correlated with nominal exchange rate stability in different countries. Since the value of FDI is affected by real exchange rates, their changes and variability, nominal regimes are only important in as much as they allow making predictions about real exchange rates. If despite a fixed exchange rate real rates are more variable in developing countries, the regime loses its predictive power for rates.

Finally, it might be that the type of investment in developing countries is of a different nature than in developed countries. Earlier literature has already established that for several reasons, it might make a difference whether FDI is horizontal or vertical, or in which industry it is taking place. If the exchange rate regime has a different effect on different types of FDI, they could also have a different influence in different countries if one particular type of investment dominates there.

These questions are so far not explored and should be the subject of further work. At least, we hope to have demonstrated that the influence of the exchange rate regime is potentially important and goes beyond the influence of exchange rate level and variability, which have so far been the focus of empirical work.

At the same time, it is reassuring that other researchers have found in other contexts that the effect of exchange rate regimes is not the same across all countries. Looking at the effect of the exchange rate regime on growth, Harms and Kretschmann (2009) find in their survey paper that no effect can be established for developing countries, whereas they find a significant effect for developed countries. This seems to indicate that indeed exchange rate regimes play different roles in these countries or that, as we suggested above, other factors matter more than this particular variable. They also find, however, that flexible exchange rates seem to be better for growth in developed countries, which is surprising if one would expect a positive relation between growth and FDI. It would be worthwhile to explore this link further.

Moreover, our results offer interesting policy conclusions. Developing countries trying to raise their attractiveness for FDI should focus their efforts, for example, on concluding bilateral investment treaties or joining regional trade agreements rather than focusing on the exchange rate regime. This is different for developed countries. Here, there seems to be an additional and quite significant gain from having a fixed exchange rate. Obviously, the results

for developed countries are partly driven by the special case of the European Monetary Union. Yet it should be kept in mind that our sample is much broader, in that it goes back to the 1980s, a period where monetary union was not yet established, and that it includes several hard pegs for non-EMU countries. Importantly from a policy perspective, our results indicate that the impact of a fixed exchange rate regime is quite large, making it a potentially effective policy device for developed countries to increase FDI inflows.

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Appendix A: Definition of Variables and Data Sources

Variable	Definition	Source
FDI	Bilateral FDI flows from source to host country, current US$ million	UNCTAD (2009a)
GDP	Total Gross Domestic Product (GDP), current US$	World Bank (2009)
DiffGDPpc	Difference between source and host GDP per capita, current US$ divided by 1,000	World Bank (2009)
Openness	Sum of imports and exports in % of GDP (host country)	World Bank (2009)
Inflation	Inflation rate of host country in % (GDP deflator)	World Bank (2009)
RTA	Dummy bilateral or regional trade agreement (free trade agreement or customs union), 0/1	WTO (2009)
BIT	Dummy bilateral investment treaty, 0/1	UNCTAD (2009b)
PolCon	Political constraints III, Henisz database, ranging from 0 (no constraints) to 1 (full set of constraints)	Downloaded from Henisz's homepage
FixRegime	Classification of fixed exchange rate regime by Reinhart and Rogoff, see text for more details	Reinhart and Rogoff (2004), updated by Eichengreen and Razo-Garcia (2006)
ExchangeRateReal	Real exchange rate vs. the US dollar, computed by the average of the local currency value against the US dollar multiplied with the ratio of the US Consumer Price Index (CPI) and the local CPI, Index 2000 equal to 100	IMF (2009) and World Bank (2009)
ExchangeRateVolatility	Standard deviation of the real exchange rate using monthly data	IMF (2009)

Appendix B: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
ln FDI	45,529	1.03	2.21	0.0	12.7
ln GDP	45,529	24.01	2.12	18.2	30.1
DiffGDPpc	45,529	11.09	13.64	-36.6	38.5
Openness	45,529	72.38	38.85	6.3	275.2
ln Inflation	45,529	2.53	1.71	-4.2	10.2
RTA	45,529	0.14	0.35	0.0	1.0
BIT	45,529	0.17	0.38	0.0	1.0
PolCon	45,454	0.32	0.21	0.0	0.7
FixRegime	45,529	0.03	0.18	0.0	1.0
ExchangeRateReal	45,529	0.61	2.22	0.01	25,565.3
ExchangeRateVolatility	45,529	0.03	0.20	0.0	4.2

Appendix C: Source Country Sample

Argentina, Australia, Austria, Belgium-Luxembourg, Brazil, Canada, Chile, Colombia, Denmark, Finland, France, Germany, Iceland, Ireland, Japan, Republic of Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, United States, Venezuela

Appendix D: Host Country Sample

Albania, Algeria, Angola, Argentina, Australia, Austria, Bangladesh, Belgium-Luxembourg, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Cameroon, Canada, Chile, China, Colombia, Republic of Congo, Costa Rica, Côte d'Ivoire, Croatia, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Gambia, Germany, Ghana, Greece, Guatemala, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Republic of Korea, Latvia, Lithuania, Malaysia, Mali, Mauritius, Mexico, Mongolia, Mozambique, Namibia, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Senegal, Slovenia, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Taiwan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Zambia, Zimbabwe