ABSTRACT

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Access to private capital markets is the most salient difference between emerging market economies and other developing countries. However, in contrast to developed economies, emerging markets have had a troubled relationship with capital flows. In particular, balance of payments and debt crises have been a recurrent problem. The three chapters of this dissertation contribute to the literature on emerging markets and their relationship with capital markets.

Chapter 1 analyzes the effects of volatility on sovereign default risk. Empirically, the paper establishes a concave relationship between spreads and volatility. While for low levels of volatility an increase in volatility is associated with an increase in the sovereign risk premium, the risk premium increases at a decreasing rate. This empirical relationship is robust to different estimation methods, samples and control variables. Furthermore, the relationship between volatility and risk premia is non-monotonic: while at low levels of volatility an increase in volatility implies an increase also in spreads, for sufficiently high levels of volatility this rela-

tionship turns negative. The chapter also presents a quantitative model of sovereign debt with default risk consistent with this feature and other characteristics of EME debt. The intuition for this result is the existence of a trade-off between prudential behavior in order to avoid large consumption fluctuations under autarky and the increased likelihood of a default, given default provides some short-run relief under a very bad realization of shocks.

Chapter 2 addresses the determinants of the composition of cross-border investment positions. Using a novel database of bilateral capital stocks for all types of investment - FDI, portfolio equity securities, debt securities as well as loans - for a broad set of 77 countries, we show the importance of two key determinants of the composition of cross-border asset positions: information frictions and the quality of host country institutions. Overall, we find that in particular FDI, and to some extent also loans, are substantially more sensitive to information frictions than investment in portfolio equity and debt securities. We also show that the share as well as the size of FDI that a country receives are largely insensitive to corruption in host countries, while portfolio investment is by far the most sensitive to the quality of institutions.

Chapter 3 focuses on a related topic to chapter 2. Using bilateral FDI stocks around the world, we explore the importance of a wide range of institutional variables as determinants of the location of FDI. While we find that better institutions have overall a positive and economically significant effect on FDI, some institutional aspects matter more than others do. Especially, the unpredictability of laws, regulations and policies, excessive regulatory burden, government instability and lack

of commitment play a major role in deterring FDI. For example, the effect of a one standard deviation improvement in the regulatory quality of the host country increases FDI by a factor of around 2. These results are robust to different specifications, estimation methods and institutional variables. We also present evidence on the significance of institutions as a determinant of FDI over time.

ESSAYS IN INTERNATIONAL FINANCE

by

Christian Daude

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Dedication

To Catalina and Virginia.

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Table of Contents

List of Tables

List of Figures

Chapter 1

Sovereign Default Risk and Volatility

1.1 Introduction

Two distinct features of emerging market economies (EME) are that they are subject to large fluctuations compared to developed economies and also more prone to suffer balance of payments crises as well as default on their debt. Mendoza (1995), for example, provides compelling evidence that fluctuations in output as well as the terms of trade are on average more than twice as large for EME compared to developed economies. Therefore, not only endogenous business cycle fluctuations but also relatively exogenous shocks are larger in EME.[1] In line with this evidence, as Mendoza and Oviedo (2006) show, government revenues are also much more volatile in EME than in developed countries.

Since Ramey and Ramey's (1995) empirical finding of a negative impact of volatility on economic growth, the literature on the interrelation between volatility and economic growth has been growing rapidly.[2] However, the link between volatility and sovereign debt issues - especially risk premia and default risk - has received relatively little attention. Since the seminal paper on defaultable sovereign debt by

[1]For papers that quantify the importance of terms-of-trade shocks for developing countries see Broda (2004), Kose (2002), and Mendoza (1995). The latter shows that terms-of-trade shocks account for up to 50 percent of business cycle fluctuations in developing countries.

[2]See e.g. Mendoza (1997) for an early analytical contribution, as well as Calvo (2005) and Aghion et al (2005) and references in these papers.

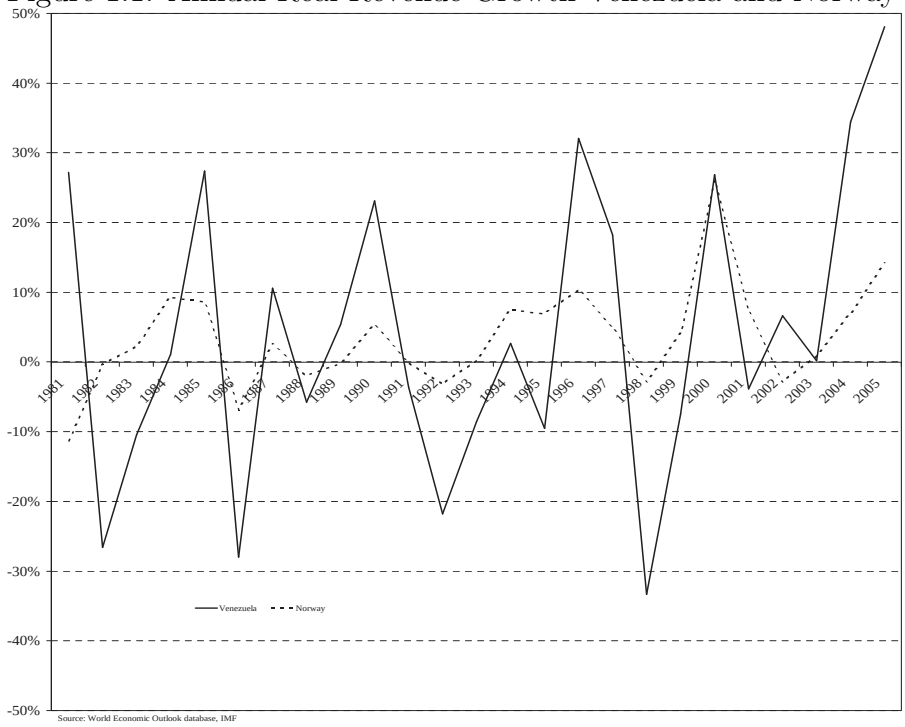
Eaton and Gersovitz (1981), the question of how volatility affects spreads and debt holdings has not been systematically addressed in the literature using a dynamic stochastic general equilibrium model.

The contribution of this chapter to the existing literature is twofold. First, it analyzes empirically the relationship between government revenue volatility and default risk (as well as risk premia). We find a concave relationship between sovereign default risk and volatility; risk is increasing in the level of volatility, but at a decreasing rate. In addition, evidence indicates a non-monotonic relationship; for low levels of revenue volatility, a change in volatility increases the risk of default; however, for sufficiently high levels of revenue volatility, default risk is actually decreasing in volatility. We show that this relationship is robust to alternative measures of default risk and premia as well as econometric methods and specifications. Second, we present a model of sovereign debt with potential repudiation that is consistent with this previous finding and other issues related to sovereign debt in EME.

The stylized facts that guide the empirical and quantitative analysis are the following:

1. Revenues are much more volatile in emerging economies than in developed economies, as shown in Figure 1.1 and Figure 1.2. This stylized fact has also been addressed earlier by Gavin, Hausmann and Perotti (1996) for the case of Latin America, as well as Mendoza and Oviedo (2006) for EME in gen-

Figure 1.1: Annual Real Revenue Growth Venezuela and Norway

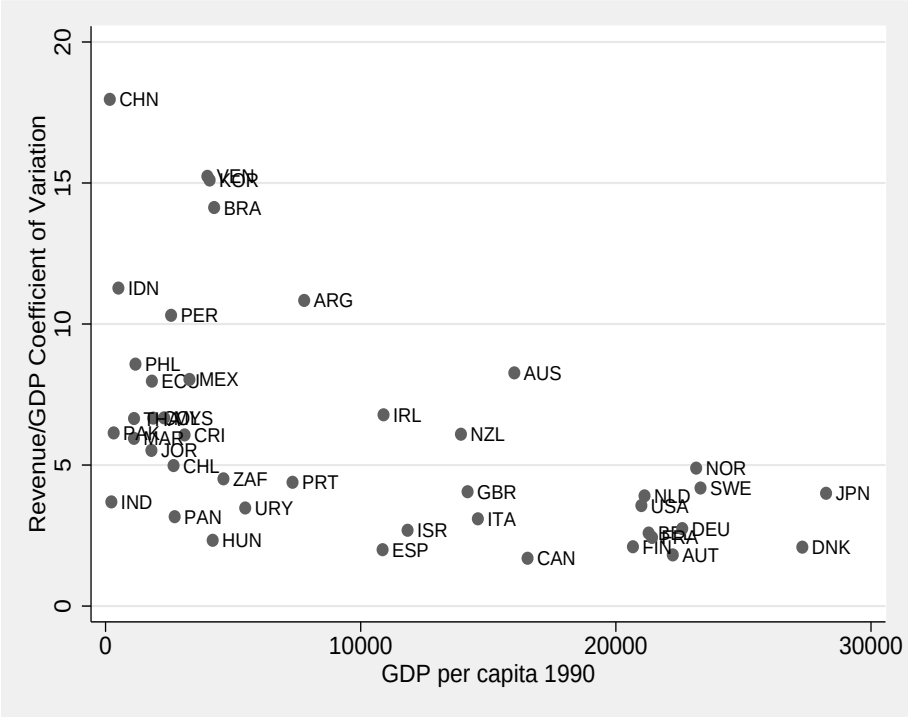


eral. Figure 1.1 shows the annual growth rate of real government revenues for Venezuela and Norway from 1981 to 2005. Both countries are large oil exporters, with oil related revenues being a significant share of the public sector's income. In particular, oil exports represented on average about 24 percent of GDP in both countries during 1995 - 2005. In addition, the importance of oil prices is reflected by the high co-movement between both series - with a correlation coefficient of 0.53. Also, on average real revenues have grown at a similar pace (4 percent annually) in both countries from 1981 to 2005. However, the differences in the volatility of both series is striking. While the standard deviation of revenue growth is 7 percent in Norway, for the case of Venezuela it is around 21 percent, three times larger.[3] The fact that revenue volatility

[3]A similar difference in magnitudes of volatility also holds for real GDP growth, with standard deviations of 2 and 6 percent, respectively.

differs significantly according to the level of development is also confirmed for a larger sample of countries in Figure 1.2, which shows the correlation between initial GDP per capita and the coefficient of variation of the revenue to GDP ratio from 1990 - 2004. The correlation between both variables is negative, around -0.53, and significant at conventional levels of confidence.

Figure 1.2: Revenue Volatility and Level of Development

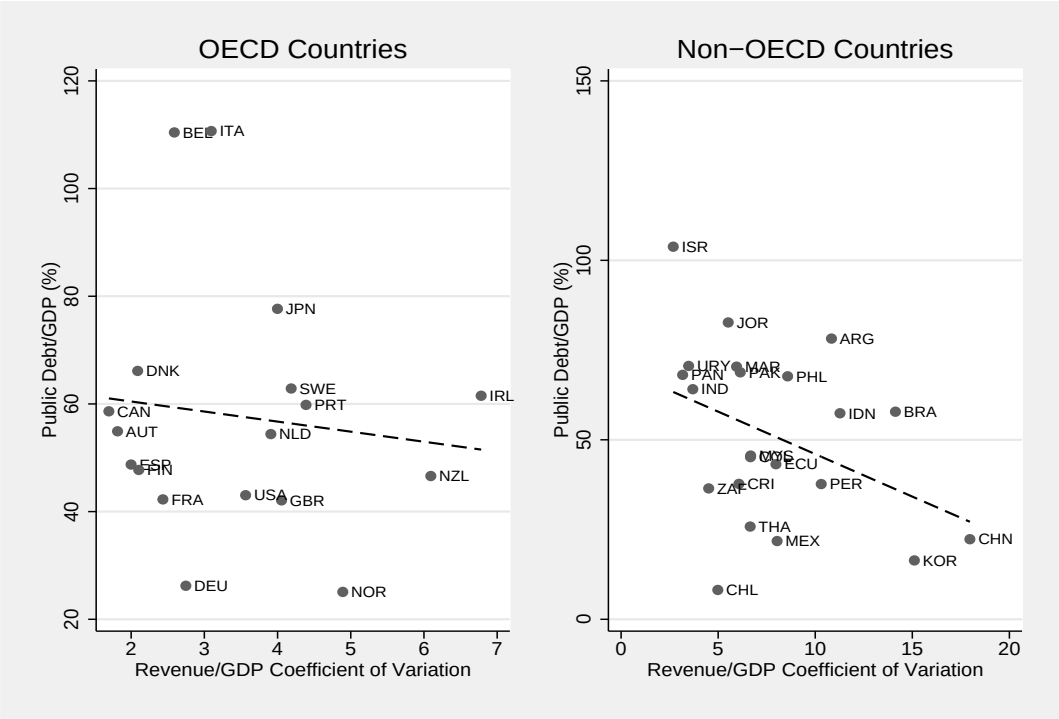


2. For the case of emerging markets, as also shown by Mendoza and Oviedo (2006), debt holdings decrease with the level of revenue volatility. However, there is no significant relationship between volatility and debt holdings among rich OECD countries, as can be seen in Figure Figure 1.3.

3. There is a non-monotonic relationship between risk premia, measured as the spread of sovereign bond secondary-market yields over US treasuries, as well as

default risk, measured by the Institutional Investors Rating (IIR) (see Figures 1.4 and 1.5).[4] As we document in section 1.2, this result is statistically significant and continues to hold when controlling for other potential determinants of risk, estimation methods and excluding potential outliers.

Figure 1.3: Revenue Volatility and Average Debt Holdings

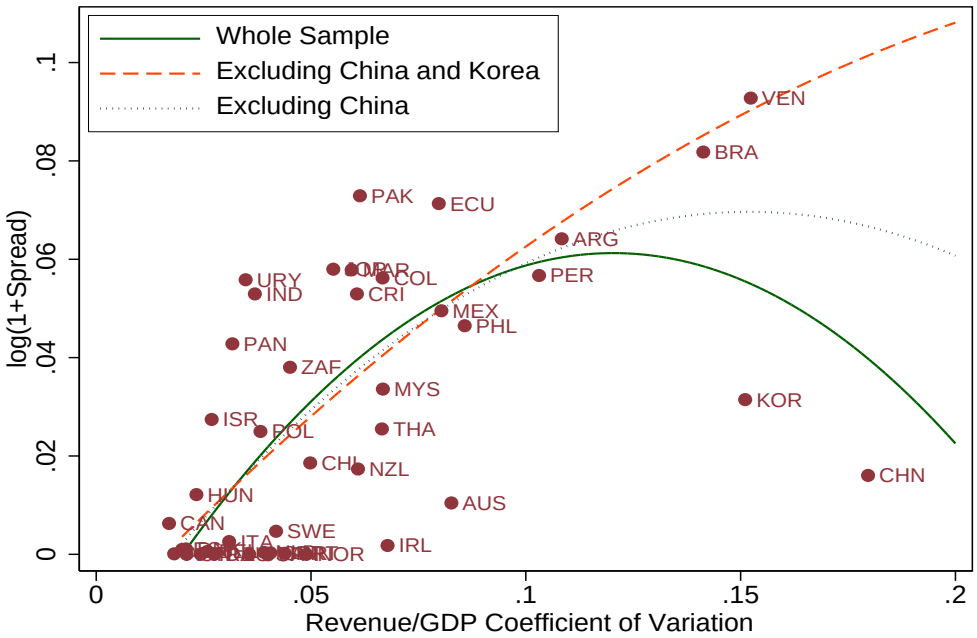


This last stylized fact is "new" in the sense that the empirical literature has not documented it so far, while theoretical and quantitative models of sovereign debt have not addressed this issue neither. To my knowledge, the only paper that explores the empirical relationship between volatility and sovereign default is Catao and Kapur (2006). According to their estimates, while demand for debt is increasing in volatility, debt ceilings - the level of debt beyond which a rational risk neutral lender is not willing to extend further credit - decrease with macroeconomic volatility,

[4]For the case of the IIR, higher values represent less risk.

measured by the volatility of the output gap or the terms of trade. In addition, they also estimate a logit model explaining sovereign default episodes and find that the probability of default increases with macroeconomic volatility.[5]

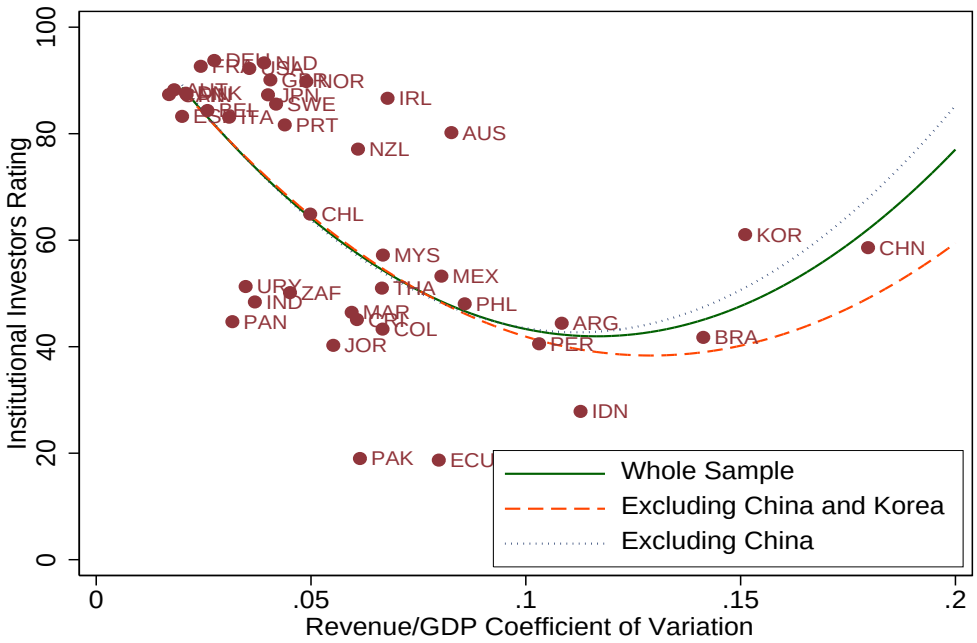
Figure 1.4: Revenue Volatility and Sovereign Bond Spreads



As seen in Figure 1.4, considering sovereign bond spreads, Korea and China are influential observations and when both are excluded, the relationship between spreads and revenue volatility is concave, but not non-monotonic in the sample. However, if we consider alternative risk measures - like the IIR in Figure 1.5 - the non-monotonic relationship is still present in the data when these two observations are excluded. Much of the effort in the empirical part of this chapter is devoted

[5]Catao and Kapur provide also a simple two-period model in the spirit of Sachs and Cohen (1982) that shows a positive relationship between volatility and risk premia under a uniform distribution. The present paper analyzes the relationship between volatility and sovereign debt issues in a more standard infinite-horizon small open economy model with a less restrictive assumption on the distribution and persistence of shocks.

Figure 1.5: Revenue Volatility and Institutional Investors Rating



to show the robustness of the non-monotonic relationship between risk premia and volatility in the data. Also, the model presented afterwards focuses especially on the relationship between revenue volatility and default risk.

While there are several papers on sovereign debt that generate a negative correlation between equilibrium debt holdings and volatility (stylized fact 2) based on precautionary savings motives in incomplete asset market economies (see Mendoza and Oviedo, 2006; Durdu et al, 2007), these papers assume that the government repays its debt under all states of nature. Therefore, they do not generate an endogenous risk premium and consequently do not analyze how changes in the volatility of shocks affect the incentive to default. In addition, default introduces the possibility of making non-contingent debt an ex-post contingent instrument. Thus, it is also

interesting to analyze the relationship of debt holdings and volatility in a model that allows for default to occur. There is a recent and growing literature of quantitative models of sovereign debt with default risk inspired by Eaton and Gersovitz (1981) (for two influential contributions in this literature see Aguiar and Gopinath, 2006; and Arellano, forthcoming). However, the quantitative implications for risk premia of changes in volatility have not been explored systematically in this literature. Thus, a contribution of the present chapter is to analyze this issue in a similar set-up.

In their seminal paper on sovereign debt, Eaton and Gersovitz (1981) address the effects of volatility on debt in a non-stochastic model where the endowment income of the economy fluctuates period-by-period between a high and a low level of output. In this set-up, they show that a greater gap between both output realizations increases the desired level of debt by the borrower and the credit ceiling, allowing the borrower to hold higher levels of debt in equilibrium. The intuition for this result is the following. Given that in the event of default borrowers are punished by being excluded from the international credit market forever, a higher volatility implies a larger welfare cost from losing the possibility to smooth income fluctuations using debt. Thus, the argument goes, countries with higher volatility would be able to commit to higher debt levels.

The non-stochastic nature of the model puts severe limitations on the results, given that default never occurs in equilibrium. Therefore, the model is not able to create an endogenous risk premium although it generates a credit ceiling - defined as a level of debt beyond which creditor would not be willing to extend more

credit at any price, given that default would occur under all states of nature. In a stochastic environment, more output variability implies also more uncertainty which could lead to an increase in the probability of default and therefore push up risk premia. This potentially important mechanism is not active in Eaton and Gersovitz's non-stochastic set-up. However, while Eaton and Gersovitz (1981) mention this possibility, they suggest that their results would hold in a more general set-up.[6] Although Eaton and Gersovitz (1981) also present econometric evidence that the volatility of exports had a positive and significant effect on credit ceilings and debt levels in the 1970's, for a more recent time period, empirical evidence by Catao and Kapur (2006) contradicts these results.

In general, the effects of volatility on debt levels, default risk and risk premia depend on the costs of default and sanctions that are imposed in the event of default. If the punishment in case of default is exclusion from the credit market, then it might be that countries that face more volatility could commit to higher debt levels, given that the cost of reverting to autarky would be more severe, whenever the sovereign borrower is risk averse. This is the main argument made by Eaton and Gersovitz (1981). However, a mean-preserving spread would also increase the likelihood of having a very bad draw. If the borrower defaults under bad states of nature, then higher volatility would increase the probability of default and creditors would tend to charge a higher risk premium. This latter effect is operating in

[6]Although they discuss briefly the potential negative effect of volatility on debt ceilings in a stochastic environment, they argue that only very high discount rates could cause this result in their model. In addition, to address this item they must make very strong and limiting assumptions on the model (e.g. that the current debt levels have to be zero in order to create lending).

Catao and Kapur's (2006) set-up, while the two-period nature of their model makes it impossible to analyze the effects of exclusion from credit markets in the future. Thus, potentially there are two effects that go in opposite directions. This chapter contributes to the literature by studying this issue quantitatively in a model where both of these channels coexist. The model shows that at low levels of volatility the increase in default risk dominates over the prudential reduction in borrowing, while for sufficiently high levels of volatility this latter effect tends to be relatively more important. This implies a non-monotonic relationship between revenue volatility and default risk, as observed in the data.

The remainder of the chapter is structured as follows. Section 1.2 analyzes the empirical relationship between volatility and default risk as well as risk premia. In section 1.3 I develop the model economy and discuss briefly the solution algorithm. Section 1.4 presents the main quantitative results related to the impact of volatility on risk premia and average debt holdings. I also present several robustness checks. Section 1.5 concludes.

1.2 Empirical Evidence

This section presents empirical evidence of a non-monotonic relationship between revenue volatility and sovereign risk premia, as well as measures of default risk. As discussed in the previous section, Figures 1.4 presents a non-monotonic relationship between sovereign risk premia - measured by the average JPMorgan EMBIG

spreads over US treasury bills between 1998 and 2000 - and the volatility of government revenues. Figure 1.5 shows a similar relationship for default risk measured by the Institutional Investors Rating (IIR).[7] This indicator has been used recently by Reinhart, Rogoff and Savastano (2003) and Reinhart and Rogoff (2004) as a measure of default risk. It is a rating on a scale from 0 to 100, where higher values represent less risk. In order to reduce the influence of potential outliers in the regressions when using spreads, I transform the risk premium to $\log(1 + s_i/10000)$, where s_i is the spread reported in basis points, so that the dependent variable is measured approximately in percentage points. The econometric estimation corresponding to the quadratic fit represented in the Figure 1.4 is shown in the first column of Table 1.1. The estimated coefficients on revenue volatility and its quadratic term are positive and negative, respectively, and statistically significant at conventional levels of confidence. In particular, the estimates imply that for a coefficient of variation of government revenues greater than 0.121 the effect of an increase in revenue volatility turns negative. A similar result using the IIR as dependent variable is shown in column 2. In addition, revenue volatility and the squared term alone explain more than 40 percent of the total cross-section variation in spreads in the sample. One immediate concern from a visual inspection of Figure 1.4 is that the results might be driven by Korea and China. Both countries present very high levels of

[7]The information of government revenues refers to annual series for the central government - thus it excludes all subnational and government-enterprize revenues. The primary source for these series are the IMF's WEO and GFS databases. In some case of missing information the national source, e.g. ministries of finance and central banks, is used. The period used to compute the coefficient of variation is 1990 to 2004, expressed in percentage points. These data were kindly provided by Marcelo Oviedo. They are also used by Mendoza and Oviedo (2006). For developed countries I use EURO-GBI spreads vis-a-vis Germany for the years 1999 - 2000.

revenue volatility and very low levels of spreads. While these low spreads might be explained by the very low levels of debt, possibly due to precautionary savings - as e.g. Durdu, Mendoza and Terrones (2007) argue - it is important to check the robustness of the correlation presented in columns 1 and 2. In order to do so, I re-estimate the quadratic regression dropping both observations. As it can be seen in column 3 and 4, the results remain significant for the case of the IIR measure, but the quadratic term is only marginally significant considering the spreads. Alternatively, in columns 5 and 6, I estimate the following regression by non-linear least squares (NLS): $Risk = \alpha + rev^{\beta} + \varepsilon$. A coefficient significantly less that 1 (greater than -1) implies a concave relationship between spreads (IIR) and volatility. As the estimates show, for both dependent variables the coefficient is significant. In addition, the linearity hypothesis is rejected in both cases, such that the NLS regressions indicate a significant concave relationship.

The next four columns of Table 1.1 present estimations based on the inclusion of additional control variables that have been found to be significant in the literature on the determinants of sovereign spreads and credit ratings.[8] This relatively parsimonious model is able to explain a large fraction of the total cross-country variation in spreads, with an R-squared of around 0.76, and an even better fit for the IIR (R-squared of 0.84). I include the average inflation rate - defined as the average of log(1+inflation) from 1990 to 1999 - given that macroeconomic instability usually tends to increase risk. This intuition is confirmed by the estimates in column 7

[8]See Cantor and Paker (1996), as well as Reinhart (2002) on these issues. All explanatory variables - except for debt levels - are taken from the World Bank's WDI database.

and 8. Inflation is highly significant and positively (negatively) correlated with the sovereign risk premium (IIR). The estimate implies that an increase in the annual inflation rate from 2 percent to 12 percent would raise the real cost of borrowing by around 1 percentage point. In addition, I include the average ratio of central government expenditures to GDP for the period 1990 - 1999. The estimated coefficient is not significant.[9] Another significant variable is the initial GDP per capita in PPP terms (in logs). This variable is in general included in the literature to proxy a series of factors, e.g. the quality of institutions, that might be relevant to the likelihood of default. The estimates show that GDP per capita has a significant and negative (positive) impact on sovereign risk premia (IIR). Next, given the relevance that the theoretical and empirical literature on sovereign debt has assigned to direct sanctions, I include trade openness - measured by the ratio of exports plus imports to GDP - as a control.[10] However, the coefficient shows is not significant. Regarding the revenue volatility coefficients, the estimates remain similar to the previous ones, with tipping points, where the effect of increases in volatility on spreads become negative, are slightly below those estimated in columns 1 and 2. Overall, these estimations show that the non-monotonic relationship between spreads and revenue volatility remain significant when other determinants of risk are included in the regressions.

In column 9, I include the central government's gross debt to GDP ratio (ex-

[9]I also estimated alternative specifications with other macroeconomic variables such as the central government budget deficit or the current account deficit, but they were also not significant.

[10]See Bulow and Rogoff (1989) and Rose (2005) on this particular issue.

pressed in percentages) as an explanatory variable. In order to reduce endogeneity problems I use the average debt ratios for the first five years of the 1990's. The estimates show that countries with higher levels of debt pay a significantly higher interest rate. The estimates imply that a one-percentage point increase in the Debt/GDP ratio increases the spread by 0.9 percentage points. The result regarding revenue volatility remains robust. As can be seen in column 10 of Table 1.1, debt levels have a very significant impact on spreads if we restrict our sample to EME countries, with the coefficient almost doubling in size. While the other controls turn out to be not significant in this subsample, the non-monotonic relationship between revenue volatility and spreads continues to be significant. Again, tipping points are well within the range of revenue volatility observed in the data. Thus, the result is not driven by a systematic difference between these two groups of countries.

So far, the evidence indicates a significantly concave relationship between sovereign risk and volatility in the sample. While in most specifications this relationship is actually non-monotonic, the presence of two influential observations seems to be partially driving these results. In what follows, we use alternative measures of volatility and default risk to further analyze the robustness of these results.

Table 1.2 shows a series of robustness tests concerning the non-monotonic relationship between revenue volatility and default risk. First, I used the volatility of the business cycle - computed as the standard deviation of the Hodrick-Prescott filtered series of annual real GDP - as an alternative measure of volatility. As the first column shows, the non-monotonic correlation between volatility and spreads continues

Table 1.1: Spreads and Revenue Volatility - Cross-section Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Estimation Method	OLS	OLS	OLS	OLS	NLS	NLS	OLS	OLS	OLS	OLS
Dep. Variable	Spreads (log)	IIR	Spreads (log)	IIR	Spreads (log)	IIR	Spreads (log)	IIR	Spreads (log)	Spreads (log)
Sample			Excluding China and Korea	Excluding China and Korea	Excluding China and Korea	Excluding China and Korea				EME only
Revenue Volatility	1.468***	-11.698***	0.926***	-10.827***	0.044***	-0.167***	0.625**	-3.983**	0.817***	0.628*
	(0.315)	(2.115)	(0.319)	(2.932)	(0.007)	(0.021)	(0.301)	(1.569)	(0.265)	(0.312)
Revenue Volatility sq.	-6.101***	50.234***	-1.568	41.946**			-3.036*	25.847***	-3.727**	-3.320**
	(1.907)	(11.202)	(1.797)	(18.732)			(1.550)	(8.094)	(1.643)	(1.540)
Inflation							0.011***	-0.059***	0.010***	0.004
							(0.002)	(0.012)	(0.002)	(0.003)
Gov. Expenditure/GDP							0.000	0.002	0.000	0.000
							(0.001)	(0.004)	(0.001)	(0.001)
GDP per capita							-0.007**	0.105***	-0.006*	-0.003
							(0.003)	(0.017)	(0.003)	(0.003)
Openness							0.000	-0.001	0.000	0.000
							(0.000)	(0.001)	(0.000)	(0.000)
Debt/GDP									0.009**	0.016***
									(0.004)	(0.004)
Constant	-0.027***	1.101***	-0.014	1.082***	-0.844***	-1.018***	0.032	0.032	-0.011	-0.025
	(0.009)	(0.067)	(0.009)	(0.079)	(0.021)	(0.114)	(0.025)	(0.175)	(0.033)	(0.026)
Observations	44	40	42	38	42	38	44	40	44	21
R-squared	0.44	0.43	0.53	0.44	0.51	0.43	0.72	0.84	0.75	0.71
Tipping point	0.121	0.116	0.295	0.129			0.102	0.077	0.109	0.094
Max. in sample	0.180	0.180	0.152	0.141			0.180	0.180	0.180	0.180

Robust standard errors in parentheses, *, **,*** significant at 10, 5 and 1 percent, respectively. Dependent variable is log(1+spread/10000). GDP per capita and inflation are in logs. Columns (5) and (6) show the estimate of β based on a non-linear least squares estimation of $y = \alpha + rev^{\beta} + \varepsilon$, with y either $log(1 + spread/10000)$ or IIR and rev is revenue volatility.

to hold using this alternative indicator of volatility. It is important to point out that for this indicator there are no clear outliers. One indication of this is the fact that the median business cycle standard deviation in the sample is 0.047, very close to the mean of 0.045. In addition, all countries lie within a two-standard deviation interval from the mean. Column 2 explores an instrumental variable estimation using the standard deviation of terms-of-trade growth as an instrument for the standard deviation of the GDP business cycle. Correcting for potential endogeneity yields similar results. Again, the quadratic term is negative and significant. The tipping point where the effects of volatility turn negative is also considerably below the sample maximum, so that it provides further evidences of the non-monotonic relationship between default risk and volatility.

Next, as an additional robustness check, I consider a series of sovereign debt ratings commonly used in the literature as proxies of default risk. Reinhart (2002) shows that downgrades in sovereign credit ratings predict future defaults, in contrast to currency crises, which tend to take place before downgrades occur. Also, Reinhart, Rogoff and Savastano (2003) show that sovereign credit ratings help statistically to separate defaulting from non-defaulting countries ex-ante. In particular, I use ratings from Moody's, Standard&Poors, and Fitch, for a similar period as the spreads used above (1997 - 2000). The three rating agencies use a letter rating which I recoded into 17 categories from 0 to 16. This procedure is the standard practice in the literature (see e.g. Cantor and Packer, 1996; as well as Reinhart, 2002). Given that the coding for all ratings is such that higher values represent a higher degree of

creditworthiness, the coefficients of revenue volatility and its quadratic term should now respectively be negative and positive if the relationship between default risk and volatility established for spreads continues to hold, as for the case of the IIR used in Table 1.1.

In columns 3 to 5, I present the estimations for these three ratings. Given that OLS estimates do not exploit the fact ratings are actually ordinal variables that take only 17 different ordered values instead of a continuous outcome, I estimate an ordered probit model which accounts for this fact correctly. As can be seen in Table 1.2, there is a significant U-shape relationship between ratings and revenue volatility for all three ratings. Furthermore, as column 6 shows, the same is true if the sample includes only EME. In addition, columns 7 and 8 show that if the ordered probit model is estimated considering the standard deviation of the business cycle or the standard deviation of terms-of-trade growth, the non-monotonic relationship between volatility and default risk remains significant. Finally, the last column shows that the logarithmic transformation for spreads does not have an impact on the significance of the non-monotonicity in the correlation between spreads and revenue volatility. When estimated in levels, the non-monotonic relationship continues to hold.

While the previous evidence is quite compelling, it considers only the cross-section dimension and does not exploit any variation across time, basically due to the fact that there are no sufficiently long time series of bond yields and consistent revenue series for emerging markets. However, in order to analyze the robustness

Table 1.2: Spreads and Revenue Volatility - Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimation Method	OLS	IV	Ordered probit	Ordered probit	Ordered probit	Ordered probit	Ordered probit	Ordered probit	OLS
Dep. Variable	Spread (log)	Spread (log)	Moody's	Fitch	S&P	S&P	S&P	S&P	Spread (level)
Sample						EME only			
Std of GDP cycle	2.074**	5.094*					-93.030**		
	(0.773)	(2.682)					(42.714)		
Std of GDP cycle sq.	-24.920***	-57.833**					831.534**		
	(8.727)	(28.190)					(398.925)		
Revenue Volatility			-49.958**	-37.492*	-43.332**	-66.005***			8564.319**
			(20.337)	(19.563)	(19.011)	(24.474)			(3193.199)
Revenue Volatility sq.			269.061**	211.355*	229.651**	381.228***			-42488.015**
			(109.549)	(110.386)	(100.800)	(120.763)			(16366.125)
Std TOT growth								-33.674**	
								(13.997)	
Std TOT growth sq.								116.039**	
								(55.317)	
Inflation	0.012***	0.014***	-0.449***	-0.646***	-0.440***	-0.345**	-0.576***	-0.513***	84.160***
	(0.003)	(0.002)	(0.151)	(0.152)	(0.141)	(0.174)	(0.176)	(0.141)	(21.641)
Gov. Expenditure/GDP	-0.001	-0.001	0.047	-0.015	0.034	-0.159**	0.094**	0.071	1.3
	(0.001)	(0.001)	(0.037)	(0.066)	(0.037)	(0.073)	(0.038)	(0.050)	(7.097)
GDP per capita	-0.003	-0.01	-0.021**	-0.385	-0.020*	0.642	-0.126	-0.836	2.703
	(0.006)	(0.009)	(0.010)	(0.575)	(0.010)	(1.242)	(0.662)	(0.674)	(1.621)
Openness	-0.008***	-0.007***	0.768***	0.729***	0.798***	0.365	0.745***	0.613***	-77.461***
	(0.002)	(0.002)	(0.177)	(0.196)	(0.183)	(0.296)	(0.187)	(0.169)	(26.797)
Constant	0.043	-0.026							431.299*
	(0.026)	(0.062)							(254.079)
Observations	38	38	42	37	42	20	48	48	44
R-squared	0.79								0.73
pseudo R-squared			0.26	0.28	0.27	0.20	0.29	0.27	
Tipping point	0.042	0.044	0.093	0.089	0.094	0.087	0.056	0.145	0.101
Max. in sample	0.076	0.076	0.180	0.180	0.180	0.180	0.090	0.200	0.180

White-corrected robust standard errors in parentheses, *, **,*** significant at 10, 5 and 1 percent, respectively. GDP per capita and inflation are in logs. In column 2, the standard deviation of terms-of-trade growth and its squared term are used as instruments for the standard deviation of the GDP cycle and its squared term.

of the results presented in the cross-country analysis so far and to compare them with the other study in the literature on this topic, we use similar econometric techniques and the same data as Catao and Kapur (2006) to analyze the shape of the relationship between volatility and default risk. These authors analyze the impact of macroeconomic volatility on default probabilities applying an event study approach to defaults and credit events in a panel of 26 EME and developing countries from 1970 to 2001. They estimate logit models to assess the impact of output gap volatility or terms-of-trade volatility on the likelihood of observing a default or rescheduling of sovereign debt. Volatility is measured by the standard deviation of these variables using 10-year rolling windows previous to the year under consideration.[11] There are two aims of this exercise. First, given that the time-series availability for spreads and revenue volatility is limited, in order to exploit the time series dimension, one has to rely on ex-post episodes as measures of default risk and alternative measures of volatility. Thus, this approach enables us to conduct a further robustness check in terms of considering an alternative definition of the dependent variables as well as additional measures of volatility. Second, this analysis allows us to check the robustness of our non-monotonicity finding using the same data and methodology as the only other study in the literature. Therefore, I augment the econometric model of Catao and Kapur (2006) to include a quadratic term of their volatility measures, and ask whether this term has a negative and significant impact on the probability of default, as the cross-section evidence above

[11] See their paper for more details and descriptive statistics on the dependent and independent variables used below. All explanatory variables are lagged one period in order to reduce endogeneity problems.

indicates. The logit estimates are presented in Table 1.3. All regressions include the international interest rate, which enters positively and highly significantly in all specifications. This reflects the common wisdom that defaults are more likely during periods of tight international liquidity. In addition, exports as a fraction of GDP (which is included to capture the potential cost of trade sanctions in the event of default), shows the expected negative sign in most specifications although it is only significant in two of them. With respect to debt indicators, debt as a fraction of exports, as well as debt service as a fraction of exports, perform better than debt-to-GDP ratios.

Regarding the variables of interest, the linear specification in column 1 shows that the volatility of the terms of trade has a positive effect on the probability of default. In column 2, I add the quadratic term of terms-of-trade volatility, which comes in highly significant with the expected negative sign. In addition, the fit of the regression measured by the pseudo-R-squared improves from 0.15 to 0.18. Hence, this evidence is consistent with the cross section regressions presented in Table 1. Adding the debt to exports ratio or estimating the model using random effects (column 3) yield similar results. While the implied tipping points at which the effects of terms-of-trade volatility on the probability of default become negative is well below the in-sample maximum, there could be concerns that the results are driven by some extreme observations. In column 4, I re-estimate the model excluding all observation with a 10-year rolling standard deviation above 50%. Again, the non-monotonic shape is significant in this subsample with an estimated tipping point at around values of 23%. Similar results are obtained when estimating con-

sidering the standard deviation of the residuals of a growth forecasting regression. These are the residuals from regressing real GDP growth on two lags and a segmented time trend (with a break in 1974) as in Ramey and Ramey (1995). Finally, the results are robust to including the debt service to exports ratio and the deviation of the real exchange rate from its Hodrick-Prescott trend as additional controls.

Summing up, the evidence presented in this section shows that there is a non-monotonic relationship between default risk/risk premia and revenue volatility. For low levels of volatility, an increase in volatility is associated with an increase in spreads and the perceived default risk. However, for sufficiently large levels of volatility, this relationship reverts. This empirical relationship is found using different measures of default risk, as well as alternative econometric methods and measures of volatility.

In terms of the discussion presented in the introduction, this empirical fact can be interpreted as a trade-off between precautionary savings motives and the increased risk of default due to a higher variance of the relevant shocks. According to Eaton and Gersovitz (1981), a higher volatility of the relevant income process increases the cost of exclusion from credit markets. Therefore, default becomes less attractive for countries that face higher volatility. However, if this is the only channel through which volatility affects default incentives, the risk premium should be a decreasing function of volatility. This clearly is not observed in the data. Alternatively, as argued by Catao and Kapur (2006), volatility increases potentially the likelihood of receiving a very bad draw and therefore increases the fraction of the

Table 1.3: Logit Regressions - Default Events

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Std TOT growth ≤ 0.5	Random Effects				
US Real Interest Rate	0.421***	0.419***	0.417***	0.363***	0.437***	0.432***	0.482***	0.495***	0.463***
	(0.128)	(0.123)	(0.121)	(0.092)	(0.104)	(0.132)	(0.150)	(0.170)	(0.148)
Exports/GDP	-0.031*	-0.025	-0.009	0.001	-0.01	-0.008	-0.016*	-0.012	-0.003
	(0.018)	(0.017)	(0.009)	(0.008)	(0.013)	(0.009)	(0.010)	(0.010)	(0.006)
Debt/GDP	0.011	0.009							
	(0.008)	(0.008)							
Std TOT growth	3.078***	9.837***	10.706***	32.561***	10.775***	9.228***			
	(0.873)	(2.848)	(3.033)	(11.806)	(3.891)	(3.049)			
Std TOT growth sq.		-9.036***	-9.707***	-69.905**	-9.574*	-7.899**			
		(2.983)	(3.263)	(31.126)	(5.242)	(3.533)			
Debt/Exports			0.003**	0.003***	0.003*	0.000	0.003***	0.000	0.003*
			(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Std Growth Forecast Residuals							227.32***	245.63***	280.45***
							(83.35)	(86.30)	(88.21)
Std Growth Forecast Residuals sq.							-9932.45*	-12031.27*	-16950.85**
							(5866.97)	(6399.67)	(0.793)
Debt Service/Exports						2.927***		3.256***	3.033***
						(0.751)		(0.824)	(0.852)
Real Exchange Rate Gap									10.283***
									(2.737)
Constant	-4.677***	-5.426***	-6.111***	-7.776***	-6.250***	-6.919***	-5.505***	-6.788***	-17.798***
	(0.790)	(0.864)	(0.989)	(1.507)	(0.924)	(1.217)	(0.815)	(1.196)	(3.318)
Observations	584	584	584	564	584	583	543	543	543
pseudo R-squared	0.16	0.18	0.18	0.19		0.26	0.17	0.27	0.34
Tipping point		0.544	0.551	0.233	0.562	0.563	0.011	0.010	0.008
Max in sample		0.958	0.958	0.498	0.958	0.958	0.018	0.018	0.018

White-corrected robust standard errors in parentheses, *, **,*** significant at 10, 5 and 1 percent, respectively. Column 4 presents random effects logit estimations.

state space where default might be optimal. Clearly, in this case, default should be monotonically increasing in the variance of shocks. This is also not the whole story, according to the empirical evidence presented in this section. In the next section, I present a model that tries to disentangle these effects in a set-up where both forces are potentially relevant.

Before finishing this section, it is useful to discuss some of the evidence regarding debt holdings and their relationship with volatility. In this case, although there is a clearly negative correlation, as shown in Figure 1.3 and also documented by Mendoza and Oviedo (2006), this empirical evidence is a little bit harder to interpret. Figure 1.3 plots the average debt holdings and revenue volatility for two distinct samples, rich OECD and Non-OECD countries.[12] Clearly, the cross-section evidence shows a negative correlation between volatility and debt for EME. For the case of revenue volatility the correlation coefficient is -0.40, which is significant at conventional levels. However, in the case of developed countries there is no significant correlation between these variables.

This distinct pattern across EME and developed countries can be interpreted in two ways. First, following Durdu, Mendoza and Terrones (2007), a higher volatility may induce agents to accumulate less debt due to precautionary saving motives in the face of incomplete asset markets. This model can explain the data if EME

[12]Average debt holdings are computed over the period 1990 - 2005. The data are taken from Jaimovich and Panizza (2006). This database has been constructed especially to allow cross country comparisons and has been used as a primary data source for the 2007 IDB Report on Economic and Social Progress in Latin America on sovereign debt. The classification of countries is based on those countries that were members of the OECD in the 1970's. Therefore, e.g. Mexico is classified as Non-OECD, given that it joined the OECD in 1994.

face a lot of market incompleteness, while developed countries have access to more sophisticated forms of finance and state-contingent assets. Second, in models with limited commitment on the borrower's side, debt holdings reflect the minimum between desired debt levels and potential debt ceilings. In economies that always have access to capital markets, the government would use debt to smooth revenue shocks over the business cycle. Given that there would be no commitment problems, the government would be expected to repay always. Combined with the previous argument, precautionary motives would also be less severe in this case, given that permanent access to credit markets would allow the government to borrow more even during severe recessions. In addition, developed market economies might have a significantly large menu of contingent financing options, which would also tend to reduce the need for self-insurance, reducing precautionary savings motives and consequently the link between volatility and precautionary savings. Thus, debt levels primarily reflect debt demand for the OECD countries, and there are no strong reasons to expect a systematic correlation between volatility and debt levels.[13] In contrast, for the case of EME, the significantly negative correlation could reflect the fact that volatile economies are more likely to be credit constrained because they have a higher probability of default. This would be in line with the finding by Catao and Kapur (2006) that debt ceilings are negatively correlated with volatility, while demand for debt increases with volatility. On the other hand, countries with very high revenue volatility (as could be the case of China, e.g.) might want to

[13]This refers to eliminating obvious short-run changes in debt levels over the business cycle. Countries that undergo a large shock are naturally expected to hold more debt than those that are close to their long-run equilibrium.

avoid a debt crisis by holding a more balanced position of net foreign assets. This precautionary motive might induce countries to demand less debt when they are at very high levels of volatility. Both of these features are distinct for EME because they are linked to potential loss of market access due to default risk.

While we do not explore these issues empirically further here, this section yields the following main conclusions. First, default risk - and as a consequence interest rates and risk premia - show a positive correlation with revenue volatility. However, there is a non-monotonic relationship between these variables such that for sufficiently high levels of volatility, the probability of default - and therefore the sovereign spread also - actually decrease. Second, debt holdings are decreasing with volatility in EME, while there is no significant correlation between debt holding and volatility for developed economies. Finally, it should be mentioned that Reinhart, Rogoff and Savastano (2003) provide a further stylized fact related to those in established above: EME tend to default on lower debt to GDP ratios than developed countries.

1.3 The Model Economy

This section presents a simple model to analyze the impact of revenue volatility on risk premia and the probability of default, as well as equilibrium debt levels. In order to generate endogenous default, I follow the existing literature on sovereign debt with incomplete markets and limited commitment, such as Arellano (forthcoming) and Aguiar and Gopinath (2006). Although these models have problems

in matching some moments of debt dynamics in emerging markets (especially debt levels and/or the magnitude of spreads), they do offer a framework to analyze the relationship between volatility and default risk. Given that the empirical evidence presented in section 1.2 shows a non-monotonic relationship between default risk and volatility, a theory that wants to match this empirical fact has to be capable of generating a risk premium and default (endogenously) in equilibrium. This is the main reason to opt for this framework.

In contrast to the standard in the literature, I use a similar set-up to Alesina and Tabellini (2006) and Mendoza and Oviedo (2006) in which the government's objective function differs from that of the representative household's. The government's objective is to smooth its expenditure, which reports no utility to the households. This implies that the competitive equilibrium in this economy will not reproduce the social optimum. In addition, I assume that the government might discount the future at a higher rate, reflecting the fact that political turnover and instability might induce the government to have a more myopic behavior.

1.3.1 The Household's Problem

The representative household maximizes the expected discounted utility value of consumption and leisure given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left[C_t - \frac{L_t^{1+\psi}}{1+\psi}\right]^{1-\delta}}{1-\delta}, \tag{1.1}$$

where β is the subjective discount factor, and δ is the coefficient of relative

risk aversion. The relationship between consumption (C_t) and labor (L_t) is modeled using the formulation by Greenwood et al (1988) which is standard in the real business cycle literature, given that it has the property that the elasticity of substitution between consumption and labor is independent of the level of consumption, which makes labor supply independent of consumption decisions. The elasticity of labor supply is given by the inverse of ψ.

Households also carry out production in the economy according to a linear production function given by:

$$Q_t = A_t L_t, \tag{1.2}$$

where total factor productivity (A_t) is a random variable.

The household's budget constraint is given by:

$$C_t = Q_t(1 - \tau_t), \tag{1.3}$$

where τ_t is an output tax rate set by the government. In particular, I follow Mendoza and Oviedo (2006) and assume that this effective tax rate is a combination of a constant tax rate over time and states and a stochastic revenue shock, such that:

$$\tau_t = \tau e^{z_t}. \tag{1.4}$$

The parameter τ is the average revenue as a fraction of GDP, while the z_t shock process is assumed to capture tax as well as non-tax revenue shocks. Given that in many developing countries non-tax revenues - linked to commodity export income e.g. - represent an important fraction of total revenues, this shock might also capture fluctuations in the terms-of-trade.[14] The representative household's problem is static in nature. The first order condition of maximizing (1) subject to (2) - (4), yields a labor supply given by:

$$L_t = \Big(A_t(1-\tau_t)\Big)^{\frac{1}{\psi}}. \tag{1.5}$$

1.3.2 The Government's Problem

I assume that the government's objective is to maximize the expected discounted utility of government expenditure given by:

$$E_0 \sum_{t=0}^{\infty} (\beta\pi)^t \frac{g_t^{1-\delta}}{1-\delta}, \tag{1.6}$$

where π represents the probability that the current government will stay in power. This parameter is included in order to account for a higher impatience of the government due to political uncertainty. For simplicity, I assume that π is constant over time and across states.[15]

[14] See Gavin and Perotti (1997) for evidence of the importance of non-tax revenues in Latin America.

[15] There is some evidence (e.g. Inter-American Development Bank, 2006) that the probability of the government being replaced or losing power increases after a default episode. Thus, π could be state-dependent.

Following the literature on quantitative models of sovereign debt with strategic default (see e.g. Arellano, forthcoming; as well as Aguiar and Gopinath, 2006), I assume that international asset markets are incomplete such that the government can only issue a one-period bond. The outstanding stock of net foreign assets is denoted by b, so that a negative value of b represents the level of outstanding debt. In addition, I assume that the government cannot commit to repay its debt, so that it will only repay its debt if the expected discounted utility value of doing so is greater than the value of defaulting on its obligations. In particular, the value function of the government's maximization problem is given by $V(b, z, A) = \max\{V^D, V^R\}$, where V^D is the value of default and V^R the value of repayment. The latter is given by:

$$V^R(b, z, A) = \max\left\{u(g) + \beta\pi \int V(b', z', A')dF(z', A'|z, A)\right\} \tag{1.7}$$

$$\text{s.t.} \quad g + q(b', z, A)b' = \tau e^z Q + b, \tag{1.8}$$

$$\lim_{T\to\infty} (\beta\pi)^T b_{T+1} \geq 0, \tag{1.9}$$

where q is the bond price, $u(.)$ is the CRRA utility function, $F(.)$ is the joint cumulative distribution of the exogenous state variable, which is assumed to follow a Markov chain, and the second condition is a standard non-Ponzi game condition.

Alternatively, the government defaults on its debt. When it does so, the government is excluded for an uncertain period of time from international credit markets, so that the government has to rely exclusively on national tax revenue to finance expenditure. In addition, I assume that default involves disorder and potential deadweight losses due to sanctions imposed by creditors, so that revenues follow a different stochastic process under default, denoted by $h(Q)$. Also, if the country is in a state of default, there is an exogenous re-entry probability α, so that the country on average is excluded only $\frac{1}{\alpha}$ years from credit markets. If the government reains access to international capital markets after a default, it does so with zero debt. The value of default under these assumptions - which are standard in the literature - is given by:

$$V^D(z,A) = u\big(h(Q)\big) + \beta\pi\Bigg\{\int\Big(\alpha V(0,z',A') + (1-\alpha)V^D(z',A')\Big)dF(z',A'|z,A)\Bigg\} \tag{1.10}$$

1.3.3 Creditors

As it is standard in the literature, international creditors are modeled as risk-neutral agents. They have access to an international capital market in which they can trade a risk-free bond at the interest rate r^* which for simplicity is assumed to be constant over time and states of nature. In addition, there is perfect competition among creditors, such that their expected profits are zero. Under these conditions

it is straightforward to show that the following condition has to hold:

$$1 + r_t = \frac{1 + r^*}{1 - \lambda(b_{t+1}, z_t, A_t)}, \tag{1.11}$$

where r is the interest rate of the bond, given by $r_t = \frac{1}{q_t} - 1$, and $\lambda(b_{t+1}, z_t, A_t)$ is the endogenous default probability, defined as:

$$\lambda(b_{t+1}, z_t, A_t) = E\Big[D(b_{t+1}, z_{t+1}, A_{t+1})|b_t, z_t, A_t\Big], \tag{1.12}$$

where D is an indicator function defined as:

$$D(b_t, z_t, A_t) = \begin{cases} 1 & \text{if } V^D(z_t, A_t) > V^R(b_t, z_t, A_t) \\ \\ 0 & \text{otherwise} \end{cases} \tag{1.13}$$

This equation just states that the expected returns of investing in the risk free asset and making a risky loan to the agent have be be equal. It also shows that the interest rate is a function of the level of net foreign assets (b_{t+1}), as well as the current state of revenues given by (z_t, A_t). A higher expected probability of default clearly implies a higher risk premium. Also, given that the default probability is decreasing in b_{t+1}, r_t will be a non-increasing function of b_{t+1}. Clearly, the risk premium or spread is analogously defined as:[16]

$$s(b_{t+1}, z_t, A_t) = \frac{\lambda(b_{t+1}, z_t, A_t)}{1 - \lambda(b_{t+1}, z_t, A_t)} \tag{1.14}$$

[16]The spread s is computed using the multiplicative formula: $(1 + r^*)(1 + s) = 1 + r$.

1.3.4 Some Intuition

In order to provide some intuition of the forces present in the model, this subsection presents a brief discussion on how the incentives to borrow and default might change with volatility.

Assume that government revenues can be characterized by the following process: $T_t = \overline{T}e^{z_t}e^{-\frac{\sigma^2}{2}}$, with z_t being an i.i.d. shock, such that $z_t \sim N(0, \sigma^2)$, which implies the expected value of T_t always equals $\overline{T}$. This allows us to analyze the effects of a mean-preserving spread. In addition, assume that $\alpha = 0$, such that there is permanent exclusion from credit markets after a default, but there is no further cost of default, i.e. $h(Q_t) = T_t$.[17] Under these assumptions, the value of default will be given by:

$$V^D = E_0 \sum_{t=0}^{\infty} \beta \frac{T_t^{1-\delta}}{1-\delta} = \frac{(\overline{T}e^{-\frac{1}{2}\delta\sigma^2})^{1-\delta}}{(1-\beta)(1-\delta)} \tag{1.15}$$

In addition, let us assume that under repayment, the government is able to complete smooth its expenditure, such that each period the government pays the amount of $R = -rb$ of interest payments.[18] Under these assumptions, the value of repayment will be given by:

[17] Aguiar and Gopinath (2006) use a very similar set-up to analyze sustainable debt levels in their model.

[18] We are assuming $b < 0$ to make the discussion interesting. Observe also that even if it were feasible, complete expenditure smoothing will not be optimal in our calibrated exercises presented in the subsequent sections due to the relative impatience we assume.

$$V^R = \frac{(\overline{T} - R)^{1-\delta}}{(1-\beta)(1-\delta)} \tag{1.16}$$

The government will default on its debt, only if the $V^D > V^R$, i.e.:

$$\frac{R}{\overline{T}} > 1 - e^{\frac{1}{2}\delta\sigma^2} \tag{1.17}$$

This equation has a series on interesting implications. If the variance of revenues tends to zero, the right-hand side of the equation converges to zero, which means that the government would default whenever it has to make any positive repayment or if it holds a positive amount of debt. The rationale for this is that the utility cost of the exclusion punishment declines when volatility declines and therefore the government would be more tempted to default on its obligations. Considering the opposite case, when the variance of revenues tends to infinity, the right-hand side of the equation converges to one. This implies that the government would not default on any debt level below the level at which repayment would compromise all available resources.[19] Thus, as also suggested by Eaton and Gersovitz (1981), for given levels of debt and interest rates, the probability of default is a decreasing function of the volatility of shocks in this set-up. In addition, the equation also shows that the speed at which the default probability decreases is a positive function of the coefficient of relative risk aversion (δ). Observe that if the government is not risk averse, it would default on any positive level of debt.[20] If we assume

[19] Of course, other optimality considerations and prudential behavior would probably prevent the government to borrow up to this level of debt in the first place.

[20] Clearly, in our model without risk aversion the only reason to borrow for the government is it relative impatience that induces it to prefer current expenditure to future expenditure.

that there is an additional cost of default that reduces the revenues in the state of default by a fraction η, such that $h(Q_t) = (1-\eta)T_t$, it is straightforward to show that the right-hand side of the equation becomes: $1-(1-\eta)e^{\frac{1}{2}\delta\sigma^2}$. This shows that the level of debt that the government can support without defaulting increases with the severity of the punishment (η).[21]

However, several of the strong assumptions made so far are unlikely to hold. In particular, the government might not be able to smooth consumption completely under repayment. In this case, the value of repayment will be affected negatively by volatility and therefore default could act as partial insurance mechanism. As Eaton and Gersovitz (1981) also argue, under uncertainty volatility has an ambiguous effect. On the one hand, it makes it more attractive to honor the current debt, given the possibility that tomorrow's revenue income will be low and therefore expenditures have to be cut. On the other hand, if the economy is hit by a larger shock today, default becomes more attractive. Therefore, the relationship between volatility and default risk will depend on which effect dominates. It is interesting to point out that this trade-off will also depend on the degree of impatience of the government. If the future is discounted at a higher rate - due to a low probability of staying in power, for example - the current gain of not having to repay the debt will become more attractive than the inter-temporal future gains from repaying the debt and conserve market access.

A second effect that could potentially affect the relationship between volatility

[21]This point is also made by Aguiar and Gopinath (2006).

and default risk is related to the impact of an increase in volatility on the demand for assets in incomplete market economies under uncertainty. In particular, given that I assume a CRRA utility function, it is well-known that this type of preferences generate prudential behavior. Thus, self-insurance via precautionary savings could reduce the demand for debt and therefore it could lower the risk of default. Furthermore, given that the utility function exhibits a positive third derivative ($u''' > 0$) a "natural" debt limit as proposed by Aiyagari (1994) could arise. Let us assume for a moment that there is no commitment problem. In this case, the government solves the the following problem:[22]

$$\max E_0 \sum_{t=0}^{\infty} (\beta\pi)^t u(g_t) \tag{1.18}$$

$$\text{s.t.} \quad g_t + q_t b_{t+1} = T_t + b_t, \tag{1.19}$$

Given that for utility functions that exhibit prudence, the following condition holds: $\lim_{g\to 0} u'(g) = \infty$, $g_t \geq 0$ has to hold. Marginal utility becomes very large as expenditure tends to zero, so that the government would always avoid getting close to very low levels of expenditure. Combining this condition with the budget constraint, the fact that $q_t = \frac{1}{1+r^*}$, and solving it forward, implies that:

$$b_{t+1} \geq -\frac{T_{min}}{r^*}, \tag{1.20}$$

[22]In addition, it is assumed that a non-Ponzi game condition also holds.

where T_{min} is the lowest possible realization of the revenue process. The right-hand side of this equation is the natural debt limit. Basically, the equation states that in order to avoid very low levels of expenditure, the government would always choose a debt level that would allow to service it under the worst possible realization of future revenues which is to receive the lowest possible draw forever.

Now suppose that T_t follows the process specified above: $T_t = \overline{T} e^{z_t} e^{-\frac{\sigma^2}{2}}$, with $z_t \sim N(0, \sigma^2)$ and i.i.d. If z_t is approximated using a discrete symmetric grid $\{z_{min}, ..., z_{max}\}$, with $z_{min} = -z_{max} < 0$, this will translate into a grid for revenues given by $\{T_{min}, \ldots, T_{max}\}$. An increase in the variance of z_t will reduce the value of T_{min}. In the limit, as $\sigma^2 \to \infty$, T_{min} will converge to 0. Thus, the government would never hold a negative level of net assets.

Although this previous debt limit was derived for the case where default does not occur, it is straightforward to show that a similar argument can be extended to the case without commitment. As Eaton and Gersovitz (1981) show, in the sovereign lending problem outlined at the beginning of this subsection there exists a finite net foreign asset ceiling, $\overline{b}_{t+1} > -\infty$ beyond which lender would not extent further credit, because the sovereign borrower would default with probability 1.[23] The proof of this proposition follows from the fact that V^R is increasing in the level of net foreign assets (b), i.e. it is a decreasing function of the outstanding debt level, while V^D does not depend on the debt level. Therefore, the probability of default λ is a monotonically increasing function of debt. Under these conditions, the sovereign

[23]The subindex is used to highlight the fact that this ceiling will depend on the state of the economy.

faces two possible constraints: the natural debt limit and the credit ceiling. Thus, the following has to hold:

$$b' \geq \max\Big[-\frac{T_{min}}{r^*}, \overline{b}'(b,T)\Big] \tag{1.21}$$

Independently from the effects of volatility on the credit ceiling, in the limit the natural debt limit will tend to zero, while $\overline{b}'(b,T) \leq 0$. Therefore, for extremely high levels of volatility, the demand for debt will converge to 0. Given that as debt converges to 0, the risk premium has to fall, in the limit the risk premium converges to 0. However, at intermediate levels of volatility, the effect of volatility on the credit ceiling might be the relevant restriction, and therefore we could observe higher risk premia and tighter ceilings. The next subsection will explore these issues further using numerical methods.

1.3.5 Calibration

Tax shocks and the TFP process are modeled jointly as a VAR(1) process, similar to Mendoza and Oviedo (2006). I use the TFP series for Argentina from 1960 to 2003 from Fernández-Arias, Manuelli and Blyde (2006) and the ratio of central government revenues to GDP from the GFS database and the *Ministry of Economics and Production*.[24] Both series were de-trended using the Hodrick-Prescott filter with a smoothing parameter of 6.25, as recommended by Uhlig and Ravn (2002). Given that revenue data are available only since 1970, the sample

[24]For 1989, revenue data are missing. In this case I interpolated linearly between the surrounding observations.

period is 1970 - 2003. Let the vector x_t be given by de-trended TFP (tfp_t) and the de-trended revenue to GDP ratio (rev_t), such that $x_t = (tfp_t, rev_t)'$. I estimate the following VAR(1): $x_t = \Gamma x_{t-1} + \varepsilon_t$, where Γ is a coefficient matrix of dimension 2 $\times$ 2 and ε_t is a white noise error vector with variance-covariance matrix Σ. The resulting estimates and variance-covariance matrix of residuals is given by (standard errors are in parenthesis):

$$\hat{\Gamma} = \begin{pmatrix} 0.8583 & 1.4052 \\ (0.1271) & (0.8274) \\ & \\ -0.0309 & 0.6927 \\ (0.0251) & (0.1634) \end{pmatrix}; \quad \hat{\Sigma} = \begin{pmatrix} 0.002664 & 0.000266 \\ 0.000266 & 0.000104 \end{pmatrix} \tag{1.22}$$

As I solve the model using discrete optimization methods, the VAR process has to be translated into a discrete approximation. Therefore, I use the quadrature procedure by Tauchen and Hussey (1991) to approximate the continuous VAR by a discrete Markov chain. In particular, I use 25 pairs of realizations of TFP and revenue shocks (5 different realizations for each particular shock). Given that the off-diagonal elements of $\hat{\Gamma}$ are marginally significant, I set them equal to zero. The average revenue to GDP ratio τ is set equal to 16.6%, which is the sample mean over the period considered above.

Several of the remaining parameters are drawn from the existing literature on

economic fluctuations in EME. As Mendoza (1991), I set the coefficient of relative risk aversion δ equal to 2 and the labor elasticity parameter ψ equal to 0.455, which are both standard in the literature. For the probability of redemption α, I use the historical evidence presented by Tomz and Wright (2007), who estimate an average exclusion duration of around ten years. Thus, α is set equal to 0.10. This parameter is somewhat smaller than alternative values used in the literature (e.g. Aguiar and Gopinath, 2006) based on Gelos et al (2004) estimate of an average exclusion duration of 2.5 years after a default in the 1990's. However, Gelos et al (2004) focus on a very short time period for such a relatively low probability event as a default. Also, the latest default by Argentina indicates that exclusion from international capital markets might be significantly longer; since defaulting at the end of 2001, Argentina has not been yet able to re-access international capital markets, as of 2007. Thus, I prefer the estimate of Tomz and Wright (2007), which is also consistent with the findings of Arraiz (2006) of long periods of exclusion from credit markets.

The risk-free real interest rate r^* is set to 2.5% per annum, which is the average ex-post real interest rate on 10-year US Treasury Bonds for the period 1997 - 2006. The discount rate β is set equal to $1/(1+r^*)$, i.e. 0.9756, while the probability of staying in power π is calibrated using the information from Alesina et al (1996) regarding the unconditional frequency of a major change in the executive in developing countries over the period 1950 - 1982 for 108 countries. This includes all "irregular" changes as well as "regular" changes. The resulting value for π is 0.735. Thus, the resulting effective discount factor of the government is around

0.72. While this value is low, it is relatively high compared to many models in the literature; Aguiar and Gopinath (2006) use a discount rate of 0.8 calibrated to quarterly data which would imply a rate of around 0.41 for annual data. Similarly, Cuadra, Hatchondo and Sapriza (2007) model default with two different types of politicians that differ in their degree of impatience with quarterly discount rates are 0.9 and 0.6, respectively, which again result in lower annual discount factors than the one used in this paper. Arellano (forthcoming) uses a rate of 0.953 for quarterly data, resulting in an annual discount rate of 0.82.[25]

Finally, with respect to the evolution of revenues under default, I follow Arellano (forthcoming) and model the function $h(.)$ as:

$$h(Q) = \begin{cases} (1-\eta)E(\tau e^z Q) & \text{if} \quad \tau e^z Q \geq E(\tau e^z Q) \\ (1-\eta)\tau e^z Q & \text{else} \end{cases} \tag{1.23}$$

The empirical motivation of this way to model revenues under default comes from the fact during the latest default episode in Argentina, output has remained below trend for almost 4 years while revenues have followed a similar path. From a mechanical point of view, the asymmetry between the revenue process under default and repayment increases the probability of default, given that default reduces the volatility of shocks. The parameter η is calibrated in order to match a probability of default of 3% per annum, which is also targeted by Arellano (forthcoming). The

[25]From a quantitative point of view, most of these models need low discount factors to create enough default episodes. This is also true in other models of lack of commitment, like Alvarez and Jermann (2001), who analyze the asset pricing implications of an endogenous incomplete markets model using a relatively low discount factor to make incentive compatibility constraints tighter and match equity premia for the US.

Table 1.4: Baseline Parameter Values

Parameter	Value
β	0.9761
r^*	0.025
α	0.10
ψ	0.455
δ	2
τ	0.166
π	0.735
η	0.031

resulting value for η is 0.031, which is equal to the parameter chosen by Arellano (forthcoming) and close to the relative output loss of 2% per year estimated by Chuhan and Sturzenegger (2005). All parameters are presented in Table 1.4.

1.4 Results

This section presents the main results from simulating the model outlined in section 1.3. The solution algorithm is presented in the appendix. First, I compare some moments of the ergodic distribution to the sample moments for Argentina. The first column of Table 1.5 shows the sample moments for Argentina, using annual data from 1980 to 2001, except for the spreads, which come from JPMorgan's EMBI spreads for sovereign debt and which are only available since 1993. The correlations and standard deviations refer to HP-filtered series. Finally, the debt series I consider is the net external debt of the central government, from which I subtract net international reserves, so that the debt aggregate is more similar to the one used in the model, as there are no debt holdings at the national level nor by the private sector in the model, so that the variable b refers to net foreign assets.

As shown in Table 1.5, the model matches the sign of the empirical correlation between output and spreads, as well as the trade balance, although the absolute values are too small. The finding that model interest rates are higher when output is below trend and that capital flows are pro-cyclical are standard results in this literature (see Arellano, forthcoming; and Aguiar and Gopinath, 2006). These results are driven by the fact that in the model the incentive to default is higher during bad times. Therefore, when output and revenues are low, spreads will be higher, creating a disincentive to borrow. In contrast, when the model is solved assuming no commitment problems, such that the sovereign always repays the debt (column 3), capital flows are counter-cyclical, given that the government borrows from abroad during recessions to smooth expenditure and repays during booms, which is the standard result in small open economy models (see Mendoza, 1991). In addition, the baseline model generates an average debt-to-revenue level of around 23%. While this is around a third of the observed average debt-to-revenue level, it should be taken into account that the model allows only for one-year bonds. In the case of Argentina, e.g. short-term debt represented less than 1/4 of its total external obligations in the sample period. In addition, observe if the sovereign could fully commit to repay in all states of nature, debt holdings would be much higher, precisely more than 21-times the average revenue, which is completely at odds with the empirical evidence. In addition, it is interesting to point out that the model is able to create a relatively large spread.

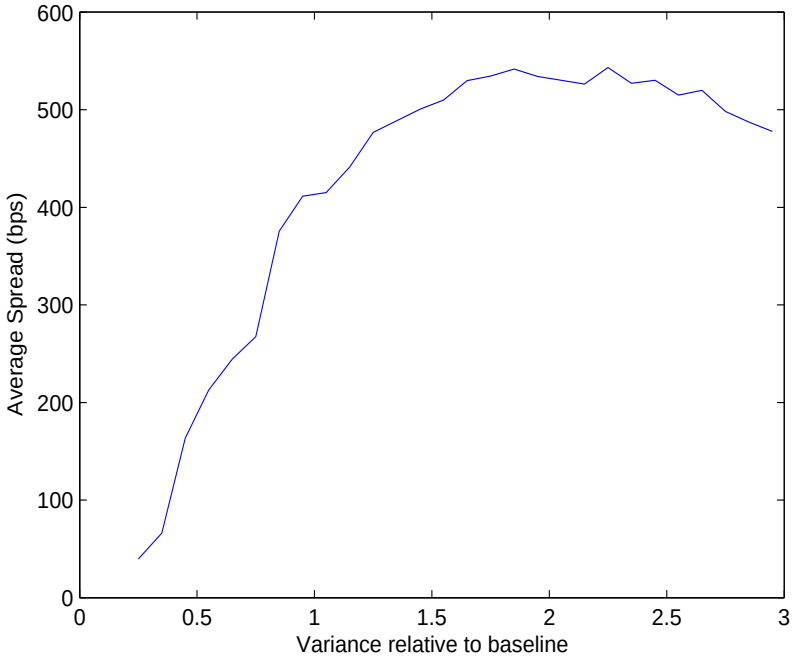
Next, in order to analyze how volatility affects spreads in the model, I simulate

Table 1.5: Sample and Simulated Moments

Moments	Argentina	Model	Full Commitment Model
$corr(output, spread)$	-0.71	-0.09	0.00
$corr(output, tradebalance)$	-0.88	-0.17	0.57
$E(b/revenue)$	-0.97	-0.23	-21.81
$E(spread)$ (bps)	783	418	0.00
$\sigma(spread)$	0.09	0.08	0.00
Default Probability	3.00%	3.01%	0.00%

the model for different levels of macroeconomic volatility. In order to do so, I hold fixed the coefficient matrix (Γ) of the joint TFP and revenue shock process remains the same, but multiply the variance and covariance matrix (Σ) by a factor that ranges from 0.25 to 3, which is close to the variation in the data used in section 1.2. The resulting average spread levels for different levels of volatility are presented in Figure 1.6. As this graph shows, the model generates the non-monotonic relationship between the spread and volatility observed in the data. The intuition for this result is the following. At relatively low levels of volatility, an increase in volatility primarily raises the probability of default, making default more likely for every level of debt. In addition, the incentives provided by the threat of exclusion at low levels of volatility are relatively low, and therefore the reduction in the demand for debt due to precautionary motives is relatively low. However, for sufficiently high levels of debt, the exclusion from capital markets in the event of default becomes more costly given the large fluctuations in the provision of public goods that would take place under autarky. Consequently, the government would borrow less, which makes it less likely that it would end up with a risky debt level on which the incentives to default are high.

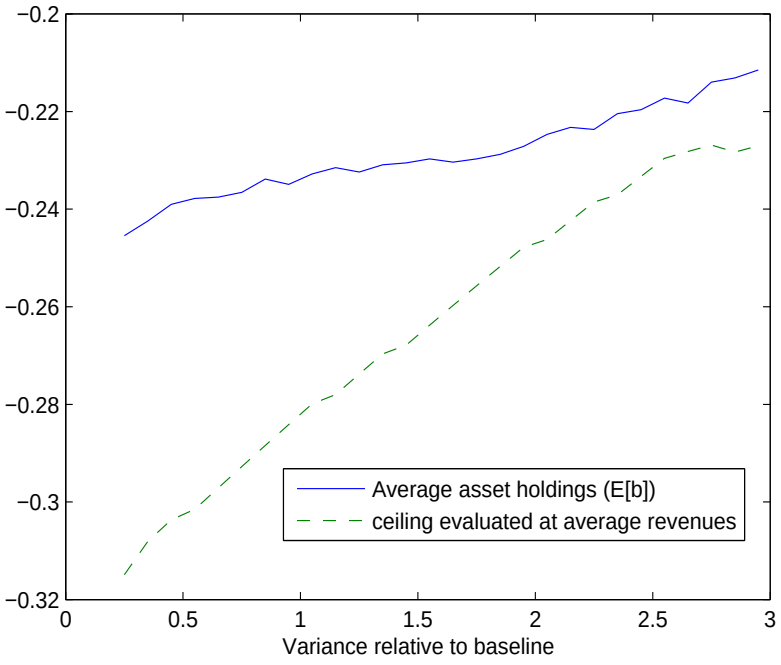
Figure 1.6: Average Simulated Spreads and Volatility



This previous intuition can be corroborated by the relationship between volatility and average asset holdings and credit ceilings, presented in Figure 1.7. This figure shows the average level of asset holding as a fraction of revenues for different levels of volatility. In addition, it also reports the ceiling - defined as the level of assets beyond which creditors are not willing to extend any further funds, given that the sovereign would default under all states of nature. Clearly, this ceiling is different for each point in the state space. The one reported in the graph refers to the average level of revenues in the model which does not change wit the increase in the variance of shocks. As Figure 1.7 shows, both average debt levels and the credit ceiling decrease initially with volatility, i.e. for higher levels of volatility the sovereign holds less debt and creditors are also willing to extend less credit. While the first fact can be explained by the standard precautionary savings result in incomplete

asset market models (as in Mendoza and Oviedo, 2006), the lower supply of credit is explained by the fact that an increase in volatility makes default a more likely outcome. However, for sufficiently high levels of volatility, average asset holdings continue to decrease, while the credit ceiling becomes relatively less sensitive to increases in volatility, i.e. the slope of the credit-ceiling curve is smaller for higher levels of volatility. Thus, at sufficient high levels of volatility, precautionary savings tend to dominate the dynamics of debt, making default less likely and therefore dampening the effects of volatility on credit ceilings.

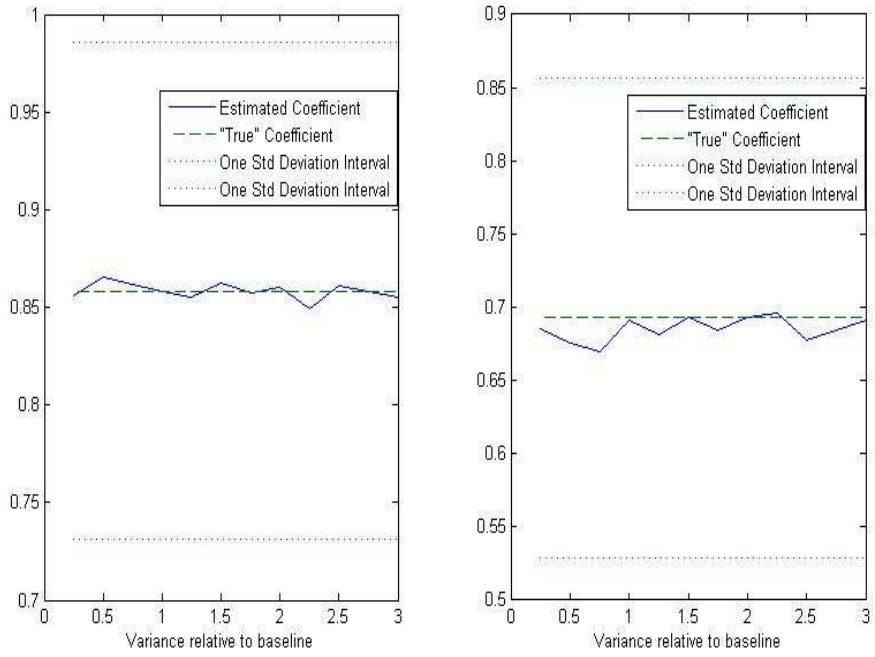
Figure 1.7: Average Net Asset Holdings, Debt Ceiling and Volatility



In Figure 1.8, I present the estimated coefficients of the VAR process for different levels of volatility, to check whether any of the results are driven by approximation errors in the Tauchen and Hussey (1991) discretization procedure. As it can

be seen, the estimated autoregressive coefficients do not vary significantly with the relative variance, such that the discretization process seems to be a relatively good approximation even for high levels of volatility.

Figure 1.8: Estimated VAR coefficients



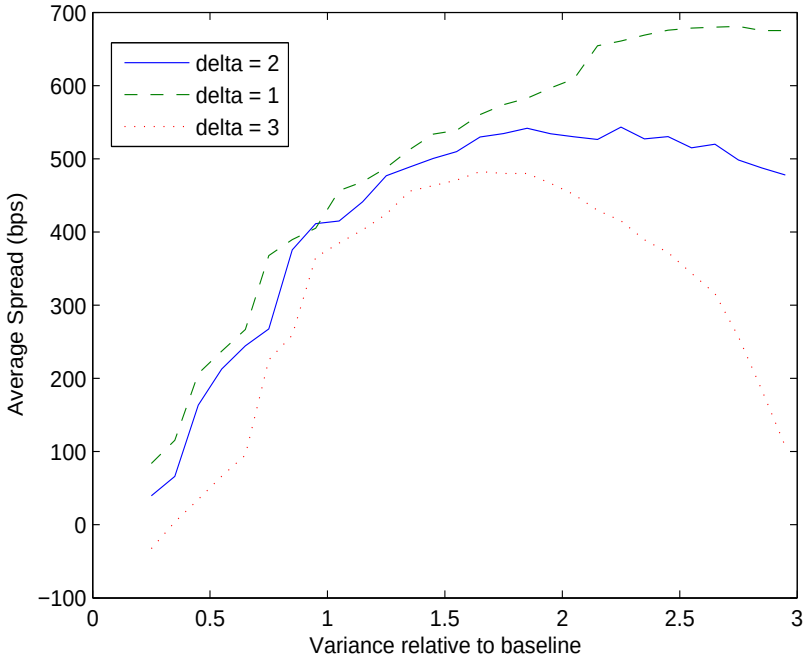
This section so far has shown that the empirical non-monotonic relationship between spreads and volatility can be explained by a model with incomplete asset markets and default risk based on the trade-off between precautionary motives and increased default risk due to higher volatility. Next, I present some more intuition for this result based on a sensitivity analysis.

A key parameter related to the intuition for the non-monotonic relationship between spreads and volatility presented in the previous section is the coefficient of

relative risk aversion. As discussed in subsection 1.3.4, lower levels of this parameter should imply that default is more likely for a given level of net foreign assets, given that the sovereign would be less concerned about precautionary motives. Therefore, spreads should be higher for lower levels of risk aversion. In addition, give that prudential behavior is less relevant, the precautionary-savings effect should kick-in at higher levels of volatility. Figure 1.9 shows the relationship for the baseline parametrization with a coefficient of relative risk aversion (δ) equal to 2, as well as 1 (log utility) and 3. As it can be seen in the graph, the previous reasoning is confirmed by the simulations. Higher levels of risk aversion are associated with lower spreads for all levels of volatility. Furthermore, the tipping point happens at lower levels of volatility the coefficient of relative risk aversion is higher, which also confirms the intuition that precautionary motives become more relevant.

The next series of sensitivity analyses relate to changes in the effective discount factor via a higher probability of remaining in power for the sovereign ($\pi = 0.9$ instead of 0.735), changes in the cost of default parameter ($\eta = 0.045$ instead of 0.031), and a lower average period of exclusion ($\alpha = 0.4$ versus 0.1). This higher value of α corresponds to an average exclusion period of 2.5 years after a default. Results are reported in Table 1.6. With respect to spreads, qualitatively all results go in the expected direction. A higher level of political stability induces the sovereign to be less impatient and therefore worry more about the future utility costs of default. This allows the sovereign to borrow at a substantially lower cost. For example, at the level of volatility estimated for Argentina, a higher value of π allows the

Figure 1.9: Average Simulated Spreads for Different Relative Risk Aversion Coefficients (δ)



government to pay on average the risk-free rate, while it contracts significantly less debt (10 percentage points less of a fraction of revenues than under the baseline parametrization). It is interesting to point out that for $\pi = 0.9$ the risk premium is very small and declines very fast with the level of volatility, which shows that the prudential motives dominate at all levels of volatility considered. This is confirmed by the fact that for $\pi = 0.9$ the average level of debt also declines faster with the level of volatility, in contrast with the other cases presented in Table 1.6 where there is a significant risk of default and average debt levels decline at a slower pace. Thus, a higher political stability induces more patience on behalf of the sovereign, reducing the demand for debt, the probability of default and the risk premium on sovereign debt.

Table 1.6: Robustness under Alternative Parameterizations

Variance relative to baseline	Average Spreads (basis points)				Average Asset Holdings/Revenues			
	Baseline	$\pi = 0.9$	$\eta = 0.045$	$\alpha = 0.4$	Baseline	$\pi = 0.9$	$\eta = 0.045$	$\alpha = 0.4$
0.25	40	6	24	738	-0.25	-0.24	-0.34	-0.12
0.50	213	6	123	746	-0.24	-0.20	-0.31	-0.15
0.75	268	5	170	779	-0.24	-0.17	-0.29	-0.17
1.00	418	0	238	752	-0.23	-0.13	-0.28	-0.18
1.25	477	0	362	1160	-0.23	-0.11	-0.26	-0.19
1.50	510	0	408	1445	-0.23	-0.09	-0.26	-0.22
1.75	534	0	495	2106	-0.23	-0.07	-0.26	-0.22
2.00	530	0	504	2940	-0.22	-0.05	-0.25	-0.24
2.25	543	0	496	3264	-0.22	-0.05	-0.24	-0.24
2.50	515	0	481	3240	-0.22	-0.03	-0.23	-0.25
2.75	498	0	484	4080	-0.21	-0.03	-0.22	-0.27
3.00	478	0	456	4753	-0.21	-0.02	-0.21	-0.28

With respect to the effects of changing the cost of default parameter η, the simulations show that the risk premium is smaller at all levels of volatility, which is reasonable, given that if default is more costly the sovereign will try harder not to default for a given level of debt. Average debt holdings are higher than under the baseline case and decrease also with the level of volatility. These results confirm the common wisdom that higher cost of default can be beneficial for the borrower, because it reduces the cost of credit and increases the supply of credit.

Finally, I analyze also the case of a higher probability of regaining access to capital markets after a default (α). In this case, the spreads are extremely high compared to those observed in the data. It should also be pointed out that for the range of volatility presented in Table 1.6 the risk premium is monotonically increasing. However, for a level of volatility 5.5 times larger than the baseline, a decline in spreads similar to the other cases is observed. This result is explained by the fact that a very high probability of being pardoned after a default reduces greatly any prudential behavior on the part of the sovereign. The simulated average debt levels under this parametrization are also consistent with this less prudent behavior. The average levels of debt holdings increase with volatility, contrary to all other parameterizations in which debt declines with volatility. Overall, these results again show the importance of the trade-offs between precautionary motives and a higher default risk in the presence of an increase in volatility.

1.5 Conclusions

This chapter analyzes the effects of volatility on sovereign default risk. Empirically, the papers establishes a "new" empirical fact, namely a non-monotonic relationship between spreads and macroeconomic volatility. While for low levels of volatility an increase in volatility is associated with an increase in the sovereign risk premium, for sufficiently high levels of volatility this relationship turns negative. This empirical relationship is robust to different estimation methods, samples and control variables. The paper also provides a quantitative model of default risk consistent with this feature and other characteristics of EME debt. In the model, there is a trade-off between a higher default probability due to the increase in the variance of shocks and an increase in precautionary savings motives by the sovereign due to a higher degree of volatility in public expenditures if the sovereign cannot access capital markets for some time after a default episode. At low levels of volatility, the first effect dominates, given that the welfare loss under autarky is relatively small in comparison to the present gain associated with debt. However, for sufficiently high levels of volatility, the cost of potential exclusion becomes more relevant and dominates the trade-off.

The analysis presented in the paper also yields some insights regarding the different behavior of EME in recent times regarding the accumulation of net foreign assets, especially in the form of reserves. Extremely volatile economies would tend to accumulate less debt - or hold more net assets - in order to self-insure against adverse shocks, while economies with lower levels of volatility would hold more debt.

This result has been standard in the incomplete asset market literature since Aiyagari (1994) and has also been applied by Durdu, Mendoza and Terrones (2007) to EME. However, this paper is the first to explain the mechanics of why EME countries with very high levels of volatility tend to have lower spreads than countries with lower levels of volatility. For example, the quantitative model as well as the empirical evidence imply that countries with very high revenue volatility like Korea and China would demand less debt and pay a lower risk premium than Argentina or Brazil. While a reduction in volatility in general is associated with an increase in social welfare, the simulations of the model presented in the paper show that for certain levels of volatility a reduction in volatility might increase the incentives to default on sovereign debt, which in general implies a reduction in the possibility to smooth consumption. The paper shows that higher political stability that induces more patience on behalf of the sovereign, as well as higher default costs, are associated with lower spreads and higher sustainable debt levels. Thus, a reform agenda that targets these problems in addition to volatility seems promising in reducing vulnerabilities. However, in order to reduce the pro-cyclicality of capital flows and increase international risk-sharing, additional mechanisms that allow for more state-contingent instruments and reduce the frictions that generate lack of commitment by the sovereign are needed.

Chapter 2

The Composition of Cross-Border Asset Positions

(co-authored with Marcel Fratzscher)

2.1 Introduction

The debate in the literature on trade in financial assets makes the important point that the type of foreign financing of cross-border investment may not pursue a random pattern, but follows some systematic pattern regarding the composition of capital flows. One key focus has been on the role of information frictions, with some important theoretical contributions arguing that portfolio investment should be more sensitive to information frictions than FDI or bank loans due to a lack of ownership control of the former (Razin, Sadka and Yuen 1998). A second important strand of the literature has concentrated on the role of institutions in influencing the composition of cross-border investment (Albuquerque 2003; Wei 2000a), with the empirical work still being inconclusive on which types of capital are most affected by the institutional environment.

The main contribution of this chapter is to test empirically for the existence of such patterns in private cross-border asset position and to identify its determinants in a bilateral country-pair setting. We concentrate on two determinants that have

been central in the literature on trade in financial assets: the role of information frictions, and the role of institutions as drivers of cross-border investment. We build on several seminal studies. In particular, Portes, Rey and Oh (2001) show that information frictions for a number of countries indeed exert a larger effect on portfolio equity and corporate debt than on government bond flows with the United States. The present chapter is complementary to this as well as other studies, but innovates in a number of ways. First, using a novel dataset on bilateral holdings, the present paper is the first that includes all types of capital, i.e. also FDI and other investment/loans, and thus allows for a systematic comparison of all types of investment in the capital account. This is an important difference because especially FDI and loans are the dominant types of investment received by many if not most emerging markets and developing countries.[1]

Second, the empirical analysis covers 77 countries and thus is much broader in scope by addressing the issue of cross-border investment also from an emerging market (EME) perspective. This allows us to investigate and indeed empirically confirm that the effect of information on cross-border investment exhibits a sizeable asymmetry across countries, exerting a larger influence on EMEs. Third, our empirical methodology is distinct from most of the literature by building on the trade literature on the border effect (Anderson and van Wincoop 2003; Cheng and Wall 2005) which stresses the importance of including source and host country fixed effects and shows that the exclusion of such fixed effects may generate a sizeable estimation bias.

[1]For example, in our sample the average share of FDI in total foreign investment is 46% for developing countries but only 22% for developed countries. Moreover, the share of combined FDI and loans accounts for 76% of total foreign inward investment for EMEs. We discuss these issues in detail in section 2.3.

Our empirical results show that information frictions have a substantial effect on the pecking order as we find that FDI and loans are the most sensitive and FPI equity and FPI debt securities the least sensitive types of investment to information frictions. For instance, the distance among country pairs has a 1.5 to 2 times larger impact on FDI stocks than on equity securities and debt securities. Similarly, we find loans to be as sensitive as FDI to information asymmetries, thus confirming and being in line with the literature on the capital structure of firms which has emphasized the special role of loans and its sensitivity to information (Myers 1984; Bolton and Freixas 2000). We use various proxies for information frictions - distance, the volume of bilateral telephone traffic, bilateral trade in newspapers and periodicals, and the stock of immigrants from the source country in the host - showing the robustness of this result to alternative specifications. While these empirical findings are new, we also confirm some of the existing findings, in particular that equity portfolio investment are not more sensitive to information frictions than debt securities (Portes, Rey and Oh 2001). Using our different econometric approach also reveals that the effects of information frictions tend to be larger than some found in the literature, though a precise comparison is impossible due to different country samples across studies.

Regarding the second determinant - the impact of institutions on the composition of cross-border investment - we make two key points. First, while many papers in the literature have focused on the effects of institutions on one or two particular types of capital flows, our analysis is the first to test for differences across all major

components of the capital account. Our results show that portfolio investment is much more sensitive than FDI or loans to a broad set of institutional indicators, such as the degree of information disclosure in local credit market regulations, as well as accounting standards in the host country. Portfolio investment also reacts much more strongly to the risk of expropriation and repudiation costs, confirming the hypothesis put forward by Albuquerque (2003) who argues that portfolio investment is easier to expropriate than other types of investment. Other hypotheses of the literature are, however, not confirmed by our analysis. For instance, portfolio investments in particular, but also loans, decrease substantially with the degree of corruption. By contrast, the stock of FDI is found to be less sensitive to corruption, which is consistent with some findings in the literature (see Daude and Stein, 2007) but contrary to others (e.g. Wei, 2000a). Overall, portfolio investment, and in particular equity securities, appear to be the most sensitive type of investment to institutional factors. Our results prove robust to various alternative proxies of institutions and country samples.

An additional point of the chapter is that we also study the impact of financial market development on the pecking order of cross-border investment positions. We find that portfolio investment is substantially more sensitive to the degree of market openness and development than FDI or loans. For instance, capital account liberalization and financial development change the *composition* of financial liabilities of a country by raising the share of portfolio investment substantially. Moreover, we find that the *volume* of FDI and loans is relatively insensitive to market develop-

ments as, for instance, capital account liberalization does not have a statistically significant effect on the volume or stock of FDI or loans. This is in line with the evidence for capital flows of previous studies that use a different empirical strategy (see e.g. Montiel and Reinhart, 1999, Magud and Reinhart, 2005).

Our findings have a number of policy implications. We underline the role of bilateral information frictions as a barrier to cross-border investment, in particular for FDI and loans. Importantly, the chapter emphasizes that FDI should not necessarily be seen as an unconditional blessing for host countries. We present evidence that the share of inward FDI and also foreign loans is highest for countries with weak institutions and poorly developed or badly functioning capital markets. Therefore, although FDI may have beneficial effects on the economy, a composition of foreign investment that is heavily tilted towards FDI is likely to be a signal of some fundamental weaknesses of the host country economy, thus providing support for the argument of Hausmann and Fernandez-Arias (2000) and Albuquerque (2003).

The remainder of the chapter is organized in the following way. The next section provides a brief overview of the literature on the determinants of capital flows and the pecking order of cross-border investment. Section 2.3 then outlines the empirical methodology and presents the data, together with a number of stylized facts on cross-border investment. The empirical results are discussed in sections 2.4 and 2.5, including various robustness and sensitivity tests. Section 2.6 concludes and offers a short discussion of policy implications.

2.2 Related Literature

Information frictions have been at the core of the debate on international capital flows.[2] Razin, Sadka and Yuen (1998) present a model that extends the pecking order argument from the corporate finance literature by Myres and Majlauf (1984) and Myres (1984) to international capital flows to analyze issues of capital taxation. In particular, they assume that FDI circumvents the informational problems completely, while portfolio debt and equity are subject to informational asymmetries where domestic investors observe the real productivity of the firm, while foreign investors do not. Therefore, FDI is the preferred form of financing in the presence of information frictions, followed by portfolio debt and then equity. Neumann (2003) presents a version of lending with moral hazard model by Gertler and Rogoff (1990) that focuses on the differences between international debt and equity financing. In contrast to Razin, Sadka and Yuen (1998), she assumes that ownership, even in the form portfolio equity, conveys some control and therefore information on the investment. Assuming that monitoring costs are decreasing in ownership, the implied pecking order is that FDI and equity are less costly ways of financing domestic investment than instruments that do not convey some degree of ownership and therefore information, like loans or debt.

Goldstein and Razin (2006) present a model that explains differences in volatility of FDI versus FPI through information asymmetries. Again the key assumption

[2]Portes and Rey (2005) and Portes, Rey and Oh (2001) provide references and a discussion of the finance literature related to information frictions. Also, see Harris and Raviv (1991) for an earlier survey on the empirical corporate finance literature on information frictions and asset markets.

is that FDI implies ownership control of the firm and therefore more information than FPI. In addition, FDI is subject to a fixed cost in contrast to FPI. They assume that foreign investors are subject to privately observed liquidity shocks which drive down the price of selling the asset before maturity due to a standard "lemons" problem. Thus, there is a trade-off between efficiency and liquidity for foreign investors. Under these conditions, they show that in equilibrium, if production costs are higher in developed countries, developed countries will receive more FPI that developing countries, given that it would be less profitable to pay the fixed cost associated to FDI. Finally, Mody, Razin and Sadka (2003) present a similar model that predicts also that more countries with good corporate governance attract more FPI. While several of these theoretical models assume different sensitiveness to information frictions across the different components of the capital account, it has not been tested systematically. Our paper tries to fill this gap in the literature. Despite limited empirical evidence, the perceived wisdom is that certain types of capital inflows are more beneficial for receiving countries than others. In particular, foreign direct investment (FDI) is generally seen as a "good" type of capital because it may promote growth in host countries by encouraging a transfer of technology and knowledge and by opening market access abroad (e.g. Aitken, Hanson and Harrison, 1997; Borensztein, De Gregorio and Lee, 1998).[3] On the other hand,

[3]For papers that find a positive and differential impact of FDI on domestic investment and economic growth compared to portfolio investments, see Bosworth and Collins (1999), Razin (2004), and Mody and Murshid (2005). However, the literature is not conclusive on the impact of FDI on growth or the channels through which it acts. Alfaro et al (2004) find that FDI has a positive impact on economic growth provided that the domestic financial sector is sufficiently developed. Alternatively, Borensztein, De Gregorio and Lee (1998) find a positive impact of FDI in interaction with human capital. For some evidence of the effects of capital flow composition on currency crises see Frankel and Rose (1996).

portfolio investment flows are considered to be more volatile, may exacerbate the magnitude of business cycles and also induce or at least worsen financial crises (e.g. Claessens, Dooley and Warner, 1995; Chuhan, Claessens and Mamingi, 1998; Sarno and Taylor, 1999).

Other papers have challenged the view of considering FDI necessarily as "good cholesterol" (e.g. Hausmann and Fernandez-Arias, 2000, Albuquerque, 2003). These papers show that actually the richest and least volatile economies, and countries with good institutions and well functioning markets, receive more foreign portfolio investment (FPI) and relatively less FDI from abroad as a fraction of total capital inflows.

Finally, the existence and functioning of markets is potentially an important determinant of foreign investment, and which is closely linked to the effects of information asymmetries. If markets are absent or are functioning poorly, firms may have no other choice than to use FDI to carry out an investment project (Hausmann and Fernandez-Arias, 2000). In this sense, FDI may function as a substitute for a functioning market mechanism. Thus, portfolio investment or bank loans may be preferred options for firms in an environment in which markets function well. In a broader sense, the quality of economic and political institutions is an analogy to the functioning of markets. In a country where property rights are poorly enforced and the risk of expropriation is high, firms may prefer FDI as it is harder to expropriate due to its information intensity and its inalienability (Albuquerque, 2003). Moreover, different types of investment may react differently to factors such as the degree of corruption, the functioning of the legal system and transparency (e.g. Wei, 2000b;

Faria and Mauro, 2004; Alfaro, Kalemli-Ozkan and Volosovych, 2005; Papaioannou, 2005; Gelos and Wei 2005). While several of these papers look at the effects on total capital flows, a specific type of flows, or the difference between portfolio and FDI, we contribute to the literature by analyzing the effect of institutional variables on all major concepts of the capital account. [4] Moreover, other important differences of the present paper with the existing literature are the focus on bilateral capital stocks as well as the methodological approach, which allows us to control for information asymmetries as well as for both source and host country factors. Finally, we also study the impact of financial market development on the composition of the capital account.

We view this research also as a complement to the literature on the cyclical determinants and characteristics of capital flows to emerging markets. Much of this literature has been focused on the drivers ("push" and "pull" factors) of *flows*. Several studies including Fernandez-Arias (1996), Calvo, Leiderman and Reinhart (1993), and Montiel and Reinhart (1999) focus on the relevance of "push" and "pull" factors regarding capital inflows towards Latin America or emerging economies during the 1990's. Using different methodologies, they tend to emphasize on external factors, like changes in the international (U.S.) interest rate as a key determinant of capital flows.[5] The focus of the present chapter is on the determinants of the size

[4]While Alfaro et al. (2005) also test the effects of institutions on the capital account, their focus is on aggregate capital flows (defined as the sum of FDI and portfolio investment flows). Therefore, they do not include bank loans nor do they test or comment on differences among the different types of investment. As we will show below, we find this distinction to be important as different types of capital react fundamentally differently to information frictions as well as institutions.

[5]See also Kaminsky, Reinhart and Vegh (2004) for evidence on the pro-cyclicality of capital

and composition of country portfolio *positions* rather than cyclical changes in flows.

2.3 Methodology, data and some stylized facts

This section gives an outline of the methodology and the main hypotheses for the empirical analysis (section 2.3.1). The subsequent presentation of our data (section 2.3.2) is then followed by a discussion of some key stylized facts of the pecking order of cross-border investment positions derived from our data (section 2.3.3).

2.3.1 Methodology and hypotheses

The empirical analysis consists of two parts. In the first part, we address the role of information frictions as a determinant of the pecking order of cross-border investment. The effects of information frictions are likely to be different across country pairs, i.e. one particular source country i may face a different degree of information costs and asymmetries vis--vis host country j than other source countries. For this purpose, we use a pseudo-fixed effects model of bilateral capital stocks held by residents of source country i in host country j:

$$log(1 + y_{ij}^k) = \alpha_i + \alpha_j + \beta^k X_{ij} + \varepsilon_{ij} \tag{2.1}$$

with y_{ij}^k is the holdings in US dollars of asset type k - where k = FDI, portfolio equity, portfolio debt securities, or loans - of residents of source country i in host

flows and macroeconomic policies in emerging markets.

country j; X_{ij} is a matrix that includes a proxy of bilateral information frictions and additional controls; and α_i and α_j are source country and host country fixed effects.

Given that in our first step we want to identify consistently the effect of information frictions - a pair-effect variable - we also need to control for all other relevant factors that affect the volume of bilateral investment from a particular source country by including source and host country dummies as well as other bilateral controls that are likely to affect the level of bilateral investment.[6] In the second step, we then try to explain the country fixed effects in order to understand which factors make host countries attractive places for investment.[7] The vector of coefficients of interest to us in this first step is β^k, i.e. we want to test whether different types of asset holdings have a different degree of sensitivity to various proxies of information frictions in X_{ij}. Note that we are interested in two separate hypotheses, one relating to the volume effect of information frictions (H_1) and the second one to the composition effect (H_2), i.e. that one type of financial asset holdings (k_1) reacts differently to information frictions than other types of assets (k_2):

$$\text{Volume effect hypothesis: } H_1 : \beta^k = 0$$

$$\text{Composition effect hypothesis: } H_2 : \beta^{k_1} = \beta^{k_2}$$

Our empirical analysis is cross-sectional, hence the explanatory power of the

[6]The inclusion of these country fixed effects has also been recommended by Anderson and van Wincoop (2003) in empirical trade models to control for multilateral resistance. In the case of investment positions, the problem of omitted and unobserved variables at the source or host level might also be more serious, given the lack of an overall accepted theory of bilateral investment positions that could be used as a benchmark for the empirical exercise.

[7]See Cheng and Wall (2005) for the relevance of such a two-step approach for trade. Lane and Milesi-Ferretti (2004) use a very similar approach to ours for the case of bilateral portfolio positions.

model comes purely from the cross-section, which is sensible given the focus on capital stocks and the fact that the independent variables on information frictions and institutions are mostly changing little over time.

Note also that we estimate the model using y_{ij}^k as the stocks in US dollars of asset type k. More precisely, we take the log value of the value in million US dollars and add one in order to be able to keep observations that are zero.[8] As there are several observations with a value of zero, it may raise the problem of censoring at zero. Although we use a Tobit estimator and a two-step Heckman procedure to show that the results are largely robust to this specification, our preferred estimation technique is via seemingly unrelated regressions (SUR). This means that we estimate the four equations for each type of capital k simultaneously. The advantage of the SUR estimator is that it improves the efficiency of the estimates by allowing for cross-correlations of the residuals of the four equations. Moreover, it allows us to directly test our pecking order hypothesis H_2 in the model.

Note that we do not "normalize" the dependent variable by dividing by host country GDP for H_1 on the volume effect or by dividing by total asset liabilities of host country j for H_2 on the pecking order effect, as is frequently done in the literature. The reason is that each of these "normalizations" imposes restrictions on the parameters of the model that may not hold. Although such a normalization is possible, our preferred specification is the one using the log of the levels of cross-border investment, given that it allows for more flexibility and it allows use to test

[8]However, in our final sample the number of zeros is relatively small. Out of the final 1116 observations, FDI values are all strictly positive, FPI portfolio has 187 zero observations, FPI debt 125, and Loans 84, respectively. Our results do not change if we drop these observations.

the volume and composition hypothesis in the same equation.[9]

More generally, although it may seem appealing to exclude the fixed effects in order to explicitly allow for including vectors of source country-specific variables X_i and of host country-specific variables X_j, this would imply excluding important unobserved components of relevant fixed effects and is likely to bias the estimators of interest β^k. We show below that the estimates of β^k indeed mostly change substantially when excluding the fixed effects.

In the second part of the analysis, our aim is to understand the factors that explain the host country fixed effects. More precisely, we want to understand *the role of markets and institutions in host countries as determinants of the composition of cross-border financial positions.* As these factors are symmetric, i.e. investors in all source countries face the same conditions in a particular host country, we use the fixed effects obtained from the gravity model (2.1) to test for the role of host country institutions and market conditions X_j on the pecking order and volume effects:

$$\alpha_j^k = \kappa^k + \lambda^k X_j + \mu_j^k, \tag{2.2}$$

where μ_j^k is an error term. Analogously to model (2.1), this specification allows us to formulate and test the two hypotheses with regard to the volume effect (H_3) and the pecking order effect (H_4) of financial market development and institutions:

$$\text{Volume effect hypothesis: } H_3 : \lambda^k = 0$$

$$\text{Composition effect hypothesis: } H_4 : \lambda^{k_1} = \lambda^{k_2}$$

[9]It should be pointed out that the country dummies capture the size effects of the source and host in an accurate way.

Our preferred estimator is again the SUR, and the same caveats and discussion apply to this second stage as to the estimation of model (2.1).

2.3.2 Data

As the focus of the paper is on the pecking order of cross-border investment, our data is on stocks of various types of foreign investment, rather than capital flows per se. We use three different data sources to construct a comprehensive database that covers all four categories of the financial account - or what is still often referred to as the capital account; two terms which we use interchangeably throughout the paper - i.e. for FDI, for portfolio investment - distinguishing also between equity and debt securities - and for loans.

For FDI, we use the UNCTAD database on bilateral FDI stocks. A database that is often employed in studies on FDI is the one provided by the OECD. However, the UNCATD database is more comprehensive as it includes both industrialized countries and developing countries. The UNCTAD data has annual entries in US dollars for around 90 reporting countries vis--vis most countries in the world from 1980 to 2003. Unfortunately, there are many missing entries, so that we do not have bilateral stocks for all country pairs. Moreover, country pairs are excluded from the analysis if there are no entries for the past ten years.

For portfolio investment, we use the Consolidated Portfolio Investment Survey (CPIS) by the IMF. It provides bilateral assets of portfolio equity and portfolio debt securities for 68 reporting countries.[10] We use the average figures for equity

[10]In fact, the effective number of reporting countries ends up being 67, because Pakistan reports

securities and for debt securities for 2001, 2002 and 2003. The CPIS also provides a breakdown between short-term and long-term debt securities. We conducted several tests but did not find systematic differences with this distinction, and thus ignore this dimension in the remainder of the paper.

For loans, we use the International Locational Banking Statistics (ILB) data provided by the Bank of International Settlement's (BIS). The database comprises aggregate assets as well as aggregate liabilities of banks in 32 reporting countries vis--vis banking and non-banking institutions in more than 100 partner countries, capturing exclusively private claims. The reported assets and liabilities capture mostly loans and deposits, but may also include other transactions that fall under portfolio or direct investment (see BIS 2003). To minimize this overlap, we use inter-bank claims, i.e. the data for assets and liabilities of banks in reporting countries vis--vis banks in partner countries. Although the number of reporting countries is smallest for this database, the fact that it includes data not only for assets but also for liabilities allows us to obtain a proxy also for asset holdings of non-reporting countries vis--vis reporting countries.

There are several caveats that are present for the various data sources. A first potential caveat is that the data stems from different sources, thus raising the issue of how comparable they are, though the definitions used are the same across sources. Moreover, one potentially important issue is that the data collection is generally based on the residence principle. This may imply that countries may report their asset holdings vis--vis their direct counterpart country but not vis--vis the country

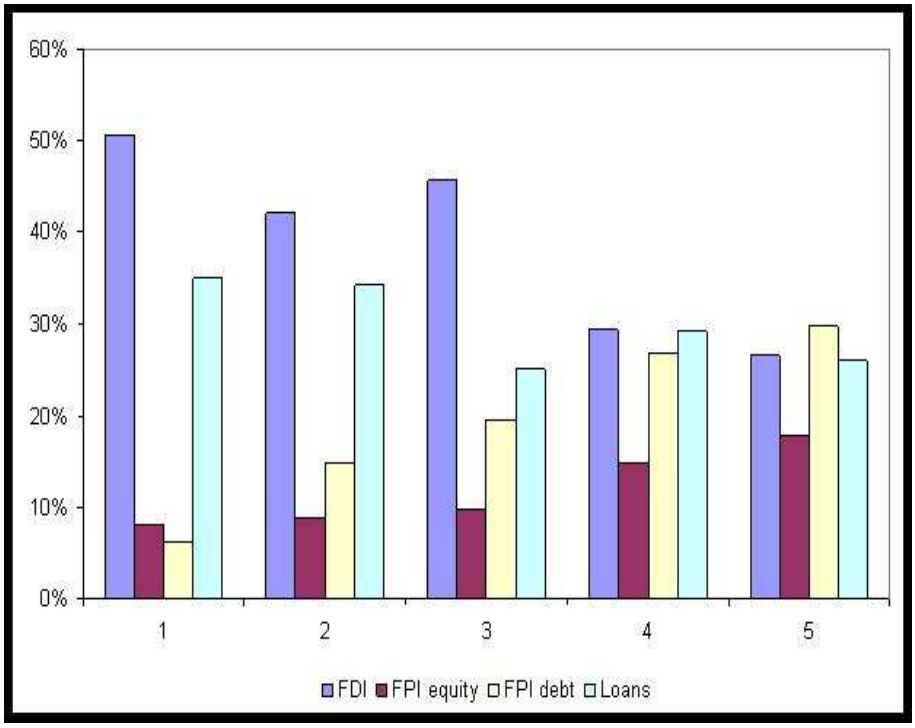
only missing data.

where the financial asset is ultimately invested. This of course would give enormous importance to financial centers as a lot of capital is channeled through these, but do not reflect the true bilateral holdings of financial assets. Hence we exclude financial centers from our analysis.

Moreover, note that our empirical analysis is purely cross-sectional for two reasons: due to the fact that capital stocks obviously change little from one year to the next and also due to data availability. Due to the potential importance of valuation changes and other special factors affecting the size of capital stocks in individual years, our cross-section is the average size of capital stocks over the five-year period of 1999-2003.

It is important to emphasize that we include only those country pairs for which all four types of asset holdings are available. This reduces the sample size to 77 countries. The appendix shows the countries which are included. It reveals that the sample includes 22 rich, industrialized countries and 55 mainly emerging markets, but also some poorer developing countries. The country sample for the EMEs is roughly balanced across regions with 12 in Africa/Middle East, 13 in Central and Eastern Europe, 13 in Asia and 17 in Latin America. The exclusion of many of the poorer developing countries is required by the fact that they do not have stock markets and/or bond markets. Thus the results on the composition of cross-border investment are not driven by the absence of stock and bond markets in less developed countries. Further tests focusing only on industrialized countries and only for emerging market economies (EMEs) are conducted below and show the robustness of the findings to different country samples.

Figure 2.1: Composition of Cross-border Investment Positions by GDP per capita Quintiles



Note: GDP per capita is measured as the average PPP GDP per capita over the period 1999-2003. The x-axis shows the first to fifth quintile of countries, ranging from those with the lowest to those with the highest GDP per capita. Sources: IMF CPIS and IFS; UNCTAD; BIS; authors' calculations.

2.3.3 Composition of cross-border investment: some stylized facts

Figure 2.1 shows for a broad set of developed and emerging market economies (EMEs) that the poorest countries have the highest shares and the richest the lowest shares of FDI in total capital stocks.

This stylized fact - as well as several others discussed in detail in the paper - makes the important point that the type of foreign financing of cross-border investment does not pursue a random pattern, but follows a certain "pecking order".

Table 2.1 presents some summary statistics for the different types of financial liabilities, i.e. the table shows the total stocks of different types of capital held

by foreigners in the host countries implied by the data described in the previous subsection. There are clear, systematic differences in the composition and volume of capital stocks across countries. First, developing countries receive on average a higher share of FDI and loans than developed countries. For example, the average share of FDI in total foreign capital for developing countries is 44% while in the case of the developed countries FDI amounts only to 22%. In contrast, the share of portfolio equity and portfolio debt holdings is significantly higher for developed countries. Second, in terms of the volume of investments, developed countries receive significantly higher volumes of all types of capital. Developed countries receive on average - as a ratio of their GDP - around 2.5 times more FPI portfolio, 6.6 times more FPI debt, 2 times more loans, and 1.3 times more FDI than developing countries.

Table 2.2 shows the correlation coefficients and the significance of investment shares with regard to selected indicators of income, market development and institutions. First, there is a large negative correlation of -0.38 between the share of FDI instocks and per capita income of a country. Loans are also negatively correlated, though the correlation coefficient is not statistically significant. The same finding applies to domestic financial market development - as proxied by the degree of capital account liberalization and by the ratio of credit to the private sector as percent of GDP: the more developed financial markets are, the lower the shares of FDI and loans a country receives. Figure 2.2 illustrates in more detail the relationships between these different types of capital and per capita GDP. Moreover, countries with a higher risk of expropriation (indicated by a lower value in the figure) receive a

Table 2.1: Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
EMEs / Developing Countries					
FDI share	55	0.46	0.22	0.1	0.9
Loans share	55	0.3	0.18	0	0.7
FPI debt share	55	0.14	0.11	0	0.4
FPI portfolio share	55	0.1	0.11	0	0.5
FDI/GDP	55	0.42	0.48	0	2.7
Loans/GDP	55	0.34	0.91	0	6.8
FPI debt/GDP	55	0.13	0.14	0	0.5
FPI equity/GDP	55	0.11	0.22	0	1.4
Developed Countries					
FDI share	22	0.22	0.1	0.05	0.38
Loans share	22	0.26	0.09	0.13	0.49
FPI debt share	22	0.35	0.16	0.03	0.66
FPI equity share	22	0.17	0.11	0.03	0.44
FDI/GDP	22	0.56	0.59	0.03	2.44
Loans/GDP	22	0.65	0.51	0.11	1.65
FPI debt/GDP	22	0.86	0.86	0.05	3.17
FPI equity/GDP	22	0.4	0.43	0.05	1.45
Total					
FDI share	77	0.394	0.23	0.05	0.92
Loans share	77	0.292	0.16	0.05	0.74
FPI debt share	77	0.198	0.16	0	0.66
FPI portfolio share	77	0.117	0.11	0	0.51
FDI/GDP	77	0.462	0.51	0.03	2.66
Loans/GDP	77	0.424	0.82	0.01	6.79
FPI debt/GDP	77	0.339	0.57	0	3.12
FPI equity/GDP	77	0.19	0.32	0	1.43

Sources: IMF CPIS and IFS; UNCTAD; BIS; authors' calculations.

Table 2.2: Correlation Matrix

	FDI share	Loans share	FPI debt share	FPI equity share
FDI share	1			
Loans share	**-0.514**	1		
FPI debt share	**-0.427**	**-0.338**	1	
FPI equity share	**-0.281**	**-0.296**	-0.057	1
GDP per capita (log)	**-0.405**	**-0.17**	**0.475**	**0.319**
Private Credit/GDP	**-0.357**	-0.106	**0.246**	**0.471**
KA Openness	-0.137	-0.152	**0.208**	**0.202**
Property Rights	**0.347**	0.147	**-0.342**	**-0.449**
GDP per capita growth	0.03	-0.144	-0.097	**0.287**

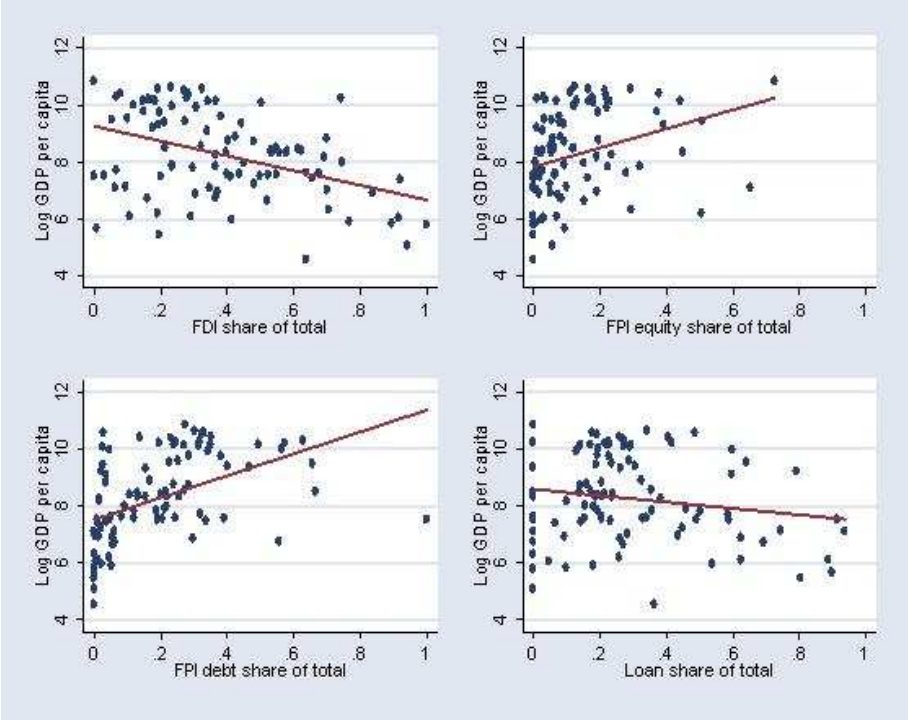
Note: Significant correlations at the 95% level are shown in bold.

significantly higher share of FDI and loans.

By contrast, both equity security and debt security holdings are strongly positively correlated with GDP per capita. Moreover, countries that have a large share of portfolio equity and debt stocks also have more developed domestic financial markets and better institutions. Moreover, when considering the correlation of the shares of different types of assets with the average growth rate of GDP per capita over 1980 - 2003, the correlations show that there is a positive and significant correlation only for portfolio investment.

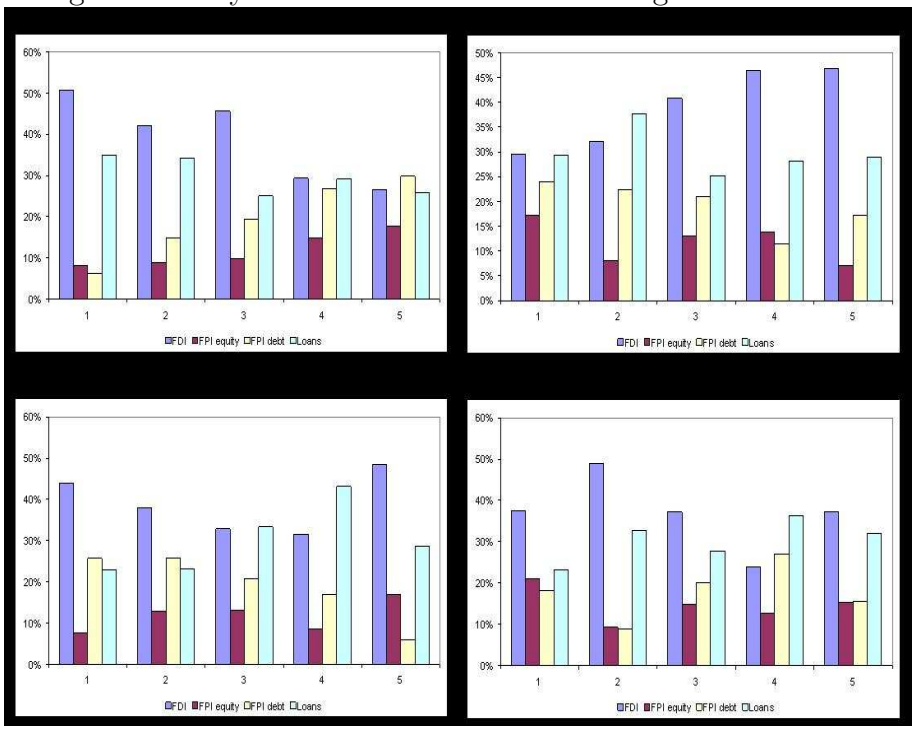
Figures 2.3 and 2.4 illustrate these points in more detail by showing the distributions of the shares of individual types of capital by quintiles of the variable of interest, e.g. starting with the quintile of countries with the lowest GDP per capita on the left and leading up to those with the highest GDP per capita (top left panel of Figure 2.3). The top right panel of Figure 2.3 shows that countries that had the highest volatility in GDP growth rates - as measured as the standard deviation of annual real GDP growth rates over the period 1980-2003 - also experienced the

Figure 2.2: Shares in Cross-Border Investment and GDP per capita



Sources: IMF CPIS and IFS; UNCTAD; BIS; authors' calculations.

Figure 2.3: Stylized facts: macro and exchange rate variables

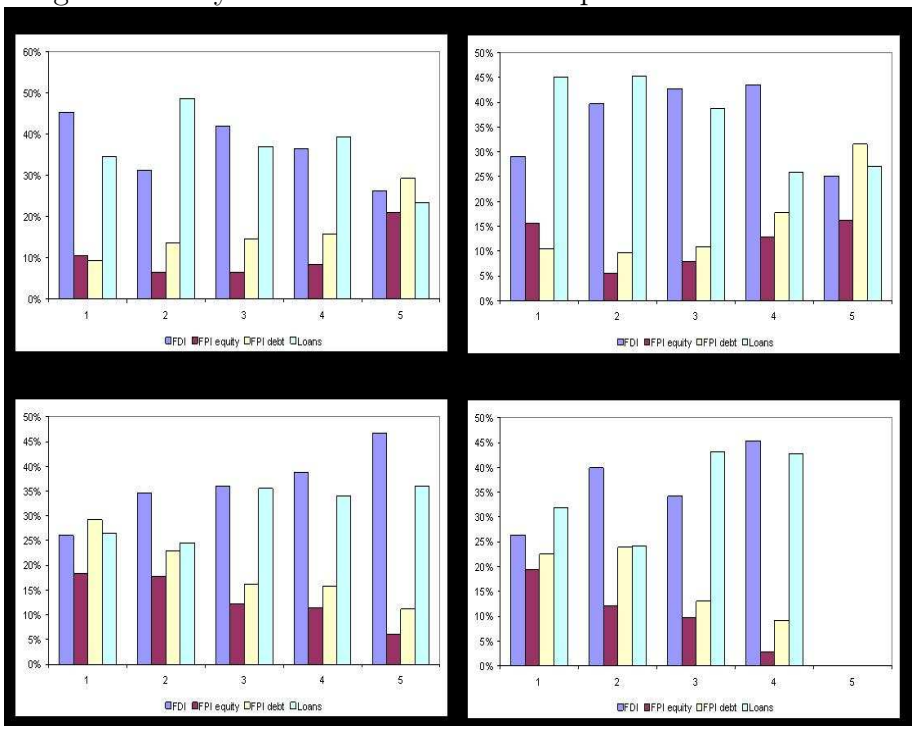


Notes: GDP growth volatility is the standard deviation of annual real GDP growth rates over the period 1980-2003. Exchange rate volatility is defined as the standard deviation of the monthly nominal exchange rate changes vis--vis the US dollar over the period 1980-2003. The x-axis shows the first to fifth quintiles of countries. Sources: IMF CPIS and IFS; UNCTAD; BIS; authors' calculations.

highest degree of output volatility.

Figure 2.4 shows corresponding charts for market development and various institutional indicators. For instance, countries with the least developed domestic financial markets - as proxied by credit to the private sector to GDP - have the highest share of the inward investment from abroad in the form of FDI and loans, which both fall as domestic financial development improves. Moreover, the bottom left panel of Figure 2.4 indicates that countries with higher corruption receive relatively more FDI and loans, and substantially less portfolio investment. Finally, also countries with a worse protection of property rights - as indicate by a rise in the

Figure 2.4: Stylized facts: market development and institutions



Notes: A higher value of the expropriation risk indicator means a lower degree of risk, and a larger indicator for property rights indicates a worse protection of property rights. The x-axis shows the first to fifth quintiles of countries. Sources: IMF CPIS and IFS; UNCTAD; BIS; authors' calculations.

indicator shown - have a larger share of FDI and loans and relatively fewer equity and debt securities.

Overall, these stylized facts provide some first, descriptive evidence that there is indeed a pecking order in cross-border investment, as the various types of foreign capital stocks are strongly correlated with indicators of market development and institutions. A detailed analysis of the causality underlying these relationships is provided in the subsequent sections.

2.4 The role of information frictions

We now turn to our econometric results. We start with the analysis of the role of information frictions (section 2.4), before presenting the findings with regard to the role of markets and institutions (section 2.5).

2.4.1 Benchmark results

What is the role of information frictions in explaining the pecking order of cross-border investment positions? A first important issue is how to measure information frictions. We start by following the common practice in the literature both on trade in goods and on trade in financial assets and proxy information frictions through the log geographic distance between country pairs. We then proceed by using various alternative measures for information.

Table 2.3 shows the results of our benchmark model (2.1), which includes in addition to distance a set of standard gravity variables, such as dummy variables on whether or not the two countries have a common language, have a common legal origin, colonial links, and whether they have a trade agreement or a joint investment treaty to facilitate cross-border investment. The results are compelling both with regard to our hypothesis H_2 about the composition of cross-border investment positions as well as with regard to the volume effects hypothesis H_1.

FDI and loans are substantially more sensible to changes in distance than portfolio equity and portfolio debt investment. The differences in the effects are sizeable as the coefficients for FDI and loans are both around -1.2 as compared

Table 2.3: Information frictions: distance

	FDI		**FPI equity**		**FPI debt**		**Loans**		**Significance for pecking order:** FDI vs. equity	FDI vs. debt	FDI vs. loans	Equity vs. debt	Equity vs. loans	Debt vs. loans
distance	-1.180	***	-0.676	***	-0.808	***	-1.231	***	0.00	0.00	0.52	0.07	0.00	0.00
	(0.068)		(0.057)		(0.063)		(0.068)							
common language	0.433	***	0.324	**	0.111		0.247		0.54	0.11	0.32	0.22	0.67	0.46
	(0.160)		(0.135)		(0.149)		(0.161)							
common legal origin	0.713	***	0.568	***	0.395	***	0.438	***	0.24	0.02	0.04	0.15	0.31	0.74
	(0.112)		(0.094)		(0.104)		(0.113)							
colonial links	0.924	***	0.333	*	0.198		0.321		0.01	0.01	0.02	0.56	0.96	0.62
	(0.216)		(0.182)		(0.200)		(0.217)							
trade agreement	-0.167		-0.336	**	0.617	***	0.230		0.38	0.00	0.06	0.00	0.00	0.05
	(0.175)		(0.147)		(0.163)		(0.176)							
investment treaty	0.260	**	0.027		0.094		0.429	***	0.06	0.24	0.20	0.58	0.00	0.01
	(0.113)		(0.095)		(0.105)		(0.113)							
# observations	1116		1116		1116		1116							
R-squared	0.828		0.907		0.881		0.847							

The right-hand side of the table shows the p-values for the equality tests across distance coefficients. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

to point estimates of -0.67 and -0.80 for portfolio equity and debt. Also, these differences are highly statistically significant as shown in the right-hand-side columns of the table.[11]

It is interesting to point out that the size of the estimated coefficients for distance is in line with the empirical literature on trade in assets, e.g. Portes and Rey (2005) report a coefficient of -0.89. In addition, the effect of distance on asset trade is greater than its effect on trade in goods, which according to Leamer and Levinsohn (1995) is mostly around -0.6. In the case of goods, Grossman (1998) shows that for sensible values of transportation costs, the distance elasticity should be around -0.03.[12] Thus, he concludes that information costs must be behind the

[11]Note that while the information variables have a large effect on FDI than on portfolio investment (our pecking order hypothesis), the goodness-of-fit of the model for FDI is generally somewhat lower than that or portfolio investment equity and debt. This finding comes from the lower explanatory power of the fixed effects in the models for FDI, which can be seen by estimating the models including only the fixed effects.

[12]For a recent survey on the importance of trade costs see Anderson and van Wincoop (2004).

empirical result that the effect is around 20 times larger. For trade in assets it therefore seems that the case for distance reflecting information rather than trade costs is even more compelling.

We explore this information hypothesis in more detail below. The point estimates for the variables on what is often referred to as "familiarity" effects are sensible as they have the correct sign and are mostly statistically significant. Like for the distance variable, FDI reacts much more strongly to these familiarity effects than this is the case for portfolio equity and debt investment. For instance, when both countries speak the same language FDI stocks in host countries are 54 percent higher and portfolio equity investment 38 percent larger, whereas portfolio debt investment and loans are not statistically significantly different.[13]

2.4.2 Robustness: alternative proxies for information frictions

How robust are these findings to different proxies for information frictions? Clearly, it may seem odd to proxy information frictions for trade in financial assets through geographic distance as one would expect that geography should have little to do with financial transactions. However, the literature on capital flows has repeatedly found distance to be highly significant, see e.g. Portes and Rey (2005) for equity flows. Nevertheless, it is useful to employ alternative and ideally more direct proxies for information frictions. We use three proxies: the amount of telephone traffic between two countries, the trade in newspapers, and bilateral stock of

[13]Note that the coefficients for the dummy variables are not strictly elasticities. The calculation of the elasticity, for instance for the former variable can be done by using: exp(0.43) - 1 = 0.537.

immigrants of the source country living in the host country and vice versa.

The intuition for the use of these variables as proxies for the degree of information frictions is straightforward. The volume of telephone call traffic was proposed first by Portes and Rey (2005) and has been used in the most recent empirical literature.[14] Telephone traffic is a proxy of the amount of information that flows between both countries and it is assumed that a larger volume of information flows - controlling additionally for the size of both economies - implies less informational frictions. A similar rationale has been put forward to use trade in newspapers and periodicals by Nicita and Olarreaga (2000) to study information spillovers in goods markets. They report a high correlation of trade in newspapers with telephone traffic (a simple correlation of 0.77), but prefer their measure due to a greater data availability. Finally, Gould (1994) analyzes the impact of the stock of immigrants in the U.S. on trade between the U.S. and the immigrants' country of origin. The intuition is that immigrants have better information on the markets and institutions in their home country which would lower transaction costs.

Table 2.4 shows the results when adding telephone traffic to the benchmark model. One important result is that when adding telephone traffic it is not only highly significant, but distance becomes insignificant for FDI and portfolio equity and debt investment. Distance retains its significance for loans, albeit with a much smaller coefficient of -0.34 as compared to -1.23 in the benchmark model of Table 2.3. It is important to point out that this result is not driven by multicollinearity

[14]See Portes, Rey and Oh (2001) for the case of equity flows; Loungani, Mody and Razin (2002), as well as Di Giovanni (2005) for FDI; and Mody, Razin and Sadka (2003) for FDI and equity.

Table 2.4: Information frictions: distance versus telephone traffic

	FDI		**FPI equity**		**FPI debt**		**Loans**		**Significance for pecking order:** FDI vs. equity	FDI vs. debt	FDI vs. loans	Equity vs. debt	Equity vs. loans	Debt vs. loans
distance	-0.072		-0.091		-0.071		-0.341	**	0.90	1.00	0.10	0.90	0.12	0.09
	(0.130)		(0.112)		(0.131)		(0.134)							
telephone traffic	0.721	***	0.447	***	0.399	***	0.595	***	0.00	0.00	0.23	0.63	0.15	0.06
	(0.083)		(0.072)		(0.084)		(0.086)							
common language	-0.016		0.130		0.126		-0.144		0.49	0.56	0.57	0.98	0.22	0.22
	(0.181)		(0.157)		(0.184)		(0.187)							
common legal origin	0.505	***	0.448	***	0.327	**	0.402	***	0.70	0.30	0.52	0.42	0.77	0.63
	(0.126)		(0.109)		(0.128)		(0.130)							
colonial links	0.353		-0.055		-0.177		-0.357		0.13	0.10	0.01	0.66	0.30	0.53
	(0.233)		(0.201)		(0.236)		(0.240)							
trade agreement	-0.106		-0.299	*	0.845	***	0.304		0.37	0.00	0.07	0.00	0.01	0.02
	(0.184)		(0.159)		(0.186)		(0.190)							
investment treaty	0.078		0.314	**	0.313	*	0.591	***	0.21	0.29	0.01	1.00	0.17	0.16
	(0.162)		(0.140)		(0.164)		(0.167)							
# observations	595		595		595		595							
R-squared	0.873		0.928		0.884		0.850							

The right-hand side of the table shows the p-values for the equality tests across coefficients for information friction variables. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

problems between telephone traffic and distance, given that the simple correlation between both variables in our sample is just -0.13. In addition, although the sample is reduced due the availability restrictions on telephone traffic, if we re-estimate the regression from Table 2.3 for this sub-sample, the distance coefficients are negative, significant, and not different from the estimates for the whole sample. Therefore, distance seems to be a proxy for overall information frictions in asset trade. When comparing the pecking order effect of information frictions, telephone traffic is again significantly larger for FDI and also loans than for equity and debt.

Table 2.5 gives the estimates for the other two alternative information proxies as well as for a model that instead includes the first principal component of the three proxies. We include the principal component of all three alternative proxies

because it may help alleviate measurement errors related to each individual variable.[15] The results confirm that FDI and loans are more sensitive to information frictions. However, distance remains significant in most of these specifications, and with the same order as before as information generally has the largest effects on FDI and loans and the smallest impact on portfolio equity and debt.

2.4.3 Robustness: Alternative model specifications and controls

Finally, we conduct a battery of sensitivity tests by using alternative econometric specification and by adding various controls to the empirical specification of the model. A first test is to ask whether the results are robust to taking ratios, of GDP or of total capital stocks, as dependent variables, which is a commonly done in the literature, despite the controversial underlying assumptions behind such a specification, as discussed in section 2.3.1. Table 2.6 shows the estimates for the benchmark model where the dependent variable is measured as a percentage of source and host country GDP and as a percentage of total capital flows from source country i to host country j. The results indicate that although the coefficients are very different, our overall results with regard to the pecking order still hold: FDI and loans are in both specifications significantly and substantially larger than portfolio equity and portfolio debt investment.

As the next step, we investigate the robustness of the results to using alternative econometric estimators. Table 2.7 provides the results for a Tobit estimator and

[15] About 81 percent of the total variation in the three alternative proxies is explained by their first principal component. The factor loadings are high for all three variables, so that they seem to be well represented by the first factor.

Table 2.5: Information frictions: alternative information proxies

	FDI						FPI equity						FPI debt						Loans					
	(1)		(2)		(3)		(1)		(2)		(3)		(1)		(2)		(3)		(1)		(2)		(3)	
distance	-1.021	***	-0.736	***	-0.225		-0.602	***	-0.521	***	-0.258	**	-0.722	***	-0.345	***	-0.073		-1.062	***	-0.855	***	-0.438	***
	(0.073)	E,D	(0.115)	E,D	(0.148)	L	(0.062)	F,L	(0.085)	F,D,L	(0.111)		(0.069)	F,L	(0.095)	F,E,L	(0.124)		(0.074)	E,D	(0.122)	E,D	(0.163)	F
trade in newspapers	0.064	***					0.030	***					0.035	***					0.069	***				
	(0.012)	E,D					(0.010)	F,L					(0.011)	F,L					(0.012)	E,D				
stock of foreigners			0.180	***					0.105	***					0.107	**					0.127	**		
			(0.050)						(0.037)						(0.041)						(0.053)			
principal component					0.498	***					0.298	***					0.209	***					0.406	***
					(0.087)	E,D					(0.065)	F					(0.073)	F,L					(0.096)	D
common language	0.364	**	0.244		0.066		0.292	**	0.146		0.128		0.073		-0.069		0.097		0.173		-0.089		0.082	
	(0.159)		(0.207)		(0.229)		(0.135)		(0.153)		(0.172)		(0.148)		(0.172)		(0.191)		(0.159)		(0.220)		(0.252)	
common legal origin	0.665	***	0.767	***	0.759	***	0.545	***	0.451	***	0.418	***	0.368	***	0.654	***	0.712	***	0.386	***	1.012	***	0.967	***
	(0.111)	D,L	(0.166)	E	(0.186)	E	(0.094)		(0.123)	F,L	(0.139)	F,D,L	(0.104)	F	(0.138)	L	(0.155)	E	(0.112)	F	(0.176)	E,D	(0.204)	E
colonial links	0.778	***	-0.274		-0.380		0.265		-0.279		-0.358		0.118		-0.071		-0.324		0.166		-0.577		-0.597	
	(0.215)	E,D,L	(0.357)		(0.370)		(0.182)	F	(0.264)		(0.278)		(0.201)	F	(0.296)		(0.309)		(0.216)	F	(0.378)		(0.407)	
trade agreement	-0.162		0.241		0.171	D	-0.333	**	-0.037		0.022		0.620	***	0.917	***	0.693	***	0.235		0.438	**	0.446	**
	(0.173)	D,L	(0.197)	D	(0.205)		(0.147)	D,L	(0.146)	D,L	(0.154)	D,L	(0.162)	F,E,L	(0.163)	F,E,L	(0.172)	F,E	(0.174)	F,E,D	(0.209)	E,D	(0.226)	E
investment treaty	0.218	*	-0.026		-0.435		0.007		0.334	**	0.318		0.071		0.617	***	0.698	***	0.385	***	0.483	**	0.766	**
	(0.112)	E	(0.225)	D,L	(0.279)	E,D,L	(0.095)	F,L	(0.167)		(0.209)	F	(0.105)	L	(0.187)	F	(0.233)	F	(0.112)	E,D	(0.239)	F	(0.307)	F
# observations	1116		474		332		1116		474		332		1116		474		332		1116		474		332	
R-squared	0.832		0.864		0.876		0.908		0.928		0.938		0.882		0.904		0.913		0.851		0.842		0.839	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_2, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

Table 2.6: Information frictions: Ratios as % of GDP and total capital stocks

	FDI		FPI equity		FPI debt		Loans		FDI		FPI equity		FPI debt		Loans	
	Ratio as % of GDP								Ratio as % of total capital stocks							
distance	-0.005	***	-0.001	***	-0.002	***	-0.005	***	-0.282	***	0.086		0.051		-0.339	***
	(0.000)	E,D	(0.000)	F,D,L	(0.000)	F,E,L	(0.000)	E,D	(0.065)	E,D	(0.062)	F,L	(0.062)	F,L	(0.050)	E,D
common language	0.004	***	0.001		0.000		-0.003	*	0.097		0.012		-0.238	*	-0.286	**
	(0.001)	E,D,L	(0.000)	F,L	(0.000)	F,L	(0.001)	F,E,D	(0.150)	L	(0.142)		(0.143)		(0.115)	F
common legal origin	0.000		0.001	**	0.002	***	0.001		0.246	**	0.212	**	0.021		0.109	
	(0.000)	D	(0.000)	D	(0.000)	F,E	(0.000)		(0.104)		(0.098)		(0.099)		(0.080)	
colonial links	0.003	**	0.002	***	0.003	***	0.005	***	0.457	**	-0.100		0.009		-0.102	
	(0.001)		(0.000)	L	(0.000)		(0.001)	E	(0.204)	E,L	(0.193)	F	(0.194)		(0.157)	F
trade agreement	0.001		0.000		0.005	***	-0.001		-0.219		-0.335	**	0.482	***	-0.117	
	(0.001)	D	(0.000)	D	(0.000)	F,E,L	(0.001)	D	(0.159)	D	(0.151)	D	(0.151)	F,E,L	(0.122)	D
investment treaty	-0.003	***	-0.001	**	-0.001		-0.003	***	-0.058		-0.002		-0.081		0.293	***
	(0.000)	E,D	(0.000)	F,L	(0.000)	F,L	(0.000)	E,D	(0.121)	L	(0.115)	L	(0.115)	L	(0.093)	F,E,D
# observations	1027		1027		1027		1027		842		842		842		842	
R-squared	0.323		0.499		0.549		0.369		0.985		0.932		0.937		0.756	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_2, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

for an OLS estimator without source and host country fixed effects. The estimates of the Tobit model are in line with those obtained from our OLS benchmark. Recall that the tobit model is a non-linear estimator that uses a mixture of a continuous distribution over the non-censored observations and a discrete distribution for the censored ones. The point estimates shown in the table are the marginal effects evaluated at the mean of the independent variables. Hence the size of the marginal effects is not so meaningful.

There are some interesting differences between the models with and without fixed effects. The model without fixed effects is estimated by including nominal GDP (in US dollar) and population of both the source country and of the host country instead of the fixed effects. There are two important points to note from the results. First, almost all point estimates for the proxies of information frictions

are substantially different from those of the benchmark fixed-effects model. This lends support to our point made above that it is important to estimate the model by including fixed effects as otherwise the point estimates are biased due to omitted variables. Nevertheless, even without the fixed effects our pecking order hypothesis is confirmed. Second, note that the hypothesis that the point estimates of the GDP variables are equal to one is rejected in almost all equations. This is a noteworthy fact because it stresses that a "normalization" of the model, i.e. including the dependent variables as ratios of GDP imposes incorrect restrictions on the parameters of the model.[16] Next, we test for the presence of asymmetries in the effects of information fictions across samples. In particular, it is possible that some types of countries are much more sensitive to information than others; for instance those where information is already very scarce. Table 2.8 shows the results when estimating the benchmark model (2.1) separately for when only industrialized countries and when only EMEs are the host countries. Overall, the results confirm that FDI and loans are most sensitive to information frictions.

Moreover, some interesting differences across country groups emerge. In particular, capital stocks are much more sensitive to information and familiarity effects when the host country is an emerging market economy. The elasticity for FDI, for instance, is -1.54 for EMEs but only -0.89 for industrialized countries. Investment in EMEs also appears to be more sensitive to the common language and the colonial links. Taken together, these findings confirm our hypothesis on the pecking order,

[16]We also tested for the importance of censoring, due to a few of the observations in our sample being zero, by using Heckman's (1979) two-step procedure. While the results are not shown for brevity reasons, the point estimates are very similar, underscoring the there is no significant bias stemming from a censoring problem in our data.

Table 2.7: Information frictions: Alternative Estimators

	FDI		FPI equity		FPI debt		Loans		FDI		FPI equity		FPI debt		Loans	
	Without fixed effects								Tobit estimator							
GDP - source country	1.985	***	2.167	***	1.821	***	1.100	***								
	(0.065)	E,D,L	(0.062)	F,D,L	(0.069)	F,E,L	(0.074)	F,E,D								
GDP - host country	0.854	***	1.647	***	1.386	***	1.137	***								
	(0.045)	E,D,L	(0.043)	F,D,L	(0.048)	F,E,L	(0.051)	F,E,D								
Population - source cty	-1.108	***	-1.543	***	-1.100	***	-0.106									
	(0.071)	E,L	(0.067)	F,D,L	(0.075)	E,L	(0.080)	F,E,D								
Population - host cty	-0.093	*	-0.650	***	-0.619	***	-0.326	***								
	(0.051)	E,D,L	(0.048)	F,L	(0.054)	F,L	(0.058)	F,E,D								
distance	-0.462	***	-0.181	***	-0.460	***	-0.717	***	-1.072	***	-0.988	***	-0.954	***	-1.445	***
	(0.064)	E,L	(0.061)	F,D,L	(0.067)	E,L	(0.073)	F,E,D	(0.051)		(0.056)		(0.057)		(0.054)	
common language	0.949	***	1.263	***	0.309		0.307		0.641	***	0.556	***	0.425	***	0.183	
	(0.179)	E,D,L	(0.169)	F,D,L	(0.188)	F,E	(0.202)	F,E	(0.134)		(0.125)		(0.127)		(0.114)	
common legal origin	0.940	***	0.603	***	0.574	***	0.805	***	0.704	***	0.547	***	0.380	***	0.271	***
	(0.146)	E,D	(0.138)	F	(0.154)	F	(0.165)		(0.092)		(0.090)		(0.091)		(0.080)	
colonial links	1.181	***	0.729	***	0.889	***	1.370	***	1.096	***	0.917	***	0.456	**	0.898	***
	(0.282)		(0.267)	D	(0.297)	E	(0.319)		(0.167)		(0.168)		(0.176)		(0.146)	
trade agreement	0.486	***	0.723	***	1.576	***	0.837	***	0.592	***	0.453	***	0.929	***	0.011	
	(0.181)	E	(0.172)	F,D	(0.191)	E,L	(0.205)	D	(0.146)		(0.146)		(0.153)		(0.152)	
investment treaty	0.310	**	-0.153		0.048		0.504	***	-0.129		-0.039		0.002		0.579	***
	(0.125)	E	(0.119)	F,L	(0.132)	L	(0.142)	E,D	(0.086)		(0.087)		(0.088)		(0.074)	
# observations	1030		1030		1030		1030		1116		1116		1116		1116	
(Pseudo) R-squared	0.651		0.757		0.679		0.589		0.357		0.486		0.418		0.369	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_2, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

but also underline the presence of important asymmetries in the effect of information frictions.

One set of explanations that we have not analyzed so far is risk sharing or risk diversification as a driver of cross-border investment. The motivation for the type and direction of cross-border capital flows may not only be information frictions and institutions but also the attempt to diversify idiosyncratic, home-country risk. Obstfeld and Rogoff (2000), Lane and Milesi-Ferretti (2004) and Aviat and Courdacier (2007) argue that a source country that receives a high share of its imports from a particular host country will want to acquire more capital in this specific host country in order to ensure itself against terms of trade shocks to this country. Extending this argument to risk diversification, it may be optimal for investors to

Table 2.8: Information frictions: Developed countries versus emerging market economiess

	FDI		FPI equity		FPI debt		Loans		FDI		FPI equity		FPI debt		Loans	
	Developed Countries								Emerging Market Economies							
distance	-0.893	***	-0.693	***	-0.513	***	-1.047	***	-1.543	***	-0.589	***	-1.019	***	-1.595	***
	(0.097)	E,D	(0.076)	F,D,L	(0.076)	F,E,L	(0.096)	E,D	(0.106)	E,D	(0.095)	F,D,L	(0.097)	F,E,L	(0.100)	E,D
common language	0.097		0.153		0.175		-0.091		0.942	***	0.444	*	0.336		0.975	***
	(0.203)		(0.158)		(0.159)		(0.200)		(0.260)	E,D	(0.232)	F,L	(0.238)	F,L	(0.244)	E,D
common legal origin	0.975	***	0.655	***	0.393	***	0.853	***	0.550	***	0.543	***	0.411	**	-0.104	
	(0.144)	E,D	(0.112)	F,D	(0.113)	F,D,L	(0.142)	D	(0.177)	L	(0.158)	L	(0.162)	L	(0.167)	F,E,D
colonial links	0.681	**	0.326		0.397	*	-0.218		0.998	***	0.083		0.387		0.851	***
	(0.294)	L	(0.229)		(0.231)	L	(0.291)	F,D	(0.330)	E	(0.294)	F,L	(0.302)		(0.310)	E
trade agreement	0.206		-0.183		1.099	***	0.441	**	0.212		1.226	*	0.808		0.663	
	(0.218)	D	(0.170)	D,L	(0.171)	F,E,L	(0.216)	E,D	(0.748)		(0.667)		(0.684)		(0.702)	
investment treaty	0.150		0.079		0.374	**	0.879	***	0.238	*	0.016		-0.065		-0.006	
	(0.224)	L	(0.175)	L	(0.176)	L	(0.222)	F,E,D	(0.140)	D	(0.125)		(0.128)	F	(0.132)	
# observations	573		573		573		573		543		543		543		543	
R-squared	0.872		0.928		0.917		0.848		0.780		0.857		0.842		0.854	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_2, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

invest relatively more in those countries with the lowest or even a negative degree of output correlation to its own.

We therefore add to our benchmark model imports of source country i from host country j (see left panel of Table 2.9) to investigate whether the findings for information frictions change when controlling for proxies of risk sharing. The table shows that trade is indeed positively correlated with all four types of capital investment. As an alternative control, we include bilateral real exchange rate volatility, measured over the period 1990-2003, as a regressor (middle panel of Table 2.9) in order to test whether uncertainty and risk affects cross border investment. It is, however, found to be significant only for investment in debt securities, and to a lesser degree for FDI.[17] We also attempt to control for the effect of global factors on cross-border investment. The intuition is that two countries that exhibit a very

[17]We also tested for the interaction effect of exchange rate volatility and information, but did not find any additional effect of this interaction in the empirical model.

different responsiveness to global shocks should also have less bilateral investment. We use daily US short-term interest rate changes as our proxy for global shocks, and take the difference in the reaction of short-term interest rates between the source country and host country as our measure of the different response to global shocks.[18] The right panel of Table 2.9 shows that the difference in the response to such global shocks indeed reduces bilateral portfolio investment and loans, though not FDI.

It is important to stress that trade, exchange rate volatility and possibly are likely to be to some extent endogenous to cross-border investment and one would need to find suitable instruments if one wanted to investigate the link between risk sharing and capital flows. However, the important point to note for the objective of this paper is that information frictions as proxied by distance (or other information proxies when substituted for distance) retain their significance and the pecking order of FDI and loans to be the most sensitive to information frictions and portfolio investment the least sensitive is confirmed.[19]

Overall, the first key result that we take from this section is that there is a clear pecking order with regard to information frictions. FDI and loans are substantially more sensitive to information frictions than portfolio investment. The differences are large and statistically significant. These findings are also robust to several alternative proxies for information frictions, in particular when using tele-

[18]Short-term interest rates for most countries are 3-month money market rates, if available. The estimation is based on daily interest rate changes over the period 1990 to 2004.

[19]As a final check, we find that the results are robust to using alternative country samples, i.e. our pecking order hypothesis in that FDI and loans are most sensitive to information frictions is confirmed for both emerging market countries as well as industrialized countries. Results are available upon request.

Table 2.9: Robustness tests with trade, exchange rate volatility and global interest rate shocks as controls

	FDI		**FPI equity**		**FPI debt**		**Loans**		**FDI**		**FPI equity**		**FPI debt**		**Loans**		**FDI**		**FPI equity**		**FPI debt**		**Loans**	
	With control for trade								**With control for exchange rate volatility**								**With control for global interest rate shocks**							
distance	-0.692	***	-0.362	***	-0.689	***	-0.773	***	-1.232	***	-0.655	***	-0.694	***	-1.246	***	-0.995	***	-0.605	***	-0.563	***	-1.063	***
	(0.088)	E	(0.074)	F,D,L	(0.083)	E	(0.088)	E	(0.073)	E,D	(0.062)	F,L	(0.068)	F,L	(0.074)	E,D	(0.079)	E,D	(0.063)	F,L	(0.076)	F,L	(0.083)	E,D
trade - imports	0.384	***	0.247	***	0.119	***	0.382	***																
	(0.047)	E,D	(0.040)	F,D,L	(0.044)	F,E,L	(0.047)	E,D																
Exchange rate volatility									10.875	*	-4.388		-23.816	***	3.136	*								
									(5.968)	D	(5.028)	D	(5.502)	F,E,L	(6.004)	D								
Global interest rate shock																	0.191		-0.389	***	-0.345	**	-0.322	**
																	(0.150)	E,D,L	(0.119)	F	(0.142)	F	(0.158)	F
common language	0.384	**	0.334	**	0.037		0.176		0.454	***	0.316	**	0.066		3.136	*	0.368	**	0.257	*	0.050		0.025	
	(0.161)	D	(0.136)	D	(0.152)	F,E	(0.162)		(0.160)		(5.028)	D	(5.502)	E	(6.004)	D	(0.175)	D,L	(0.139)		(0.166)	F	(0.184)	F
common legal origin	0.603	***	0.500	***	0.390	***	0.330	***	0.703	***	0.572	***	0.417	***	0.435	***	0.628	***	0.538	***	0.443	***	0.631	***
	(0.113)	L	(0.095)		(0.106)		(0.113)	F	(0.112)	D;L	(0.094)		(0.103)	F	(0.113)	F	(0.124)	D	(0.098)		(0.118)	F	(0.184)	
colonial links	0.811	***	0.208		0.135		0.209		0.922	***	0.334	*	0.200		0.321		0.905	***	0.380	*	0.221		0.304	
	(0.216)	E,D,L	(0.183)	F	(0.203)	F	(0.218)	F	(0.215)	E	(0.181)		(0.199)		(0.217)		(0.252)	E,D,L	(0.199)	F	(0.239)	F	(0.265)	F
trade agreement	-0.075		-0.283	*	0.632	***	0.267		-0.068		-0.376	**	0.399	**	0.258		0.080		-0.170		0.877	***	0.463	**
	(0.173)	D	(0.147)	D,L	(0.163)	F,E,L	(0.175)	E,D	(0.183)	D,L	(0.154)	D,L	(0.169)	F,E	(0.184)	F,E	(0.184)	D,L	(0.145)	D,L	(0.174)	F,E	(0.193)	F,E
investment treaty	0.042		-0.038		-0.010		0.297	**	0.222	*	0.042		0.177	*	0.419	***	0.458	***	0.335	***	0.330	**	0.532	***
	(0.118)	L	(0.100)	D	(0.111)	E,L	(0.119)	F,E,D	(0.115)	L	(0.096)	L	(0.106)	L	(0.115)	F,E,D	(0.144)		(0.113)		(0.137)		(0.152)	
# observations	1027		1027		1027		1027		782		782		782		782		1027		1027		1027		1027	
R-squared	0.841		0.911		0.883		0.851		0.845		0.920		0.895		0.849		0.830		0.912		0.876		0.823	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_2, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

phone traffic. Moreover, various robustness tests confirm the specification of the model and underline the robustness of the results on the pecking order hypothesis to alternative specifications and different econometric estimators.[20] Thus, the results indicate that FDI and loans are more sensitive to information frictions - or more information-intensive - than portfolio investment, equity and debt. A possible explanation for this fact is that FDI and loans in general require frequent interaction and a deeper knowledge of the markets where they operate. Also, especially for the case of FDI, once an asset has been acquired, direct ownership makes the asset less liquid given the potential lemon problem in case of a re-sale as Goldstein and Razin (2006) point out. Thus, FDI becomes partially irreversible or costlier to liquidate, and therefore more sensitive to information in the first place.[21]

2.5 The role of institutions and financial market development

We now turn to the role of financial markets and institutions. The central focus is on the question of whether we can identify a pecking order of cross-border capital positions with regard to the degree of development and openness of markets and the quality of institutions in the host country. For this purpose, we extract the host country fixed effects from model (2.1) and then estimate model (2.2), i.e. we attempt to explain the host country fixed effects through market conditions and

[20] We have also conducted further robustness checks, especially splitting the sample between industrialized and emerging economies and the results hold for both groupings of countries. They can be found in an earlier working paper version (Daude and Fratzscher, 2006).

[21] Although we cannot distinguish between greenfield investments and mergers and acquisitions in our data, this informational friction is linked to ownership control and thus applies to both types of FDI.

institutions. Note that given the specification of model (2.1) where the dependent variable is measured in value terms, we need to control for size effects in model (2.2). We do so by including host country GDP in each of the specifications below, though we omit showing the point estimates for this variable for brevity reasons. All variables used are described in more detail in the appendix.

We start with the role of market development and openness. We use three different proxies. First, we employ a capital account openness dummy. This dummy takes the value of one if the country had fully liberalized its capital account by the mid-1990s, and is zero otherwise. Data for this variable comes from the IMF's Annual Report of Exchange Arrangements and Exchange Restrictions (AREAER). The finding is remarkably strong as portfolio equity and portfolio debt investment react strongly to capital account openness, whereas the coefficients for FDI and loans are positive but only marginally statistically significant (see Table 2.10). The magnitude of the effects is large: a country that is open receives about 80% more equity capital and 80% more debt investment compared to an economy with a closed capital account.

Second, we investigate the effect of the development of the domestic financial sector on the pecking order. We include credit to the private sector as a proxy for financial development. Table 2.10 shows that the elasticities are by the far the largest for equity investment, which is about twice as large as that for debt securities and FDI. These differences are statistically significant, while in the case of FDI investment appears to not react to changes in the degree of financial market

Table 2.10: Role of market development and transparency

	FDI		FPI equity		FPI debt		Loans	
Market openness and development:								
capital account openness	0.262		0.825	**	0.803	**	0.387	
	(0.232)		(0.354)		(0.372)		(0.288)	
# observations	69		69		69		69	
R-squared	0.7556		0.8184		0.6801		0.7019	
financial development	0.462		2.270	***	1.396	***	1.344	***
	(0.321)	E,D,L	(0.424)	F,D,L	(0.469)	F,E	(0.366)	
# observations	64		64		64		64	
R-squared	0.7311		0.8693		0.7537		0.7575	
stock market capitalisation	0.435	***	1.104	***	0.560	**	0.743	***
	(0.126)	E,L	(0.131)	F,D,L	(0.219)	E	(0.133)	F,E
# observations	46		46		46		46	
R-squared	0.6589		0.888		0.6045		0.7349	

	FDI		FPI equity		FPI debt		Loans	
Transparency:								
quality of disclosure	0.137	*	0.389	***	0.191		0.134	
	(0.074)	E	(0.111)	F,D,L	(0.121)	E	(0.093)	E
# observations	65		65		65		65	
R-squared	0.7449		0.8355		0.6968		0.7079	
accounting standards	0.019		0.067	***	0.033	**	0.024	**
	(0.011)	E	(0.014)	F,D,L	(0.015)	E	(0.012)	E
# observations	37		37		37		37	
R-squared	0.5543		0.8117		0.6446		0.6261	
property rights	-0.139		-0.847	***	-0.904	***	-0.570	***
	(0.118)	E,D,L	(0.158)	F,L	(0.156)	F,L	(0.133)	F,E,D
# observations	63		63		63		63	
R-squared	0.741		0.868		0.7992		0.7684	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_4, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

development in the host country.

Third, we analyze the role of the development of the local stock market, and proxy this through stock market capitalization. The bottom panel of Table 2.10 indicates again that equity investment is most strongly related to changes in market capitalization but nevertheless also cross-border investment in debt securities, loans and FDI react, though to a lesser extent.

As a next step, we analyze the role of institutions for the pecking order of cross-border capital positions. As discussed in section 2.2, there have been a number of studies arguing that different types of capital should react differently to various institutional features. For instance, Albuquerque's (2003) model implies that FDI is harder to expropriate as the information required for and obtained by FDI is inalienable. Various other studies have focused on individual types of capital flows and how they are linked to other institutional elements such as e.g. corruption, transparency and political risk etc. (e.g. Wei 2000a, Papaioannou 2005, Gelos and Wei 2005).

We test the effect of various institutional features. While it is hard to determine which institutional factors to focus on, we are guided in our choice of institutional variables by the mostly theoretical literature discussed in section 2.2. The sources for these variables are manifold, partly stemming from the work by La Porta et al. (1998), Djankov et al. (2002) and partly from the databases by the World Bank Doing Business and by the International Country Risk Guide (ICRG).

Tables 2.10 and 2.11 show the findings for three sets of institutional variables.

Table 2.11: Role of investor protection and corruption

	FDI		FPI equity		FPI debt		Loans			FDI		FPI equity		FPI debt		Loans	
	Investor protection:									**Corruption:**							
expropriation risk	0.054		0.913	***	0.952	***	0.492	***	**TI**	-0.048		-0.407	***	-0.372	***	-0.198	***
	(0.125)	E,D,L	(0.166)	F,L	(0.175)	F,L	(0.143)	F,E,D		(0.049)	E,D,L	(0.059)	F,L	(0.061)	F,L	(0.052)	F,E,D
# observations	66		66		66		66		# observations	61		61		61		61	
R-squared	0.7497		0.8644		0.7562		0.7326		R-squared	0.7508		0.8835		0.7896		0.7618	
repudiation costs	0.078		0.781	***	0.701	***	0.445	***	**WDR**	-0.146		-0.583	***	-0.434	***	-0.335	***
	(0.093)	E,D,L	(0.115)	F,L	(0.132)	F,L	(0.103)	F,E,D		(0.099)	E,D,L	(0.137)	F,L	(0.143)	F	(0.107)	F,E
# observations	66		66		66		66		# observations	56		56		56		56	
R-squared	0.7516		0.8832		0.7528		0.7542		R-squared	0.733		0.8372		0.7109		0.7382	
days of enforcements	-0.103		-0.626	***	-0.573	**	-0.277		**German survey**	-0.025		-0.254	***	-0.242	***	-0.113	**
	(0.147)	E,D	(0.222)	F,L	(0.229)	F	(0.182)	E		(0.036)	E,D,L	(0.048)	F,L	(0.048)	F,L	(0.044)	F,E,D
# observations	65		65		65		65		# observations	57		57		57		57	
R-squared	0.7335		0.8258		0.7127		0.7091		R-squared	0.712		0.8477		0.763		0.7051	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_4, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

First, we look at the role of transparency. For this, we employ both a measure on the quality of information disclosure and on the quality of the accounting standards required by law in the host country - with higher values indicating a better quality. For both measures, portfolio equity investment reacts the strongest to changes in these transparency measures, while in the case of accounting standards the coefficient for debt securities and loans are also significant at a 10% level. FDI and loans are the least responsive. In fact, the elasticity of equity investment is about three times larger than that for FDI and for loans.

Second, we analyze the role of investor protection (last regression in Table 2.10 and Table 2.11). In particular, a lower risk of expropriation - indicated by a higher value of the variable in the table - has a highly significant impact mainly on portfolio investment. By contrast, the elasticity of loans is only about one half of that of portfolio investment, while FDI does not react at all to differences in expropriation risk. This finding thus provides strong support for the hypothesis formulated by Albuquerque (2003) and is line with the stylized facts presented above in section 2.3.

Moreover, Table 2.10 shows that an improvement in the quality of property rights - indicated by a decline in the variable in the table - has a significant and the largest impact on portfolio equity and debt investment, a lower effect on loans, but no effect on FDI. An almost identical picture emerges for repudiation costs and for the quality of enforcement of laws and regulations - which is measured in the days it takes to enforce a particular ruling, so that a higher number for the latter indicates a worse system of enforcement. Overall, all three measures therefore indicate that

investor protection has the largest effect on portfolio investment but does not appear to have any significant effect on FDI stocks.

Third, we analyze the importance of corruption for the pecking order. We use three alternative proxies for corruption; a first one from Transparency International, a second one from the World Development Report of the World Bank and the third one from a survey of German manufacturing firms. All three indicators have been used previously by Wei (2000b). In all cases, a higher value indicates a higher degree of corruption. Overall, the same finding emerges for all three of the proxies: corruption has the strongest negative effect on portfolio investment and some, though smaller effect on loans. Corruption does not appear to have any significant effect on FDI. This finding is in line with Daude and Stein (2007) who do not find a robust relation between different corruption indicators and FDI in contrast to other institutional indicators.[22] We conduct various sensitivity tests to check for the robustness of these findings. For instance, we find very similar results when controlling also for GDP per capita in model (2.2). The stylized facts of section 2.3 underline that there is a high correlation between per capita GDP and the pecking order of cross-border capital positions. However, the fact that the results hold also when controlling for GDP per capita stresses that market development and institutions have a large and significant effect on the pecking order independent of the level of development of a country.

As a further important sensitivity test, we use an IV estimator to take into account the possibility that institutional arrangements and market development

[22]See also chapter 3 of the present dissertation.

Table 2.12: Role of market development and transparency - 3SLS estimator

	FDI		FPI equity		FPI debt		Loans			FDI		FPI equity		FPI debt		Loans	
	Market openness and development:									**Transparency:**							
capital account openness	0.828 (0.460)	* E,D	1.796 (0.717)	** F,D	2.953 (0.850)	*** F,E,L	1.112 (0.572)	* D	**quality of disclosure**	-0.035 (0.136)	E	0.548 (0.199)	*** F,D,L	0.117 (0.215)	E	0.147 (0.165)	E
# observations	65		65		65		65		# observations	65		65		65		65	
R-squared	0.7162		0.8015		0.5682		0.6843		R-squared	0.7238		0.8303		0.695		0.7079	
financial development	0.898 (0.538)	* E,L	2.376 (0.700)	*** F	1.491 (0.775)	*	2.207 (0.630)	*** F	**accounting standards**	0.019 (0.015)	E	0.069 (0.018)	*** F,D,L	0.039 (0.019)	* E	0.022 (0.015)	E
# observations	64		64		64		64		# observations	37		37		37		37	
R-squared	0.7233		0.8692		0.7535		0.7364		R-squared	0.5543		0.8117		0.6434		0.6256	
stock market capitalisation	0.520 (0.199)	*** E,L	1.036 (0.205)	*** F	0.595 (0.341)	*	1.027 (0.218)	*** F	**property rights**	0.008 (0.154)	E,D,L	-1.017 (0.204)	*** F,L	-1.015 (0.201)	*** F,L	-0.690 (0.171)	*** F,E,D
# observations	45		45		45		45		# observations	63		63		63		63	
R-squared	0.6374		0.8793		0.6017		0.697		R-squared	0.7347		0.8656		0.7976		0.7654	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_4, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

may be. We estimate the system using a three-stage least square estimator (3SLS), which in essence implies instrumenting the institutional variables. An additional advantage of this approach is that we also address potential measurement errors in the institutional variables with our estimation technique.

We draw our instruments from the literature on law and finance and the literature on institutions and economic development. Specifically, we use legal origin dummies and dummies for religion which have been found to be important determinants of financial markets development and regulations (see La Porta et al. 1997, 1998). In the case of institutions, we use the mortality of settler from Acemoglu et al (2001). Our approach therefore also draws on the work by Alfaro et al. (2005).

The results for the 3SLS estimates are given in Tables 2.12 and 2.13. Overall, the key point is that the results are highly robust to those without instrumenting the institutions. All the results described above are qualitatively identical when using 3SLS, underlining that portfolio investment is substantially more sensitive to institutions and market development than FDI, and to some extent also than loans. It is also reassuring to observe that with the IV estimates the effects on FDI turn significant, but still significantly smaller than for portfolio investment. Moreover, the fact that the size of the coefficients and their significance increase somewhat also helps to stress the robustness of the results.

In summary, we find that market development and institutions are strongly related to the pecking order of cross-border investment. The key finding of this section is that portfolio investment, in particular in equity securities, is the type of

Table 2.13: Role of market development and transparency - 3SLS estimator

	FDI		FPI equity		FPI debt		Loans			FDI		FPI equity		FPI debt		Loans	
	Investor protection:									**Corruption:**							
expropriation risk	-0.407		1.397	***	1.430	***	0.273		**TI**	0.108		-0.371	***	-0.346	***	-0.145	**
	(0.259)	E,D,L	(0.328)	F,L	(0.352)	F,L	(0.277)	F,E,D		(0.068)	E,D,L	(0.078)	F,L	(0.080)	F,L	(0.069)	F,E,D
# observations	63		63		63		63		# observations	61		61		61		61	
R-squared	0.6678		0.8488		0.7279		0.7228		R-squared	0.7096		0.8828		0.7889		0.7579	
repudiation costs	-0.128		0.957	***	0.802	***	0.434	**	**WDR**	0.133		-0.825	***	-0.755	***	-0.450	***
	(0.160)	E,D,L	(0.197)	F,L	(0.223)	F,L	(0.172)	F,E,D		(0.151)	E,D,L	(0.200)	F,L	(0.213)	F,L	(0.155)	F,E,D
# observations	63		63		63		63		# observations	56		56		56		56	
R-squared	0.709		0.8758		0.7506		0.7551		R-squared	0.6955		0.8281		0.6849		0.7329	
days of enforcements	0.184		-0.954	***	-0.602		-0.628	**	**German survey**	0.106		-0.272	***	-0.204	***	-0.050	
	(0.243)	E,D,L	(0.363)	F	(0.368)	F	(0.300)	F		(0.064)	E,D,L	(0.076)	F,L	(0.077)	F,L	(0.072)	F,E,D
# observations	65		65		65		65		# observations	57		57		57		57	
R-squared	0.718		0.82		0.7126		0.6925		R-squared	0.647		0.8473		0.7603		0.6945	

The superscripted letters ^{F},^{E},^{D} and ^{L} indicate the test of the hypothesis H_4, that the coefficient is different to that of FDI, equity portfolio, debt securities, and loans, respectively. ***,**,* show statistical significance of the coefficients at the 99%, 95% and 90% levels, respectively.

capital that is the most sensitive to differences in market development/openness and the quality of host country institutions. A second key result is that FDI appears to be the type of capital that is most immune to the quality of domestic institutions. We find that FDI is least sensitive in all institutional categories, including with regard to transparency, investor protection, to the degree of corruption and to expropriation risk.

2.6 Conclusions

Is there a pecking order of cross-border investment in that countries become financially integrated primarily through one type of investment rather than others? The perceived wisdom in much of the debate on financial integration and trade in financial assets is that FDI constitutes a type of investment that is desirable from a host country perspective because it brings about a transfer of know-how, creates access to foreign markets and reduces the risks of financial distress. However, the facts of cross-border capital positions also show that countries that are richer, have higher growth and better institutions receive a higher share of their foreign investment in the form of portfolio investment and a much lower share through FDI and loans.

The objective of this chapter has been to analyze whether there is a natural pecking order in cross-border investment. We focus on the role of two key determinants for the trade in financial assets that have been central in this literature in

recent years: the importance of information frictions, and the role of institutions. Recent theoretical contributions to this literature emphasize the importance of differences in the ownership structure of different forms of investment. In particular, FDI has stronger ownership implications and thus tends to be more information sensitive than portfolio equity or debt investment. A second strand of the literature has focused on the implications of this theory for the role of institutions. One line of reasoning is that due to the larger information sensitivity of FDI, it is also harder to expropriate and thus it may be more immune to differences in the quality of institutions and market development.

Our contribution is to test these hypotheses empirically for a broad set of countries. To our knowledge, this is the first study that provides a comprehensive comparison of all four types of cross-border investment - distinguishing between FDI, portfolio equity securities, debt securities as well as loans. We develop and use a unique, combined data source of the capital stocks, rather than capital flows, for 77 countries.

The empirical results are compelling and confirm our hypotheses on the composition of cross-border investment. First, information frictions across countries are an important determinant of the pecking order of cross-border capital positions. In line with the theory on the capital structure of the firm, we find that FDI, and to some extent loans, are the most sensitive types of capital to information frictions, whereas portfolio investment is much less responsive. The magnitude of these pecking order effects is large: FDI and loans are about 1.5 to 2 times more sen-

sitive to information frictions than equity and portfolio investment. This finding is robust to several sensitivity tests, including the use of alternative proxies for information frictions; various specifications of the econometric model; controlling for other determinants, such as risk diversification; and across country samples, both for industrialized and for emerging market economies.

The second key result of the analysis is that the degree of market development and the quality of host country institutions are important determinants of the pecking order of cross-border investment. We find that portfolio investment is substantially more sensitive than FDI and loans to both market development - such as the openness of the capital account and the development of the domestic financial sector - and to domestic institutional features. We use three proxies for the quality of institutions - the degree of transparency, investor protection and corruption - and show that this result is robust across all these different elements of host country institutions. These results confirm some hypotheses formulated in the literature but contradict others. For instance, in line with the argument by Albuquerque (2003), we find that FDI does not react to differences to the risk of expropriation, whereas portfolio equity and debt investment is highly sensitive to this risk. Similarly, we do not find that corruption has a more detrimental effect on FDI, as hypothesized in the literature, but that the magnitude of FDI is not sensitive to corruption, whereas portfolio investment is. This implies that in fact corruption tilts the composition of foreign investment significantly towards FDI, and to a lesser extent towards loans.

Our findings have a number of important policy implications. In particular, the empirical results indicate that a large share of foreign investment that takes the form of FDI - despite the various benefits FDI may ultimately entail - may not necessarily be a blessing, but may in fact also be a signal of some underlying weaknesses - either in terms of weak institutions or in terms of the poor functioning or underdevelopment of domestic financial markets - of the host country. By contrast, a large share of foreign investment that comes through portfolio equity or debt securities is likely, at least in part, to signal well-functioning domestic financial markets and the trust of foreign investors in domestic institutions.

Chapter 3

The Quality of Institutions and Foreign Direct Investment (co-authored with Ernesto Stein)

3.1 Introduction

One of the most notorious features of the trend towards globalization in recent times has been the increased importance of foreign direct investment (FDI) around the world. Over the last couple of decades, worldwide FDI flows have grown by a factor of almost 10. To put this evolution in perspective, trade flows around the world, by comparison, only doubled during a similar period. In this context, a deeper understanding of the determinants of the location of multinational enterprises is becoming more and more relevant for the design of successful policies to attract investors.

While the existing literature has focused mainly on the effects of corruption or political risk on FDI, we contribute to the literature by testing a broader set of institutional variables that may affect the decision of foreign investors to undertake investment projects in a particular country.[1] This also allows us to assess what

[1] Among the papers that focus on the impact of political risk on US investment abroad are Fathi-Sedeh and Safizadeh (1989, 1994), Loree and Guisinger (1995), and Schneider and Frey (1985), among others. For a more recent study see Sethi et al (2003). Schollhammer and Nigh (1987) focus on the impact of international conflicts German FDI. In general, the main message from this literature is that the evidence for political instability as a significant determinant is weak.

dimensions of the quality of governance institutions affect foreign investors' location decisions more. In addition, while most papers in the literature analyze the effects of host country institutions on investment from a particular source, we use a large sample of bilateral investment data. The use of bilateral data allows us also to estimate the impact of institutional variables embedded in an empirical model backed by FDI theory rather than ad-hoc formulations as most studies in the literature.

The impact of institutions on investment, either domestic or foreign can be related to two different channels. First,"bad" institutions might act as a tax by increasing the cost of doing business. Second, imperfect enforcement of contracts might also increase uncertainty regarding future returns and thus have a negative impact on the level of investment.[2] Thus, for example corruption may deter investment by increasing the cost of doing business, as investors need to bribe officials in order to obtain licenses and permits. In addition, corruption may increase uncertainty, which may deter investment as well. According to Shleifer and Vishny (1993), the secrecy of corruption is what makes it much more distortionary than taxes.

In the empirical literature of FDI location decisions an often-cited paper related to ours is Wheeler and Mody (1992). They find that a composite measure

[2]Although this seems to be a natural argument, Dixit and Pindyck (1993) show that important restrictive assumptions are required to create a negative effect of uncertainty on the level investment. See Stasavage (2002) for an empirical application that analyzes the effects on domestic investment of checks and balances, as a mechanism to reduce time-inconsistency in capital taxation.

of risk factors, which includes institutional variables such as the extent of bureaucratic red tape, political instability, corruption and the quality of the legal system, does not affect the location of US foreign affiliates. However, their index aggregates these variables together with others such as attitudes towards the private sector, living environment, inequality, risk of terrorism, etc, making it impossible to assess the role of individual variables. In particular, the question of whether any of the institutional aspects have a significant impact on FDI is left unanswered. Mauro (1995) represents the first systematic empirical study on a related topic. He shows that corruption has a negative impact on the ratio of total and private investment to GDP and therefore causes harm to economic growth.[3]Wei (2000), using data on bilateral FDI stocks from OECD countries, finds that corruption has an economically significant and negative impact on FDI. His results imply that an increase in the level of corruption from Singapore to that of Mexico is equivalent to increasing the tax rate on multinationals by more than twenty percentage points. In addition, Wei (1997) finds that uncertainty regarding corruption has also important negative effects on FDI location.[4]

However, investment decisions may depend on different dimensions of public institutions in addition to corruption, like the regulatory framework, the predictability of economic policy, the protection of property right, or the efficiency of law enforcement. In this chapter, we provide evidence on the impact of these different

[3]See also Henisz (2000) for an analysis of the impact of formal political institutions on economic growth, rather than outcome variables like those used by Mauro (1995).

[4]See Smarzynska and Wei (2000) for a firm-level study in transition economies of the impact of corruption on FDI.

dimensions of governance institutions on the location of FDI. In addition, we use different types of institutional variables based on experts' reports, surveys and a combination of both in order to ensure the robustness of our results.

A different literature that is related to the present chapter includes Albuquerque (2003), Aizmann and Spiegel (2002), Hausmann and Fernndez-Arias (2000), as well as Mody et al (2003). This literature focuses on the effects of institutions on the composition of capital flows. Albuquerque's paper develops an imperfect enforcement model, where FDI has a risk-sharing advantage over other capital flows, because it contains more intangible assets that are inalienable and make FDI therefore less attractive to expropriation. The optimal contract implies that share of FDI in total capital flows is higher for financially constrained countries. In a set of cross-country regressions with the average FDI shares in gross private capital flows as dependent variable and controlling by GDP per capita and trade openness, he finds that the ICRG variable of Law and Order has a negative but not significant effect. However, once credit ratings are included in the regression, the institutional quality has a positive and significant effect on the FDI share. Mody et al present a model where multinational firms have an advantage over domestic firms in the screening process of projects with a noisy signal concerning their real level of profitability. In this context, the value of this advantage is decreasing in the host country's degree of corporate transparency. Thus, their model predicts that the proportion of FDI in comparison to portfolio investment is lower in countries where institutions are more transparent. They present empirical evidence in favor of this prediction, using an

index of creditors' rights from La Porta et al (2000) in a gravity model to explain the ratio of FDI flows to trade. Aizmann and Spiegel present an efficiency wage model where ex-post monitoring costs and enforcement of labor contracts are lower for domestic firms than for multinationals, but the later are more productive. In this situation, multinationals will be more sensitive to changes in the enforcement cost (quality of institutions) and pay higher wages than domestic firms do. They find that the share of FDI to gross fixed investment, as well as the ratio of FDI to private domestic investment, is negatively and significantly correlated with the level of corruption, such that FDI seems to be more sensitive than domestic investment to the institutional quality. Finally, Hausmann and Fernndez-Arias study the effects of institutional variables on the composition of capital inflows, using six different institutional variables compiled by Kaufmann et al (1999a), as well as indices of creditor and shareholder rights from La Porta et al (1998).[5] The authors find that better institutions lead to a reduction of the share of inflows represented by FDI. They conclude that, in comparison to FDI, other forms of capital are more sensitive to the quality of institutions. When they look at the effects of their institutional variables on FDI as a share of GDP, only a small subset of the institutional variables - regulatory quality, government effectiveness and shareholder rights - remain significant after including some controls. Their summary index of institutions, the first principal component of the six institutional variables of Kaufmann et al, does not have significant effects on the ratio of FDI to GDP.

[5]The institutional variables from Kaufmann et al (1999a) are regulatory quality, voice and accountability, government effectiveness, political stability and lack of violence, control of corruption and rule of law. We will describe these in more detail below, as we will use them here as well.

Unlike these studies, our focus is on FDI per se, rather than on the composition of capital inflows. As in Wei (1997, 2000), we use bilateral data on FDI stocks, but we use a wider range of institutional indicators. The use of bilateral data allows us to use a much richer set of control variables.

Another contribution of our analysis is that we avoid the shortcoming of the existing empirical literature, especially the studies that analyze the effects of the some institutional dimensions on FDI as Wheeler and Mody (1992), Hausmann and Fernndez-Arias (2000), Wei (1997, 2000), and Mody et al (2003), that they rely on ad-hoc empirical specifications. In this sense, we test the significance of the quality of institutions on FDI in an empirical model that follows recent developments in the theory of multinational enterprise location (see Markusen, 1997 and 2001) more closely. Carr, et al (2001) and Blonigen et al (2002) have used very similar econometrics specifications recently.

The rest of the chapter is organized as follows: In Section 2, we present the data, and discuss our empirical strategy. Section 3 presents our main results on the institutional quality as a determinant of the location of FDI, while in Section 4 we perform some sensitivity analysis and robustness checks. In Section 5 we extend to the effects of institutions over time using a panel data analysis. Finally, in Section 6 we present our main conclusions.

3.2 Data and Empirical Strategy

3.2.1 FDI Data

We use bilateral outward FDI stocks from the UNCTAD FDI database. The dataset covers FDI from 34 source countries, most of them developed, to 152 host countries.[6] By using outward stocks, we ensure that differences across countries in the definition and measurement of FDI do not alter the relative allocation of FDI for each of the source countries. The data are available from 1982 to 2002. For the cross-section analysis, we use the 2002 information.[7]

3.2.2 Institutional Variables

In order to assess the role of institutions as a determinant of the location of FDI, we primarily use a set of institutional variables developed by Kaufmann et al (1999a). These indicators are constructed based on information gathered through a wide variety of cross-country surveys as well as polls of experts. The authors use a model of unobserved components, which enables them to achieve levels of coverage of approximately 160 countries for each of their indicators.[8]They construct six different indicators, each representing a different dimension of governance: Voice and

[6]Thus the number of annual observations is 34 x (152 - 1) = 5134. However, data availability in our regressions reduces significantly the effective number of observations. In addition, most of the observations present no investment at all (around 75 percent are 0). An important part of our robustness checks deals with this issue.

[7]This dataset has become a primary source for empirical studies. For example, Daude and Fratzscher (2007) - chapter 2 - use the same database to study the impact of information frictions on the composition of cross-border investments; Daude et al (2007) study the impact of regional integration agreements on FDI using UNCTAD FDI data.

[8]For more technical details see Kaufmann et al (1999b). The database is available at http://www.worldbank.org/wbi/governance/govdata/index.html

Accountability, Political Stability and Lack of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. This clustering of institutional indicators into different dimensions allows us to study whether some dimensions of governance matter for FDI location, while others do not. The indicators are recoded such that they all have mean zero and unit standard deviation. In all cases, larger values indicate better institutions. We re-standardize these variables to have mean zero and standard deviation of one in our own sample, in order to simplify the interpretation of the coefficients, as well as the comparison of their relative importance. In order to reduce simultaneity problems, we consider data for 1996, the earliest date these indicators are available.[9] Thus, in the cross-section analysis our institutional variables precede the stock of FDI by 6 years.

Voice and Accountability, as well as *Political Stability* and *Lack of Violence* aggregate those aspects related to the way authorities are selected and replaced. The first variable focuses on different indicators related to the political process, civil rights, and institutions that facilitate citizens' control of government actions, such as media independence. The second variable combines indicators that measure the risk of a destabilization or removal from power of the government in a violent or unconstitutional way.

The indicators clustered in *Government Effectiveness* and in *Regulatory Qual-*

[9]The correlation for all indicators between their value in 1996 and the value in 2002 is above 0.95 except *Political Stability*, which has a correlation of 0.85. Thus, as it is common knowledge these institutional aspects tend to change slowly over time and identification will mainly come from the cross-section variation in the data.

ity are related to the ability of the government to formulate and implement policies. The first variable aggregates indicators on the quality of bureaucracy, the competence of civil servants, the quality of public service provision and the credibility of the government's commitment to its policies. The second brings together indicators related to the content of policies, like the existence of market-unfriendly regulations such as price controls and other forms of excessive regulation.

The last two variables, *Rule of Law* and *Control of Corruption*, consider aspects related to the respect, on the part of both citizens and the government, for the institutions that resolve their conflicts and govern their interactions. The first one includes variables that measure the perceptions on the effectiveness and predictability of the judiciary, as well as enforceability of contracts, while the second aggregates different indicators of corruption.

In Table 3.1, we present the simple correlations between the six variables, and the partial correlation between them controlling for GDP per capita. There is a remarkably significant correlation between the variables, even when controlling for GDP per capita. For example, in our sample, the simple correlation between Rule of Law and Control of Corruption is 0.93 and it remains at 0.76 once we control for GDP per capita.

As Mauro (1995) points out, there may be good reasons to expect this positive correlation between most variables. For example, Krueger (1993) argues that corruption may induce a less efficient bureaucracy since officials may introduce re-

Table 3.1: Simple and Partial Correlations (controlling for GDP per capita) of Kaufmann et al Variables

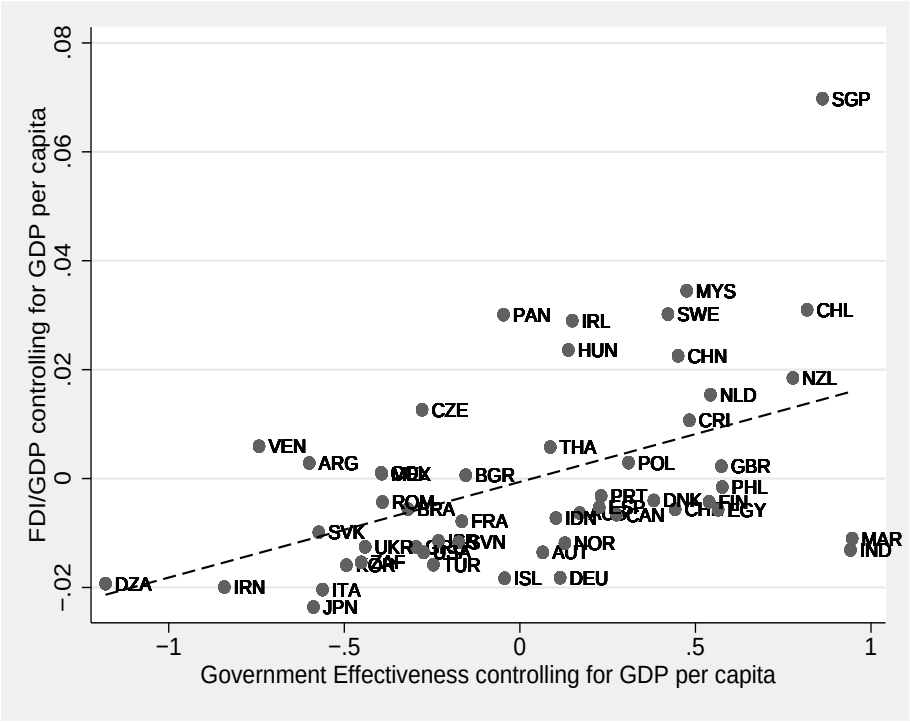
VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)
(1) Voice and Accountability	1.000					
	1.000					
(2) Political Instability	0.718	1.000				
	0.435	*1.000*				
(3) Control of Corruption	0.781	0.766	1.000			
	0.475	*0.457*	*1.000*			
(4) Regulatory Quality	0.691	0.683	0.768	1.000		
	0.424	*0.417*	*0.534*	*1.000*		
(5) Government Effectiveness	0.736	0.785	0.963	0.782	1.000	
	0.372	*0.513*	*0.880*	*0.569*	*1.000*	
(6) Rule of Law	0.700	0.851	0.928	0.727	0.929	1.000
	0.270	*0.677*	*0.760*	*0.437*	*0.774*	*1.000*
(7) Log GDP per capita	0.714	0.701	0.843	0.653	0.825	0.833

Partial correlations controlling for GDP per capita are in italic.

quirements and additional obstacles in order to receive bribes. However, from an econometric point of view this correlation can induce serious problems of multicollinearity and might limit the extent to which the relevance of each institutional dimension can be identified. The most standard solution is to group those variables that capture similar dimensions. In this sense, in several regressions we will use the average of *Voice and Accountability* and *Political Stability* and *Lack of Violence* as *Political Stability and Freedom*, while we group *Rule of Law, Control of Corruption, Government Effectiveness* and *Regulatory Quality* as *Government Efficiency*. This grouping may also reduce measurement problems of the individual components.

In Figure 3.1 we plot the partial correlation between the ratio of average FDI inflows to GDP in the 1990's and Government Efficiency - after controlling for GDP per capita - for the countries that will be considered in our subsequent regression

Figure 3.1: Partial Correlation between Average FDI Inflows 1990-2000 as a Ratio of GDP and Government Efficiency in 1996, controlling by GDP per capita



analysis. There is a positive and significant partial correlation between this institutional variable and the rate of FDI to GDP.[10]

In our robustness analysis and for the panel regressions, we use variables from the International Country Risk Guide (ICRG) compiled by the PRS Group. Unlike those of Kaufmann et al (1999a), these indicators rely exclusively on polls of experts. The main advantage of this dataset is that they are available for a considerable time span, allowing us also to test the relevance of institutions in attracting FDI exploiting the time variation. This also enables us to control for potential unobserved heterogeneity that could bias our cross-section estimates. The variables

[10]The partial correlation between government efficiency and the ratio of FDI to GDP is 0.36, which is significant at a 99 percent confidence level.

we consider are a subset of the ones available from the ICRG database that refer to political risk.[11] Specifically, we use the following indicators: Risk of Expropriation, Government Stability, Democratic Accountability, Law and Order and Corruption. While the first two variables are coded on a 0 to 10 scale, the other three are coded between 0 and 6. In order to facilitate comparability we standardize all variables in our sample to mean zero and unit variance. In all cases, higher rankings imply better institutions.

Finally, a third source of institutional data we use comes from the World Business Environment Survey (WBES) from the Worldbank.[12] In particular, we consider the average by country of the answers to the following questions in the survey: i) Quality of the courts (1 very good to 6 very bad); ii) Quality of central government (1 very good to 6 very bad), iii) Corruption is a general constraint to do business (1 no obstacle to 4 major obstacle, iv) Change in law and regulations are predictable (1 completely predictable to 6 completely unpredictable). Thus, for the WBES, higher values imply bad institutions.

[11]This dataset has been used extensively to analyze the impact of institutions on economic performance (see e.g. Knack and Keefer, 1995).

[12]This survey was conducted between 1999 and 2000, collecting information regarding constraints to business activities that firms face, including institutional and governance aspects. The sample covers 80 countries and approximately 100 enterprises in each country. The advantage of this kind of surveys is that they report in a more accurate way the perception of entrepreneurs about the different risks. However, the main purpose of this survey is to ensure a representative measure at a country level, such that their comparability across countries may be lower than in the case of indicators based on subjective perceptions of experts.

3.2.3 Empirical Strategy

Most of the empirical studies of FDI location are based on some variation of the so-called "gravity model", which is a standard specification in empirical models of bilateral trade.[13] In its simplest formulation, it states that bilateral trade flows (in our case bilateral FDI stocks) depend positively on the product of the GDPs of both economies and negatively on the distance between them. Typical variables added to the simplest gravity specification in the trade literature include GDP per capita, as well as dummies indicating whether the two countries share a common border, a common language, past colonial links, etc.

While in the trade literature the gravity model has good theoretical foundations, the use of this model for the case of FDI is somewhat ad-hoc. Although we will look at the results of the standard gravity model for reasons of robustness, we base our empirical evaluation of the effects of the different institutional variables on FDI on an empirical model recently developed by Carr et al (2001) which in turn follows closely a theoretical model of location of multinational activity developed by Markusen (1997, 2001). The model incorporates horizontal and vertical motives for FDI. The type of FDI that is observed between two countries is determined endogenously in a general equilibrium framework considering a two-country, two-factor, two-good world. The types of firms that can arise in this context are: horizontal

[13]For a discussion of the empirical application and theoretical foundations of the gravity equation in trade theory see Frankel (1997). Papers that have used the gravity model to study the location of FDI include Wei (1997, 2000), Mody et al (2003), Stein and Daude (2002) and Daude et al (2003).

firms with plants in both countries and headquarters in one, vertical firms that have a single production facility in one country and headquarters in the other country, and national firms that maintain headquarters and the production plant in only one country and may serve the other market through trade. One good (A) is produced in a competitive industry with constant returns to scale using unskilled labor, while the other good (B) is produced under imperfect competition with increasing returns to scale at the firm level due to R&D, and management services. The model includes similar assumptions as earlier models of vertical FDI as Helpman (1984), Helpman, and Krugman (1985) such as the possibility of fragmenting the production and the location of the headquarters and the operational plant. Also, plant scale economies are assumed for this sector. Finally, a key assumption of the model is the factor intensity in the different production facilities. In this sense, headquarters activities are the most skilled-labor intense, followed by the firm that produces good B and has headquarters in the same location. Moreover, a production plant in sector B is supposed to be less skilled-labor intensive than the former, but more intensive than one in sector A. It is clear that while differences in factor endowments tend to favor vertical FDI, firm level economies of scale would favor horizontal FDI, given the existence of trade costs.

The type and volume of FDI between two countries depends on the size of each economy, differences in the size between the host and the source country, relative factor endowments, trade costs and investment costs. When countries differ in size, but not in factor endowments, there is an inverted U-shaped relation, indicating

that horizontal FDI is highest between countries that are of the same size. In this sense, the empirical specification should include the squared difference in size in order to account for this relationship. Additionally, vertical FDI takes place if the difference in the size of the economies is significant and the small country is skilled labor intensive, so that the production facility tends to be installed abroad. Notice that since headquarters location decisions are based on factor endowments and plant location on the basis of the factor endowments and the market size, an interaction term between both variables should be included in the empirical specification of the model.

As in the pure horizontal model (see Horstmann and Markusen, 1987, 1992), trade costs in the host country encourage horizontal FDI, while investment restrictions in the host country - captured in our institutional variable - and trade costs in the source country restrict FDI activity of vertical nature. However, since trade costs favor horizontal FDI but not vertical FDI, and horizontal FDI increases if factor endowments are similar, Carr et al (2001) include an interaction between trade costs and the squared endowment differences.

To the benchmark model of Carr et al (2001), we add our measure of institutional quality, such that the empirical specification is as follows:

$$
\begin{aligned}
ln(FDI_{ij}) &= \beta_0 + \beta_1 SUMGDP_{ij} + \beta_2 SQDIFGDP_{ij} + \beta_3 ADIFGDP_{ij} \\
&\quad \times ADIFSKILL_{ij} + \beta_4 ADIFSKILL_{ij} + \beta_5 ln(Distance_{ij}) + \beta_6 TARIFF_j \\
&\quad + \beta_7 TARIFF_j \times SQDIFSKILL_{ij} + \beta_8 Institutions_j + \psi_i + \varepsilon_{ij}. \qquad (3.1)
\end{aligned}
$$

The definitions of the variables are as follows. FDI is the outward stock of FDI from country i (source) in country j (host) from the UNCTAD database. SUMGDP is the sum of the logs of the host country and the source country GDPs, in current dollars from the WDI database in 2000. The variable SQDIFGDP is the squared difference in the GDPs of the host and the source country, while ADIFGDP is the absolute difference between them. Similarly, ADIFSKILL is the absolute difference between the countries' endowments of skilled labor and SQDIFSKILL is the corresponding squared difference. We use the average percentage of the labor force with secondary education from the WDI database over 1990 and 2000 as our variable of skilled labor endowment. DISTANCE is the great circle distance between the countries' capitals.[14] Trade costs in the host are measured by the average tariff level between 1990 and 2000.[15] Finally, source country dummies (ψ_i) are included in order to capture the effects of possible systematic differences in the FDI accounting methodology of reporting countries, as well as other relevant source country characteristics.

[14] only exceptions are the U.S. and China, where we consider Chicago and Shanghai respectively.
[15] Tariff data are from the Worldbank.

The log specification is used because it has typically shown the best adjustment to the data in the empirical literature. A problem that arises when using the log of FDI as a dependent variable, however, is how to deal with the observations with zero values. Our dataset includes more than two-third of observations with zero FDI stocks[16], which would be dropped by taking logs. The problem of zero values of the dependent variable is typical in gravity equations for trade, and it has been dealt with in different ways.

Some authors (see for example Rose, 2000) simply exclude the observations in which the dependent variable takes a value of zero. A problem with this approach is that those observations may convey important information for the problem under consideration. Given the importance of zero observations in our sample, this strategy could lead to a serious estimation bias. One alternative we explore is that used by Eichengreen and Irwin (1995) who use a simple transformation to deal with the zeros problem: work with log (1 + trade), instead of the log of trade. This has the advantage that the coefficients can be interpreted as elasticities when the values of trade tend to be large, since in this case log (1 + trade) is approximately equal to log (trade). However, if zero FDI is a consequence of the existence of fixed costs, it would be inappropriate to deal with this problem in a linear way as Eichengreen and Irwin (1995) do for the case of trade. Therefore, an alternative method is to use Tobit estimations instead of OLS. Santos and Tenreyro (2006) propose an alternative estimation method based on Poisson regressions in order to address the

[16]More specifically, in 2002 there are 3970 zero observations out of 5134.

potential bias in gravity models in the presence of heteroscedasticity. Our approach here is to first present the estimates for the sub-sample that excludes the zeroes and then to show that the results are robust to the use of several of these alternative estimation techniques and solutions to the zero-FDI problem.

3.3 Empirical Results

3.3.1 OLS Estimates

In the first column of Table 3.2, we present our estimate of equation (3.1) without including any institutional indicator. A first interesting point is that the model explains a high proportion - approximately 71 percentage points - of the total variation in FDI stocks.[17]The significant variables are the sum of GDPs, the squared difference of GDPs, distance, and the absolute difference in factor endowments. Distance has a negative effect on bilateral FDI, while economic mass measured by the sum of GDPs has a significantly positive impact. In addition, large differences of scale between the source and host country discourage FDI, as well as differences in factor endowments. These results are consistent with those obtained by Blonigen et al (2002).

In columns 2 to 7 we introduce the Kaufmann et al (1999a) variables into equation (3.1). The estimates show that the impact of institutions depends on the

[17]While the source country dummies are jointly significant, they do not drive this result, since an estimation of equation (1) without the source dummies explains approximately 61 percent of the variation in the dependent variable, while a regression with only source country dummies as explanatory variables explains 31 percent of the total variation. While not presented in the tables, the source dummies are jointly significant at conventional levels.

Table 3.2: Cross Section OLS Estimates of Equation (3.1)

INDEP. VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SUMGDP	0.632	0.629	0.635	0.586	0.577	0.622	0.61	0.705	0.605
	(4.90)***	(4.54)***	(4.88)***	(4.30)***	(4.73)***	(4.52)***	(4.28)***	(5.92)***	(4.50)***
SQDIFGDP	-0.049	-0.049	-0.056	-0.054	-0.045	-0.057	-0.049	-0.048	-0.054
	(2.33)**	(2.37)**	(2.62)**	(2.47)**	(2.19)**	(2.45)**	(2.29)**	(2.62)**	(2.36)**
ADIFLAB	-0.027	-0.027	-0.027	-0.025	-0.027	-0.026	-0.026	-0.031	-0.025
	(2.96)***	(2.90)***	(2.90)***	(2.70)***	(2.83)***	(2.79)***	(2.84)***	(3.35)***	(2.85)***
ADIFGDP x ADIFLAB	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.003	0.003
	(1.05)	(1.12)	(1.11)	(1.26)	(1.45)	(1.18)	(1.19)	(1.33)	(1.23)
TARIFF	-0.022	-0.021	-0.007	0.004	0.018	-0.009	-0.013	0.024	-0.003
	(1.56)	(1.21)	(0.40)	(0.23)	(0.95)	(0.54)	(0.86)	(1.57)	(0.19)
TARIFF x SQDIFLAB	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.95)	(0.90)	(0.63)	(0.14)	(0.12)	(0.58)	(0.72)	(0.85)	(0.31)
DISTANCE (logs)	-0.763	-0.761	-0.728	-0.756	-0.794	-0.756	-0.761	-0.813	-0.805
	(8.32)***	(8.27)***	(7.65)***	(8.40)***	(8.53)***	(8.38)***	(8.32)***	(8.58)***	(8.14)***
Voice and Accountability		0.022						-0.317	
		(0.10)						(1.30)	
Political Stability			0.251					0.67	
			(1.25)					(2.17)**	
Government Effectiveness				0.355				1.474	
				(1.93)*				(2.74)***	
Regulatory Quality					0.702			1.259	
					(3.38)***			(2.78)***	
Control of Corruption						0.185		0.18	
						(1.00)		(0.46)	
Rule of Law							0.129	-2.445	
							-0.7	(3.51)***	
Political Stability and Freedom									-0.379
									(1.23)
Government Efficiency									0.635
									(2.05)**
Observations	714	714	711	711	714	710	714	710	710
R-squared	0.71	0.71	0.72	0.72	0.72	0.72	0.71	0.75	0.72

OLS estimates. The dependent variable is the log of the bilateral stock of FDI in 2002. Institutional variables are from 1996. All regressions include source country dummies, not reported. Absolute robust White-corrected t-statistics in parentheses. *, **, *** significant at 10, 5 and 1 percent, respectively.

specific dimension considered. While *Voice and Accountability*, *Political Stability*, *Rule of Law*, and *Control of Corruption* have no significant impact on FDI, *Regulatory Quality* and *Government Effectiveness* have a positive and significant impact on the volume of FDI. The largest effect seems to be associated to *Regulatory Quality* where a one standard deviation increase in this dimension of governance would increase FDI stocks by a factor of 2.[18] While initially the magnitude of this effect might seem very large, it should be kept in mind that a one standard deviation improvement in the regulatory quality of government implies a substantial change, e.g. from the level of Thailand to that of Canada or Germany. A slightly lower effect corresponds to *Government Effectiveness*, where a one standard deviation improvement would imply an increase in FDI stocks by a factor of 1.4. This first evidence indicates that several dimensions of government institutions clustered in *Government Efficiency* seem to be especially relevant in explaining the location of FDI.

There are however at least two possible problems with the preceding regressions. On the one hand, if various institutional dimensions determine simultaneously the location of FDI, by including them one by one as before there might be an omitted variable bias, especially severe given the correlation among the different indicators reported in the previous section. On the other hand, as mentioned previously, the different variables might be subject to measurement errors. In order to address these problems, we run two additional regressions, one including the six re-

[18] $\exp(0.702)=2.018$.

gressors simultaneously, and the other clustering all variables into *Political Stability and Freedom* or *Government Efficiency* as previously mentioned.

In column 8, we present the results from including all six variables together. Given the high correlation among them, there might be important multicollinearity problems, as indicated by the negative sign of *Voice and Accountability* or *Rule of law*. Taking into account this caveat it is still interesting to point out that the variables *Regulatory Quality* and *Government Effectiveness* seem to the most relevant governance dimensions. In the last column of Table 3.2 we estimate equation (3.1) incorporating the clusters *Political Stability and Freedom* and *Government Efficiency*. A one standard deviation improvement in *Government Efficiency* - e.g. from Slovenia to Sweden or Argentina to Chile - would increase FDI by a factor of 1.89. Let us consider Argentina and Chile to assess the economic significance and plausibility of the estimates. In 2002, the FDI stock is 7.3 percentage points of GDP for Argentina, while in the case of Chile it is 25.8. An improvement in Argentina's institutional quality to the level of Chile would therefore lead to an FDI stock to GDP ratio of approximately 13.8 percent, still significantly below that of Chile. *Political Stability and Freedom* has no significant effect on FDI.[19]

[19]The fact that *Political Stability and Freedom* is not significant in our regression means that it has no direct effect on FDI. This does not exclude the possibility that it might still have an important indirect effect, for example via the accumulation of human capital.

3.3.2 Instrumental Variables Estimations

Although we use institutional variables for 1996 and FDI stocks for 2002 to reduce simultaneity problem, these problems might subsist. Thus, the previous estimates could potentially be biased due to endogeneity.[20] It might be reasonable to consider the possibility that the quality of institutions might be endogenous for two reasons. First, once foreign investors are located in a country, they might become a constituency that demands better institutions. Therefore, there could be a feedback effect on the quality of institutions. Second, there is a potential subjectivity bias, where experts report a better score on the quality of institutions because they observe a high level of FDI, which generates the same econometric problems. In order to address this issue, we re-estimated the regressions in Table 3.2 using instrumental variables. We use two distinct sets of instruments for the two different sets of institutional variables. First, to instrument *Voice and Accountability* as well as *Political Stability*, we use an index of ethnolinguistic fragmentation (ELF)[21] from Easterly and Levine (1997) and the average number of homicides per 100,000 inhabitants during the 1990's. Both variables have been used extensively in the literature to analyze political violence and social risk. The simple correlation coefficients of *Voice and Accountability* and *Political Stability* with ELF are - 0.35 and - 0.21, respectively. For the case of homicides these correlations are - 0.34 and - 0.55,

[20] We do not consider institutional variables that are strongly related to macroeconomic factors (e.g. "investment climate") in order to reduce the possibility that experts opinions might be caused by the observed volume of FDI. In addition, the bilateral nature of the FDI data reduces partially the potential severity of endogeneity.

[21] Mauro (1995) to instrument corruption has also used this variable. It measures the probability with in a country that two randomly selected persons are members of different ethnic groups. See Easterly and Levine (1997) and Mauro (1995) for more details.

respectively.[22] For the second group of variables clustered in *Government Efficiency* we use the fraction of population that speaks English and the fraction of the population that speaks a Western European language from Hall and Jones (1999). Hall and Jones (1999) use these variables to instrument institutions in cross-country growth regressions. It seems natural to assume that the extent to which this constitutes the mother tongue of a country is positively correlated with the degree of influence of Western Europe. La Porta et al (1999) find that the origin of the legal code is an important and significant determinant of a series of government institutions and economic outcomes. In addition, Chong and Zanforlin (2000) find that countries with law tradition based on the French Civil code display significantly lower levels of bureaucratic development, lower levels of credibility of the government and higher levels of corruption, while countries with English Common Law show a higher level of institutional quality. Thus, we consider a set of dummy variables for Common Law, French Law, German Law and Scandinavian Law as instruments.

In Table 3.3, we present the results for the IV estimations. In columns 1 - 6, we first present the regressions including one variable at the time. The first interesting result is that in terms of significance, the results are analogous to the OLS estimations. Thus, only *Government Effectiveness* and *Regulatory Quality* have a significant effect on FDI stocks, while the remaining variables are not significant. Similarly, for the clustered institutional variables, we find that *Government Efficiency* has a positive and significant impact on FDI, while for *Political Stability and*

[22]These correlations are significant at conventional levels of confidence.

Freedom the estimate is negative.[23] Taking a look at the size of the coefficients, the IV estimates look rather large. A one standard deviation increase in *Government Efficiency* would increase FDI by a factor of 10![24]However, this huge increase in the estimated coefficient is partially due to the change in the sample due to limited data availability of some instruments. In column 8, we present the OLS estimates for the same reduced sample. Observe that the coefficient of *Government Efficiency* changes from 0.635 (see Table 3.2, column 9) to 1.541 just due to the change in the sample. Thus, if we assume that the change in the coefficient would be similar for the IV estimations if we could estimate the model for the whole sample, the effect of a one standard deviation improvement in *Government Efficiency* would be an increase of bilateral FDI by a factor of "only" 2.58.[25] This order of magnitude implies that, e.g., if Kenya had the same level of institutional quality than South Africa it would almost receive the same amount of FDI as a fraction of GDP.[26]

Overall, the results so far show that the quality of institutions has a significant and economically important impact on the location of FDI. In addition, not all dimensions of the institutional framework have the same direct importance for foreign investors' investment decisions. We find that the regulatory framework and the effectiveness of the government in "getting things done" are the most sensitive aspects to foreign investors. Thus, variables that refer to the predictability and

[23]This last result should not be interpreted that in order to attract FDI a country should reduce its civil liberties. It only shows that, once we take into account other institutional aspects, there is no direct positive effect of political stability on FDI. However, it might still be the case that without political stability it is difficult to maintain a predictable regulatory framework.

[24]exp(2.303) = 10.004.

[25]exp(0.635*2.303/1.541) = 2.583.

[26]South Africa has a one standard deviation better institutional quality than Kenya, while the FDI stock to GDP ratios are 17 percent versus 5.1 percent.

Table 3.3: IV Estimates of Equation (3.1)

INDEP. VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SUMGDP	0.904	0.652	0.633	0.68	0.687	0.666	0.721	0.693
	(3.77)***	(4.94)***	(6.00)***	(8.05)***	(5.94)***	(5.42)***	(6.53)***	(6.58)***
SQDIFGDP	-0.026	-0.01	-0.01	-0.001	-0.016	-0.017	-0.003	-0.004
	(0.94)	(0.45)	(0.47)	(0.03)	(0.76)	(0.75)	(0.11)	(0.19)
ADIFLAB	-0.048	-0.029	-0.01	-0.011	-0.013	-0.015	-0.014	-0.018
	(2.85)***	(3.32)***	(0.87)	(1.03)	(0.97)	(1.27)	(1.07)	(1.91)*
ADIFGDP x ADIFLAB	0.003	0.002	0.001	0.003	0.001	0.001	0.004	0.003
	(0.60)	(0.63)	(0.40)	(1.05)	(0.31)	(0.40)	(0.94)	(0.92)
TARIFF	-0.124	-0.027	0.038	0.085	0.013	0.013	0.011	0.008
	(1.75)*	(0.90)	(1.07)	(1.84)*	(0.39)	(0.35)	(0.31)	(0.32)
TARIFF x SQDIFLAB	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(2.38)**	(1.54)	(0.63)	(0.84)	(0.07)	(0.03)	(0.21)	(0.47)
DISTANCE (logs)	-0.903	-0.679	-0.639	-0.714	-0.675	-0.647	-0.823	-0.765
	(3.74)***	(6.42)***	(6.89)***	(7.10)***	(7.14)***	(6.17)***	(6.73)***	(6.89)***
Voice and Accountability	-2.042	-	-	-	-	-	-	-
	(1.23)							
Political Stability	-	0.143	-	-	-	-	-	-
		(0.31)						
Government Effectiveness	-	-	0.886	-	-	-	-	-
			(2.10)**					
Regulatory Quality	-	-	-	2.098	-	-	-	-
				(2.96)***				
Control of Corruption	-	-	-	-	0.546	-	-	-
					(1.41)			
Rule of Law	-	-	-	-	-	0.572	-	-
						(1.26)		
Political Stability and Freedom	-	-	-	-	-	-	-1.835	-1.059
							(2.46)**	(2.21)**
Government Efficiency	-	-	-	-	-	-	2.303	1.541
							(2.95)***	(3.37)***
Observations	514	514	566	566	566	566	500	500
R-squared of first stage	0.51	0.66	0.79	0.75	0.8	0.79	0.79; 0.81	0.82
F-test on instruments	3.35	19.33	5.93	3.68	10.84	8.18	9.79; 8.70	-
	[0.046]	[0.000]	[0.000]	[0.006]	[0.000]	[0.000]	[0.00;0.00]	

Notes: Instrumental variable estimations, except column 8 which is OLS. Instruments for the first two variables are ethnolinguistic fragmentation and homicides, while for the other variables the instruments are the English speaking fraction of the population, European language speaking fraction, and legal code dummies. The dependent variable is the log of the bilateral stock of FDI in 2002. Institutional variables are from 1996. All regressions include source country dummies, not reported. Absolute robust White-corrected t-statistics in parentheses. P-values in brackets. *, **, *** significant at 10, 5 and 1 percent, respectively.

stability of policies are especially important to establish a foreign investor friendly environment. The results show no evidence of a direct effect of civil liberties and political violence. This holds for OLS as well as 2SLS estimates. In the next section, we analyze the robustness of these results. There is little evidence of any significant impact of political instability and violence on FDI. This result is also in line with the empirical literature on this issue (see e.g. Sethi et al, 2003), which has often failed to find a significant impact of political violence on FDI.

3.4 Robustness

The first issue we address in our robustness tests is whether our results are sensitive to the solution used to deal with the observations with zero FDI. In the first two columns of Table 3.4, we present estimates of equation (3.1) considering adding the minimum observed FDI stock to the log of the bilateral FDI stock.[27] In the first column, we restrict the sample to exclude all zero FDI observations, while in column 2 we include these observations. Focusing on the institutional variables, column 1 shows that the transformation of the dependent variable does not alter significantly the results, given that the estimates are virtually identical to those in column 9 of Table 3.2. By contrast, the inclusion of the zero FDI observations alters significantly the estimated impact of *Government Efficiency* on FDI, while *Political Stability and Freedom* remain insignificant. In particular, the point estimate indicates that the estimated impact of a one standard deviation improvement in

[27]The results do not change if we consider adding the unity instead of the minimum. While not reported here, they are available upon request.

Table 3.4: Robustness: Estimation Methods and Model Specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation Method	OLS	2SLS	OLS	POISSON	TOBIT	OLS	OLS	OLS
Dep. Variable	Ln Stock+min	Ln Stock+min	Stock in levels	Stock in levels	Ln Stock+min	Ln Stock	Ln Stock+min	Ln Flow
SUMGDP	1.200	1.165	0.008	0.877	0.110	-	-	-
	(13.59)***	(6.97)***	(2.15)**	(20.07)***	(0.71)			
SQDIFGDP	-0.079	-0.069	0.001	0.006	-0.086	-	-	-
	(4.83)***	(2.64)**	(1.31)	(0.49)	(5.16)***			
ADIFLAB	-0.012	-0.008	48.85	-0.038	-0.027	-	-	-
	(0.87)	(0.45)	(1.28)	(1.86)*	(1.60)			
ADIFGDP x ADIFLAB	-0.001	-0.001	0.001	0.004	0.006	-	-	-
	(0.21)	(0.21)	(3.50)***	(0.85)	(1.30)			
TARIFF	0.001	-0.001	35.466	0.028	0.022	-	-	-
	(0.01)	(0.03)	(0.71)	(1.11)	(0.91)			
TARIFF x SQDIFLAB	0.001	0.001	0.005	0.001	0.001	-	-	-
	(0.69)	(0.64)	(0.17)	(0.25)	(2.12)**			
DISTANCE (log)	-1.313	-1.381	-0.519	-0.572	-0.235	-0.817	-1.341	-0.817
	(10.04)***	(6.11)***	(3.08)***	(6.66)***	(0.78)	(7.20)***	(7.85)***	(7.56)***
LPGDP	-	-	-	-	-	0.716	1.033	0.76
						(7.19)***	(10.13)***	(9.75)***
LPGDPPC	-	-	-	-	-	-0.374	-0.141	-0.347
						(1.34)	(0.47)	(1.36)
COMLANG	-	-	-	-	-	0.125	0.513	0.262
						(0.51)	(2.22)**	(0.98)
COL	-	-	-	-	-	1.157	0.049	0.662
						(4.14)***	-0.1	(2.42)**
ADJACENCY	-	-	-	-	-	1.065	1.745	0.769
						(3.37)***	(3.30)***	(2.89)***
COMCOL	-	-	-	-	-	1.489	-	-
						(2.25)**		
Political Stability and Freedom	-0.484	-1.838	-938.339	-0.724	0.263	-0.068	0.391	-0.312
	(1.19)	(1.15)	(1.74)*	(2.09)**	(0.52)	(0.26)	(1.15)	(1.48)
Government Effectiveness	1.291	2.572	2	1.518	1.043	0.752	0.89	0.763
	(3.80)***	(1.71)*	(2.71)***	(3.82)***	(1.98)*	(2.47)**	(2.31)**	(2.20)**
Observations	1375	1375	2173	2173	2173	863	4007	925
R-squared	0.84	0.84	0.31	-	0.75	0.72	0.68	0.71

Notes: Notes: Instruments used in column (2) are ethnolinguistic fragmentation and homicides for Political Stability and Freedom, and English speaking fraction of the population, European language speaking fraction, and legal code dummies for Government Effectiveness. In column (3) the explanatory variables are also in levels. All regressions include source country dummies, not reported. Absolute robust White-corrected t-statistics in parentheses. P-values in brackets. *, **, *** significant at 10, 5 and 1 percent, respectively.

Government Efficiency raises FDI stocks by a factor of 3.6. While this magnitude is large, it is in line with the estimates discussed in the previous section. The fact that the point estimate is greater when we include the zero FDI observations shows that the sample selection bias goes in the expected direction. If the likelihood of observing a zero FDI stock is higher for host countries with "bad" institutions, excluding these observations would bias the estimates downwards towards zero.

In column 3, we explore a different alternative to deal with the zero FDI observations by estimating the model in levels.[28] The estimates indicate that on average

[28]The right hand variables, like SUMGDP and distance, are also expressed in levels rather than

an improvement of one standard deviation in *Government Efficiency* increases FDI stocks on average by 2482 million dollars.[29]

In column 4, we present the results of estimating the regression using the Poisson regression approach recently proposed by Santos and Tenreyro (2006) which corrects for the potential bias of the log-linearlized model under heteroscedasticity. Clearly, the results regarding your main variables of interest remain unchanged. As we mentioned above, an additional alternative approach could be the estimation of a TOBIT model of equation (3.1). In column 5 of Table 3.4, we present the estimates considering this alternative estimation method. The main results remain; *Government Efficiency* has a positive and significant effect on FDI, while *Political Stability and Freedom* has again no significant effect. While the estimated coefficient is slighter higher, the implied impact on FDI is in line with the OLS estimated presented above.

In the next column, we present a standard gravity model in order to explore the sensitiveness of our results to the specification of our baseline regression. We include the product of GDPs (LPGDP) and GDP per capita of the host and source countries - LPGDPPC - (in logs), distance (in logs), a common language dummy (COMLANG), a dummy if both countries were colonized by the same country (COMCOL), a dummy that equals unity if the source country was the colonizer

logs.

[29]While this estimate might seem very large, it is important to remember that the standard deviation of the estimation is high. For example, the 95 percent interval goes from 658 to 4305 million dollars.

of the host country (COL), an adjacency dummy (ADJ), and a dummy for common membership in a Free Trade Area (SAMEFTA). The estimates show that overall the gravity equation is successful in explaining the variation in FDI across countries with an R-squared of 0.72. Regarding our variables of interest, the estimates show that a one standard deviation improvement in the degree of efficiency of the government would increase FDI by a factor of 2.1, this point estimate is very close to the one presented in Table 3.2. As before, the estimated effect of *Political Stability and Freedom* on FDI is not significant.

In column 7, we present the gravity model estimate considering the alternative dependent variable that adds the minimum observed FDI. Again, the results are very similar to our previous estimates. A one standard deviation improvement in *Government Efficiency* increases FDI by a factor of 2.4, while *Political Stability and Freedom* does not have any significant direct effect.

Next we consider FDI flows instead of stocks. While our preferred dependent variable is stocks, the estimates for our variables of interest remain at similar levels of significance and magnitude. As before, *Political Stability and Freedom* does not have any impact on FDI, a one standard deviation change in *Government Efficiency* change FDI flows by a factor of 2.1.[30]

[30]The similarity in the size of the coefficient is quite logical, given the high correlation between flows and stocks. The simple correlation coefficient is 0.86. This high correlation is because on average the FDI stock reflects recent large FDI flows.

In Table 3.5, we consider a set of alternative measures of institutional outcomes in order to test the robustness of our results. In the first three columns, we consider the ICRG variables. The only variable that is systematically significant is *Government Stability*, with a one-standard deviation improvement in *Government Stability* implying an increase of between 38 and 46 percentage points. All other variables do have no significant impact on FDI.[31] In next two columns, we consider the WBES variables. In this case, only the predictability of laws and regulations has consistently a significant impact on FDI. A deterioration of a one standard deviation in this dimension of the institutional quality of a country decreases FDI between 54 and 94 percentage points.[32]

Overall, the results from this section show that our results are robust to different estimation methods, definitions of the dependent variable, and specifications. Furthermore, some institutional dimensions have a greater impact on FDI than others. Especially, institutions that create predictable regulatory and legal frameworks, as well as policy stability are the most important. This result is consistent with those of Stasavage (2002) who finds that formal institutions that produce policies that are more predictable and stable have a positive and significant impact on domestic investment.

[31]This result does not seem to be driven by multicollinearity, given that regressions including on one variable at the time produce the same results. Results are available upon request.

[32]It should be kept in mind that in this case higher values of the institutional variables imply worse institutions.

Table 3.5: Robustness Alternative Institutional Variables

	(1)	(2)	(3)	(4)	(5)
Dep. Variable	Ln Stock	Ln Stock+min	Ln Stock+min	Ln Stock+min	Ln Stock+min
Model	CMM	CMM	Gravity	CMM	Gravity
Expropriation Risk	-0.034	-0.155	0.229	-	-
	-0.18	-0.37	-0.71		
Government Stability	0.374	0.377	0.278	-	-
	(2.40)**	(1.82)*	(1.92)*		
Democratic Accountability	-0.101	0.22	0.393	-	-
	-0.43	-0.59	-1.57		
Corruption	-0.047	0.07	0.087	-	-
	-0.2	-0.24	-0.4		
Law and Order	-0.018	0.147	0.178	-	-
	-0.12	-0.44	-0.53		
Quality of the Courts	-	-	-	-0.044	0.043
				-0.11	-0.16
Quality of the Government	-	-	-	0.419	0.157
				-1.63	-0.86
Government Corruption	-	-	-	-0.219	-0.061
				-0.45	-0.14
Legal and Regulatory Predictability	-	-	-	-0.664	-0.431
				(2.59)**	(1.92)*
Observations	596	1635	2728	1182	1995
R-squared	0.74	0.8	0.8	0.77	0.72

Note: Columns with CMM include the Carr et al (2001) controls, while Gravity stands for the gravity model. Estimation results for controls are similar to previous tables and not reported here. All regressions include source country dummies, not reported. Absolute robust White-corrected host country clustered t-statistics in parentheses. *, **, *** significant at 10, 5 and 1 percent, respectively.

3.5 Time series evidence of the relevance of institutions

In this section, we extend our analysis to assess the impact of institutions over time. This panel data analysis is also an alternative approach to the IV regressions presented in Section 3 to deal with potential endogeneity problems. Thus, it represents an additional important robustness check. In this section, we use the ICRG component *Government Stability* that turned out to be consistently the most significant in our cross section analysis. We use five-year periods for our panel, such that we are left with 4 periods: 82-86, 87-91, 92-96, and 97-02. The dependent variable is the FDI stock at the end of the period, while for controls we use period averages, except for institutions where we use the value at the beginning of the period in order to reduce simultaneity problems. All regressions include period dummies to account for common shocks.

In the first column of Table 3.6, we present the pooled OLS estimates. The impact of institutions is positive and significant. The coefficient implies that a one-standard deviation improvement in *Government Stability* increases FDI by 17 percentage points. While this estimate is smaller than the cross-section estimate, it remains economically important. Next, we estimated the model using random effects and fixed effects estimators. Again, the coefficient of our institutional variable is significant and positive. Moreover, the magnitude is only slightly higher than in the case of pooled OLS, with an estimated impact of between 22 and 26 percent of a one-standard deviation change.

Table 3.6: Panel Data Estimates

Estimation Method	(1) Pooled OLS	(2) Random Effects	(3) Fixed Effects	(4) Poisson Regression	(5) Prais Winsten	(6) GMM	(7) GEE
Lag Dependent Variable	-	-	-	-	-	0.566	-
						(8.63)***	
LPGDP	1.172	0.872	0.175	0.863	0.895	0.316	0 .936
	(34.31)***	(19.80)***	(2.15)**	(25.91)***	(20.48)***	(2.48)**	(19.73)***
LPGDPPC	-0.034	0.185	0.894	0.613	0.138	-0.29	0.168
	-0.37	(2.08)**	(6.23)***	(3.10)***	-1.47	-1.15	-1.63
DISTANCE (log)	-1.025	-0.903	-	-0.325	-0.931	-	-1.009
	(9.95)***	(7.50)***		(2.70)***	(7.74)***		(7.40)***
COMLANG	1.678	1.377	-	0.558	1.285	-	1.828
	(12.98)***	(6.23)***		(2.76)***	(5.97)***		(8.36)***
COMCOL	0.482	0.341	-	2.299	0.196	-	0.21
	-1.45	-0.67		(5.62)***	-0.39		-0.35
COLONY	-0.683	-0.086	-	0.784	-0.025	-	-0.62
	(2.54)**	-0.21		(4.45)***	-0.06		-1.64
ADJANCENCY	2.502	2.647	-	0.173	2.726	-	2.141
	(6.10)***	(5.27)***		-0.6	(5.46)***		(3.73)***
SAMEFTA	0.175	0.88	1.052	0.276	0.684	-0.26	0.286
	-0.89	(5.77)***	(5.73)***	-1.56	(4.28)***	-0.82	(1.65)*
Government Stability	0.153	0.2	0.232	0.508	0.209	0.121	0.208
	(2.37)**	(5.80)***	(6.58)***	(2.91)***	(5.81)***	(2.12)**	(5.27)***
Observations	9760	9760	9760	9127	9760	5761	8484
R-squared overall	0.61	0.6	0.26	-	0.46	-	-
R-squared within	-	0.07	0.08	-	-	-	-
R-squared between	-	0.59	0.28	-	-	-	-
Number of pairs	-	3496	3496	-	-	2054	2439
AR (1) coefficient	-	-	-	-	0.875	-	-
Sargan test	-	-	-	-	-	5.76	-
						[0.060)	

Note: The dependent variable in all regressions is the log of the FDI stock plus the minimum positive value expect column 4 where the dependent variable is the FDI stock in levels. All regressions include source country dummies, not reported. Absolute robust White-corrected t-statistics in parentheses. P-values in brackets. *, **, *** significant at 10, 5 and 1 percent, respectively.

The results for the Poisson estimation, proposed by Santos and Tenreyro (2006), are presented in column 4. Again, while the point estimate is slightly higher than for the other regressions the effect of institutions on FDI is statistically significant and in line with our cross section results in terms of economic significance.[33]

In column 5, we use the Prais - Winsten estimator that corrects for first order autocorrelation in the residuals, which could potentially be a problem. As it can be seen, while we find evidence of a significantly autocorrelated error term, our result regarding the institutional variable is not sensitive to this issue. The point estimate for the impact of institutions over time almost identical to the random and fixed effects estimates. Given the evidence of a significant autocorrelation in the residuals, an alternative is to formulate an explicitly dynamic model by including a lag of the dependent variable in our model. In this case, it is well known that OLS estimates tend to be inconsistent. Thus, we proceed to estimate the equation using the Arellano-Bond GMM estimator. Results are reported in column 6. Again, the coefficient of Government Stability is positive and significant, although somewhat smaller. However, it should be kept in mind that the effect of the explanatory variables is no longer straightforward to compute if the lagged dependent variable is included. Given the size of the coefficient on the lagged dependent variable, the long-run coefficient of the institutional variable is actually very near to the previous estimates. A last robustness check we perform is to estimate the model

[33]Fixed effects estimates using the Poisson approach yield a smaller but significant estimate of around 0.04. Results are not reported due to space considerations but are available upon request.

using panel-corrected standard errors GEE, assuming an AR(1) process. The results are reported in column 7. Again, the estimate for our coefficient of interest remains significant. Furthermore, the point estimate is very close to those reported in the previous levels. Overall, this section shows that the panel data evidence also shows a significant and important impact of institutions on FDI.

3.6 Conclusions

In this chapter, we have shown the relevance of the institutional quality as a factor of attraction of FDI. We find that the quality of institutions has positive effects on FDI. The impact of institutional variables is statistically significant, and economically very important. For example, a one standard deviation change in the regulatory quality of the host country's government changes FDI by a factor of 2. Additionally, not all institutional dimensions have the same importance for the decision of where to invest. We find that unpredictable policies, excessive regulatory burden, and lack of commitment on the part of the government seem to play a major role in deterring FDI. These results are robust to the use of a wide variety of institutional variables, collected from different sources, and using different methodologies. Furthermore, they are also robust to different specifications, and different estimation techniques. In addition, we have also contributed panel data evidence that confirm our results from the cross section.

Thus, countries that would increase foreign investment would be able to do so

by increasing their institutional framework, especially by establishing a predictable framework for economic policies and enforcement. In particular, the results presented In addition, this development strategy would also have positive spillovers to other economic activities that are key to economic growth and development. The results of our paper are clearly in line with the empirical growth literature that has stressed the importance of institutions for economic growth (e.g., see Acemoglu et al, 2001 and Hall and Jones, 1999). In particular, our paper highlights one channel through which institutions might affect growth: by increasing FDI. In addition, raising the institutional quality would have also a positive effect on domestic investment as Mauro (1995) and Stasavage (2002) have shown.

Appendix A

Appendix

A.1 Solution Algorithm

The following algorithm is used to solve for the equilibrium of the model outlined in section 1.3. It follows Arellano (forthcoming) very closely.

1. Start with a guess for η and a equally spaced grid of 300 points.

2. Initiate the process formulating a guess for asset prices $q_0(b', z, A)$. I start considering the risk free rate, such that $q_0(b', z, A) = \frac{1}{1+r^*}$.

3. For this intial guess of bond prices, solve the model by value function iteration until convergence and compute policy functions and the implied default decisions, as well as asset prices $q_1(b', z, A)$.

4. Check whether the resulting asset prices matrices q_1 and the initial guess q_0 are sufficiently close, by computing $||q_0 - q_1|| < \varepsilon = 10^-6$. If this condition holds, continue to the next step, else set $q_0 = q_1$ and start at step 3 again.

5. Compute business cycle statistics for 100 samples of 100 years. Compare the average default frequency with the 3% default frequency in the data. If the model matches this frequency, stop. Else, adjust η and start at step 2 again.

A.2 Sample

- **Latin America**: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Paraguay, Peru, Trinidad and Tobago, Uruguay, Venezuela
- **Asia**: Bangladesh, China, Hong Kong, India, Indonesia, Kazakhstan, Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Vietnam
- **Eastern Europe**: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovenia, Turkey
- **Africa/Middle East**: Cote d'Ivoire, Egypt, Ghana, Israel, Kenya, Morocco, Namibia, Nigeria, South Africa, Tanzania, Tunisia, Zambia
- **Europe**: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom
- **Other**: Australia, Canada, Japan, New Zealand, United States

A.3 Variable

- Bilateral FDI stocks FDI asset holdings of source country i in host country j in million US dollar; UNCTAD
- Bilateral portfolio equity and portfolio debt stocks average 2001-2003 holdings of source country i in host country j in million US dollar; Coordinated Portfolio

Investment Survey (CPIS), IMF

- Bilateral loans aggregate assets and aggregate liabilities of banks in reporting countries vis--vis banking and non-banking institutions in host countries; International Locational Banking Statistics (ILB), BIS

- Distance log bilateral great circle distance in miles between economic centers of source country and host country; Andy Roses website

- Telephone traffic volume of telephone call traffic between source and host country; ITU Directions of Trade

- Trade in newspapers and periodicals Exports from country i to country j plus exports from j to i in million US dollar; UN Comtrade database Exports of item 8922 SITC Rev.2

- Bilateral stock of foreigner sum of foreigners born in country i currently living in country j and vice-versa; OECD Database on Foreign-born and Expatriates

- Common language dummy equal to one if both countries speak the same language and zero otherwise; Andy Roses website and CIA World Factbook

- Common legal origin dummy equal to one if both countries have legal system with same origin and zero otherwise; La Porta et al (1998)

- Colonial links dummy equal to one if both countries have been linked through colonization; Andy Roses website and CIA World Factbook

- Trade agreement dummy equal to one if both countries have a bilateral trade agreement or are part of a common agreement and zero otherwise; Andy Roses website

- Investment treaty dummy equal to one if both countries have a bilateral investment treaty and zero otherwise; UNCTAD

- Bilateral trade the imports of goods and services of host country from and source country in US dollar million; IFS, IMF

- Capital account openness dummy equal to one if the host country had fully liberalized its capital account by 1996 and zero otherwise; Annual Report of Exchange Arrangements and Exchange Restrictions, IMF

- Financial development credit to the private sector in USD million; IFS, IMF

- Stock market capitalization average stock market capitalization in USD million over the period 1999-2003; Datastream and national sources

- Quality of information disclosure index that goes from 0 to 7 with higher values indicating that regulation requires more disclosure of information (see source for more details); World Bank Doing Business Database

- Accounting standards rating of companies in seven different categories in 1990. The index goes from 0 to 100, with higher values representing better standards; La Porta et al (1998)

- Property rights index that goes from 0 to 5, with higher values representing bad protection of property rights; Heritage Foundation

- Expropriation risk index goes from 0 to 10, with high values representing low risk; ICRG PRS

- Repudiation risk index goes from 0 to 10, with high values representing low risk; ICRG PRS

- Days of enforcement the time of dispute resolutionin calendar dayscounted from the moment the plaintiff files the lawsuit in court until settlement or payment; World Bank Doing Business Database

- TI corruption value of index goes from 0 to 10, with higher values indicating higher levels of corruption; Transparency International (Wei, 2000b)

- WDR corruption index goes from 1 to 8, with higher values indicating higher levels of corruption; World Bank (Wei, 2000b)

- German exporters corruption index survey based index that goes from 0 to 10. Higher values represent higher levels of corruption; Wei (2000b)

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