FOREIGN PORTFOLIO INVESTMENT, THE EUROPEAN MONETARY UNION AND EXCHANGE RATE UNCERTAINTY

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Abstract

The objective of this paper is to analyze the determinants of the European portfolio investment outflows with emphasis on the impacts of the European Monetary Union (EMU) and exchange rate uncertainty. The asymmetric information hypothesis argues that reduced transactions costs due to the EMU should increase the share of European portfolio investment within the currency area. We tested these assumptions based on an extended gravity model where the dependent variable is the portfolio investment held by residents of the main European countries in 14 countries, including EU, Eastern European and OECD countries and the main emerging markets. Among the explanatory variables are interest rate differentials, the expected exchange rate uncertainty – estimated by an ARCH model – a dummy variable for the EMU and gravity variables (e.g. distance and GDP differentials). The model was estimated based on a panel data set over the period 2001-2005 Our results find support for the argument that most European portfolio investment is dominated by the transaction cost hypothesis since the EMU variable, the exchange rate uncertainty measure and geographic and institutional distances are statistically significant.

Keywords: *foreign portfolio investment; EMU; exchange rate uncertainty; gravity model*
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1. Introduction

Cross-border flows of portfolio investment are by nature more unstable than foreign direct investment (FDI). Clearly, portfolio holdings are not subject to the high sunk costs and the market irreversibility that affect FDI. Given this more erratic behavior, the literature has given less attention to the determinants of foreign portfolio investment (FPI). More recently, however, the deepening of international financial integration has brought about an unprecedent movement of capital in bonds and equity markets. Among the reasons that explain international capital flows are the search for higher returns and a better sharing and diversification of risk.

In the context of a currency union, as the European Monetary Union (EMU), we can argue that a higher degree of financial integration enhances savings availability – increasing potential GDP growth – and risk sharing among the member countries. Besides, within the currency union area and also for those countries with a greater degree of financial integration, the volatility of asset prices tends to be lower, motivating a more efficient allocation of financial capital.

Portfolio holdings in foreign countries are also subject to transaction and information costs. Therefore, geography matters when investors decide where to allocate their capital, in the sense that cultural, institutional and legal proximity as well as the relative size of the host market are key factors to portfolio decisions. Both the European financial integration and the gravity variables arguments tend to reinforce the home bias preference of portfolio holders – not longer at a country level but rather at the regional (European or EMU) level.

The main objective of this paper is, then, to analyze the determinants of foreign portfolio investment from the main European countries into fourteen main host countries, including EU, Eastern European and OECD countries and the main emerging markets. The focus is on both financial and real variables, specially exchange rate uncertainty, monetary integration and geographic and institutional distance. An FPI model is developed and estimated based on a panel data set over the period 2001-2005. The remainder of this paper is organized as follows. In next two sections we provide a summary of the relevant literature and develop the basic model. Section four reports the empirical results and section five summarizes and states our conclusions.

2. Portfolio Investment Behavior

The introduction of the EMU provides an opportunity to discriminate between different theoretical explanations for investment behavior. There are basically two competing theoretical approaches to explain investment behavior given the implementation of a currency union. From the diversification motive standpoint, the monetary union should reduce the attractiveness of portfolio holdings in other EMU countries. On the other hand, the asymmetric information hypothesis argues that reduced transactions costs due to the EMU should increase the share of European portfolio investment within the currency area.

The basic intuition of the diversification motive in theory of finance was developed by Grubel (1968), Levy and Sarnat (1970), Solnik (1974). More recently, Harvey (1991) and De Santis and Gerard (1997) argued that portfolio investors hold foreign securities because of the risk reduction benefits. In addition, based on this theoretical approach, investors tend to include too little of their wealth in foreign assets relative to the proportion modern finance theory would suggest; a behavior that the finance literature refers to as “home bias”.

A growing section of the “home bias” literature suggests information asymmetry between domestic and foreign investors introduces a significant indirect barrier that leads investors to concentrate the choice of portfolio investments in their domestic market. This literature also suggests the decimation of information on investment targets, as well as of the characteristics that are common to both investors and investment targets. Coval and Moskowitz (1999) and Grinblatt and Keloharju (2001) provide strong evidence that geography, language and culture induces a “home bias” even within a country´s borders. Huberman (2001) shows that the “home bias” is a consequence of investors preferences for holding equities that they are more familiar with. Kang and Stulz (1997), and Dahlquist and Robertsson (2001) find foreign investors to exhibit preference for large and more visible firms.

According to Al-Khail and Berglund (2001), the explanations for the “home bias” phenomenon fall into to two different categories. The first one explains the concentration of portfolio investments by investors in their domestic countries by the existence of some inertia in financial markets and severe institutional restrictions. Institutions that handle international transactions are sluggish to adjust. Once rigidities are overcome and adjustment has taken place, the new capital allocation is not far different from the international capital asset pricing model would predict. The other explanation to the diversification motive relies on geographic

proximity, strong trade linkages and language and has been put forward basically by Tesar and Werner (1995).

Cooper and Kaplanis (1994) test whether the home bias in equity portfolio decisions are caused by investors attempting to hedge purchasing power parity (PPP) deviations. They find that the bias towards domestic stocks is not reconcilable with investors need for hedging the domestic inflation. They also show that the fraction of domestic and foreign stock in investors portfolios implies "a dead weight cost" on foreign investment that is too high to reconcile with existing barriers to cross-border investments.

French and Poterba (1991) use investors aggregate equity portfolio allocations in the domestic and a number of foreign markets and show that a simple mean-variance model imply returns that substantially deviates from the ex-post returns of these markets. They suggest that the home bias of investors portfolios can only be justified if investors have higher expectations of the returns in their domestic equity market returns.

Overall, the literature points out that while international financial markets have been witnessing a higher degree of integration in recent years, there still remain a number of considerations that prevent investors from taking advantage of the large diversification that simple mean-variance suggest. The evidence also suggests that at least some fraction of the home bias may be the result of the inability of simple mean-variance theory to capture other sources of risk. International investing introduces additional risk arising from different currencies, political, legal and institutional difference across countries that complicates information gathering on the equities of these markets.

Recent research emphasizes these informational considerations and provides evidence that they have a large impact on the deviations in investors domestic and international portfolios from the weights that portfolio theory prescribes. For example, Brennan and Cao (1997) construct and empirically test a model where differences in the informational endowments between foreign and domestic investors, influence the cross border equity portfolio flows.

3. The Model

Portfolio investment decisions are assumed to be affected by the expectation of return differential at the domestic and the foreign capital markets. The underlying model for this hypothesis is provided by the well-known uncovered interest parity (UIP) condition. However, portfolio decisions are argued to be also influenced by the investment climate at the source and the host country. Therefore, the nature of the investment determinants is twofold: financial variables, as interest rate differentials, and real variables, as the quality of institutions.

Interest parity conditions recognize that investors have the choice of holding assets denominated in the currency of the source country (in bilateral terms, named as country *i*), which offer a domestic rate of return (r_t^i), and of holding assets denominated in host currency (named as country *j*), which offer a foreign rate of return (r_t^j). Since investors are concerned with returns denominated in their own currency, foreign rates of returns have to be adjusted by the expected devaluation of the foreign currency with respect to the domestic one. Therefore, the uncovered interest parity can be written as

$$r_t^i = r_t^j + E_t[s_{t+1}^{ij} - s_t^{ij}] \qquad (1)$$

where s^{ij} is the nominal bilateral exchange rate.

The empirical evidence of the UIP condition has been widely tested. Most of the studies have pointed out the empirical failure of the UIP (e.g., Engel, 1996), although more recently, attempts to estimate long-run horizon regressions have found support for the uncovered interest parity[2]. For the purpose of this study, we are not concerned with the assumption of whether the UIP holds; but we simply assume that the investment decision is driven by the interest differential, including the expected devaluation and the risk of default. Therefore, foreign portfolio investment (*fpi*) allocations between the source and the host country can be specified as follows

$$fpi_t^{ij} = f((r_t^j - r_t^i),(E_t[s_{t+1}^{ij} - s_t^{ij}])) \qquad (2)$$

[2] See, for instance, Chinn and Meredith (2005).

The second component of our model of foreign portfolio decisions is derived from the well-established gravity equation. We assume, therefore, that portfolio investment is not only conditioned by financial variables but also by real factors. The literature on theoretical and empirical studies using the gravity model is quite vast. The gravity equation has been extensively used to explain bilateral trade and foreign direct investment[3], however the applications to portfolio flows are more limited, partly due to lack of available information. One of the earliest studies on bilateral financial flows using the gravity approach is Portes and Rey (1999), who find support for gravity variables – mainly distance as a measure of information costs – in explaining bilateral equity flows between 14 countries. More recently, Guerin (2006) also estimated a modified gravity model to examine the determinants of bilateral foreign direct investment, trade and portfolio investment. Bilateral portfolio investment is found to be significantly affected by information costs and also to be more sensitive (than foreign direct investment) to control variables, as macroeconomic fundamentals.

In its original form, the gravity equation can be written as

$$g^{ij} = g\left(\frac{m^i m^j}{dist^{ij}}\right) \qquad (3)$$

where g is the attraction force; m_1 and m_2 are the objects due to attraction; *dist* is the distance between the objects *i* and *j*. In our case, the variable that is under the influence of the attraction force from the source country *i* to the host country *j* is the portfolio investment and the objects – that explain the intensity of the flows – are *proxied* by the GDP in each country. Distance is traditionally argued to be an indicator of transport costs. For portfolio investment, geographical distance can be assumed to be positively related to transaction costs – due, for instance, to imperfect information related to the host country. In addition, investment decisions are also affected by the institutional environment in the host country (with respect to the institutional quality prevailing in the source country). Therefore, as the gravity attraction also exerts influence on investment decisions, equation (4) can be written as

[3] See, for instance, the seminal papers by Deardorff (1998) and Feenstra, Markusen and Rose (2001).

$$fpi_t^{ij} = f((r_t^j - r_t^i),(E_t[s_{t+1}^{ij} - s_t^{ij}]),\frac{m^i m^j}{dist^{ij}}) \qquad (4)$$

In order to state equation (4) in an estimable form, some further assumptions have to be made. The expected devaluation of the nominal bilateral exchange rate is approximated by two variables: the current bilateral exchange rate and a measure for the exchange rate uncertainty – which *proxies* the size of the exchange rate premium. Given that investors use all available information to forecast future exchange rates, the uncertainty measure is estimated by an ARCH model. The model for the conditional variance of the nominal bilateral exchange rate (s_t^{ij}) is specified in the simplest way, as following

$$s_t^{ij} = a_0 + \sum_{k=1}^{q} a_k s_{t-k}^{ij} + \varepsilon_t \qquad (5)$$

$$\hat{\varepsilon}_t^2 = \alpha_0 + \sum_{k=1}^{q} \alpha_k \hat{\varepsilon}_{t-k}^2 + \omega_t \qquad (6)$$

where $\hat{\varepsilon}_t^2$ is the conditional variance of the nominal bilateral exchange rate. Equation (6) is estimated as long as the ARCH effect is significant in the mean equation (5). If there is no ARCH, the exchange rate uncertainty variable is given by the unconditional variance of the exchange rate.

In addition, the gravity variables, included in equation (4), can be argued to be capturing real sector effects on portfolio investment. As mentioned before, the objects due to attraction are measured by the GDP difference (in US$) between the host and the source country. Distance, in its turn, is taken in geographical and institutional terms.

The extension and quality of institutions have been often related as a structural change with significant impacts on economic development. In international financial sectors, institutions play a significant role since foreign investors are subject to uninsurable instability arising from different currencies, political and legal systems across countries. According to Al-Khail (2003), asymmetric information is a significant indirect barrier to capital inflows. He includes institutional variables as *proxies* for the information costs, as long as these

institutions provide a regulatory and legal environment that reduces the non-familiarity conditions with respect to the host country.

In the same line of institutions, we can also argue that financial integration facilitates portfolio allocation between different countries. The reduction of transaction costs and of exchange rate uncertainty achieved from exchange rate arrangements to monetary union stimulate portfolio investment and tend to magnify the home bias evidence to the level of regional integration areas. In fact, financial integration has progressed more remarkably within countries that are part of preferential trade agreements than at a multilateral level. As found by De Santis and Gérard (2006), the establishment of the European Monetary Union (EMU) enhanced regional financial integration in the Euro area and motivated equity and bonds flows within the region. Al Khail and Berglund (2001) reached similar results for the case of Finland. They concluded that the allocation of Finnish portfolio investment is predominantly influenced by the information based assumption – which supports that reduced information asymmetry produced by the EMU increases portfolio holdings in other EMU.

Therefore, in our case – where focus is given to the portfolio holdings of the main European countries in the main recipient countries – the equation to be estimated for bilateral portfolio investment can be specified as follows

$$fpi_t^{ij} = \beta_0^{ij} + \beta_1 (r_t^j - r_t^i) + \beta_2 s_t^{ij} + \beta_3 eru_t^{ij} + \beta_4 \left(gdp_t^j - gdp_t^i \right) + \beta_5 geodist^{ij} + \beta_6 instdist_t^{ij} + \beta_7 EMU_t^j + u_t^{ij} \quad (7)$$

We use bilateral outward stock of international portfolio investment (published by the International Monetary Fund). The data comprise cross-border holdings of securities by the financial sector of 14 countries from 2001 to 2005. The European source countries in our sample are: France, Germany and United Kingdom; and the host countries (besides the three previous European countries) are: Italy, Netherlands, Czech Republic, Hungary, Poland, Brazil, Mexico, India, S. Korea, Japan and the United States.

Annual macroeconomic data for the source and host countries on interest rates, exchange rates and GDP were collected from the International Financial Statistics/IMF. Distances between country capitals were taken from the USDA (United States Department of Agriculture) web site.

In order to assess the role of institutional quality as a determinant of portfolio investment, we adopted the six different indicators, each representing a different dimension of governance, developed by Kaufmann et al (1999a). The six institutional variables calculated in that study are: Government Effectiveness, Regulatory Quality, Voice and Accountability, Political Stability, Rule of Law and Control of Corruption. In all cases, a larger value of the variable indicates a higher performance of the institution in question[4].

Government Effectiveness and Regulatory Quality are related to the ability of the government to formulate and implement policies. Voice and Accountability, as well as Political Stability, aggregate those aspects related to the way authorities are selected and replaced. 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.

According to Daude and Stein (2004), there may be good reasons to expect a positive correlation[5] between most of these institutional variables. This correlation induces serious problems of multicollinearity and limits the extent to which the relevance of each institutional dimension can be identified. To solve this problem the authors group the variables that had similar dimensions. In our case, we follow the same procedure as Daude and Stein (2004) and we group, in a simple average, Voice and Accountability and Political Stability, calling the composite indicator as *Political Stability*. The other four variables, Rule of Law, Control of Corruption, Government Effectiveness and Regulatory Quality, are grouped as *Government Efficiency*.

4. Results

Before dealing with the estimation of the determinants of bilateral portfolio investment, we focus on some preliminary results regarding our main variable – the foreign portfolio investment (FPI) – and the exchange rate uncertainty measure.

Table 1 shows the FPI stocks for the three source European countries (France, Germany and the UK) and the 14 host countries in our sample. For the cases of France and Germany, the EU bias is quite evident, since the main European countries are largest recipients of portfolio investments. For the UK, on the other hand, foreign portfolio holdings

[4] For more technical details see Kaufmann et al (1999b).
[5] In the Appendix we show the correlation between the institutional variables.

are more distributed internationally, both to other developed countries (the USA and Japan) and to emerging markets.

Table 1 Foreign Portfolio Investment in 2005 (in millions of U.S. dollars)

Host Country	***Source Country***		
	France	*Germany*	*UK*
France	-	152,362	73,871
Germany	198,094	-	106,398
UK	187,582	108,109	-
USA	202,127	135,479	589,974
Japan	66,668	33,222	195,936
Italy	226,961	167,650	108,309
Netherlands	192,577	135,933	152,237
Czech Republic	447	2,383	2,004
Hungary	2,588	9,435	777
Poland	4,024	8,871	7,693
Brazil	1,768	4,687	11,745
Korea	3,468	1,616	34,656
India	1,522	514	10,125
Mexico	1,446	2,849	16,855
Total	1,857,001	1,559,651	2,373,924

Source: www.imf.org

In the theoretical model, we argued that the expected devaluation of the host country currency could be *proxied* by the exchange rate uncertainty, which was assumed to be measured based on an ARCH model of the bilateral exchange rate. The ARCH model, outlined in equations (5) and (6), was estimated for the exchange rate of the host country currency against the Euro and the British Pound based on a sample of monthly data from Jan./2001-Dec./2005. For the cases where ARCH was significant, the annual average of the squared root of the expected conditional variance was computed. Whenever ARCH was not significant, the simple squared root of the unconditional variance of the monthly bilateral exchange rate was calculated. The results of the ARCH test for all bilateral exchange rates are reported in Appendix A1. Out of 20 pairs of bilateral exchange rates, in 5 cases ARCH was found to be statistically significant.

The results for the exchange rate uncertainty measure are, then, depicted in Figure 1 and 2. In general terms, we can say that uncertainty is not higher among emerging markets (depicted in the right-hand side panels) than in developed countries. It is worth mentioning the relatively high uncertainty of the British Pound against the Euro, the low and declining exchange rate uncertainty (with respect to the Euro) of the Eastern European countries and the generally higher exchange rate uncertainty of the host country currency against the British Pound than against the Euro.

Figure 1 – Exchange rate uncertainty measure – Host country currency against the Euro

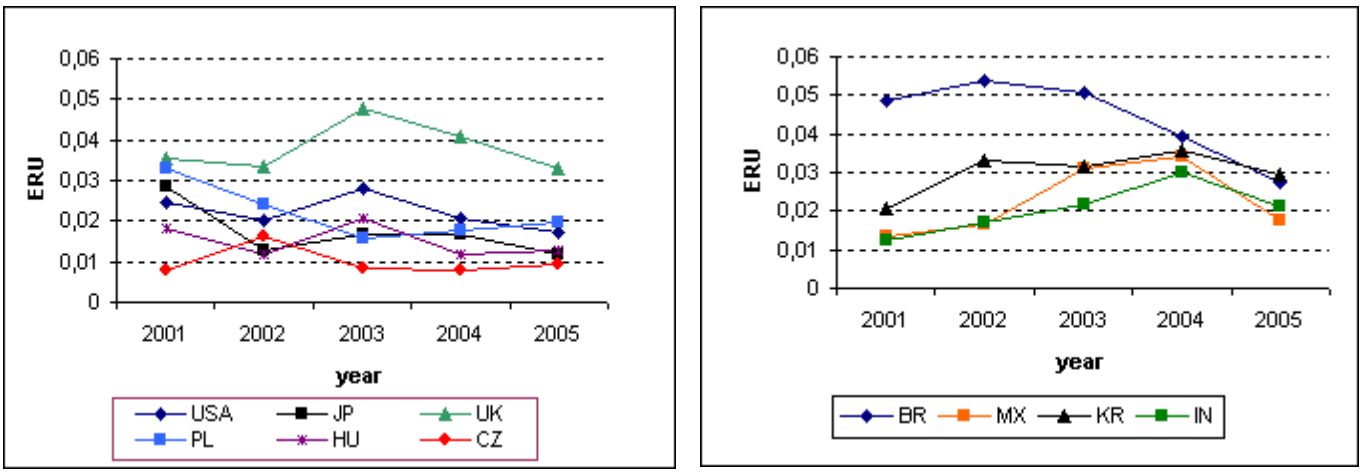
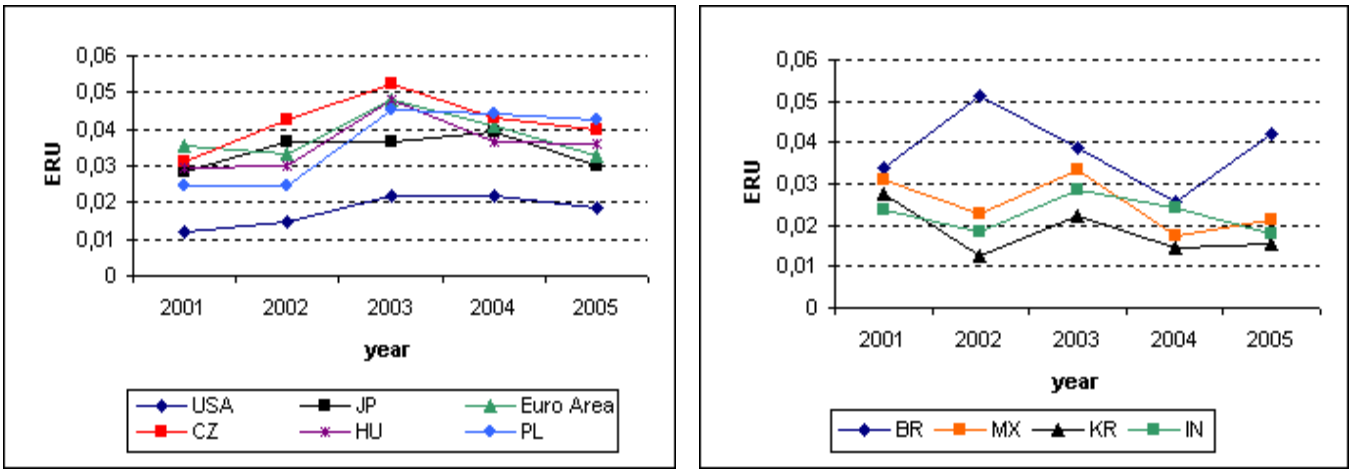


Figure 2 – Exchange rate uncertainty measure – Host country currency against the British Pound



The determinants of bilateral foreign portfolio investment are given by the estimation of equation (7). The panel data model is estimated by the random effects method since

geographic distance is invariant over time for a given country pair[6]. Before dealing with the main results, some preliminary tests were done to evaluate sample characteristics. The condition of stationarity data was examined. The results for the panel data unit root test (Table 2) suggested by Levin, Lin and Shin (2002) indicate that the null hypothesis of a unit root cannot be accepted, indicating that all series in the panel are stationary.

Table 2 Panel Unit Root Tests (Levin, Lin & Shin)

Null Hypothesis: Unit root	***Statistic***	***Probability***
fpi_t^{ij}	6.176	0.000
eru_t^{ij}	16.234	0.000
s_{t-1}^{ij}	5.666	0.000
$\left(r_t^j - r_t^i\right)$	18.407	0.000
$\left(gdp_t^j - gdp_t^i\right)$	3.330	0.000
Government Efficiency	2.335	0.009
Political Stability	8.554	0.000

In order to evaluate model specification adequacy, the Granger causality test was also implemented. The results (Table 3) show that all independent variables (except nominal bilateral exchange rate) were found to Granger cause (the logarithm) of bilateral foreign portfolio investment. The reverse is not true; that is, *log(fpi)* does not Granger cause any of the assumed independent variables (at 5% level). For the case of exchange rates, since the result might indicate that current exchange rates are endogenous, we considered in the model the variable lagged one period.

[6] Since the random effects model is estimated by a maximum likelihood approach, the parameters obtained have minimum variance.

Table 3 Granger Causality Tests

Null Hypothesis	*F-Statistic*	*Probability*
eru^{ij} *does not Granger Cause log(fpi)*	4.158	0.018
log(fpi) does not Granger Cause eru^{ij}	2.130	0.123
$(s^{ij})_t$ *does not Granger Cause log(fpi)*	2.316	0.103
log(fpi) does not Granger Cause $(s^{ij})_t$	0.976	0.379
$(r^j - r^i)$ *does not Granger Cause log(fpi)*	8.781	0.000
log(fpi) does not Granger Cause $(r^j - r^i)$	0.559	0.572
$log(gdp^j - gdp^i)$ *does not Granger Cause log(fpi)*	3.008	0.053
log(fpi) does not Granger Cause $log(gdp^j - gdp^i)$	0.770	0.465
government efficiency does not Granger Cause log(fpi)	6.188	0.002
log(fpi) does not Granger Cause government efficiency	0.376	0.687
political regulatory does not Granger Cause log(fpi)	4.723	0.010
log(fpi) does not Granger Cause political regulatory	2.770	0.066

Finally, Table 4 reports the results for the estimation of the determinants of foreign portfolio investment for the three main European countries (France, Germany and the United Kingdom) to 14 main host countries (as described above).

Table 4 Foreign Portfolio Investments Determinants

	(1)	**(2)**	**(3)**
Constant	**13.354*** **	**13.456*** **	**13.390*** **
	(1.916)	(1.821)	(1.808)
$(r^j - r^i)_t$	**-0.405**		
	(2.662)		
$Log(s^{ij})_{t-1}$	**0.040**	**0.049**	
	(0.074)	(0.069)	
$(eru^{ij})_t$	**-0.113***	**-0.115***	**-0.113***
	(0.062)	(0.061)	(0.062)
$geodist^{ij}$	**-0.356***	**-0.373***	**-0.345***
	(0.243)	(0.227)	(0.221)
$Log(gdp^j - gdp^i)_t$	**0.951*** **	**0.960*** **	**0.944*** **
	(0.168)	(0.152)	(0.148)
EMU	**1.207** **	**1.227** **	**1.104** **
	(0.530)	(0.541)	(0.516)
Government Efficiency	**0.206*** **	**0.210*** **	**0.214*** **
	(0.079)	(0.069)	(0.068)
Political Stability	**0.019**		
	(0.186)		
Number of observations	195	195	195
Adjusted R^2	**0.680**	**0.677**	**0.681**
F-Statistic	43.769	56.216	67.161

***, **, * Significant at the 1, 5, and 10% level. Standard error are in parentheses.

Specification (1) includes all variables in the model. Among the financial variables, only the exchange rate uncertainty measure was found to be statistically significant. The interest rate differential was not significant in all our estimation attempts, indicating that difference in returns are not a key in portfolio allocations. The coefficient of the lagged exchange rate, although positive (indicating that portfolio inflows will be higher when the host country currency is devaluated), was also not statistically significant. Conditional uncertainty measured by the ARCH model was estimated to significantly decrease portfolio holdings in the host economy.

The two traditional gravity variables are significant to explain cross-border portfolio decisions[7]. The coefficient for the difference in GDP levels between the host and the source country was estimated with a sizable magnitude and is highly statistically significant. A ten percent increase in the host market (relative to the source market) implies an increase of about 9.4 percent in foreign investors allocations to the host country. The coefficient for the geographic distance is positive and statistically significant (at 10% level), which means that information and other transaction costs – *proxied* by distance – are important for portfolio investment.

Regarding the other three variables – which are also related to the gravity model – the results show that government efficiency (the first composite institutional indicator) was estimated with a positive and statistically significant coefficient. Therefore, considering the variables that comprise this indicator, an improvement in the ability of the host country government to formulate and implement policies as well as an increase in the regulatory quality tend to stimulate the influx of portfolio investment to the host country. On the other hand, the coefficient for the second aggregated indicator, called political stability, was not statistically significant. This result points out that portfolio investors are more concerned with institutional aspects related to policy effectiveness and regulation than those related to the political environment. Finally, for the European monetary integration variable, the EMU dummy, the coefficient was estimated to be positive and significant. Such result confirms the asymmetric information hypothesis and indicates that the reduced transactions costs due to the EMU increase the share of European portfolio investment within the currency area.

[7] Other conventional gravity dummy variables were included in the model, as common borders and common language, but they were found to be statistically non-significant.

5. Conclusion

The literature on portfolio investment has pointed out two theoretical hypotheses: the diversification motive and the asymmetric information motive for cross-border portfolio holdings. Under the asymmetric information assumption, the launch of the EMU and the significant decline in uncertainty among member countries should have facilitated capital movements within the currency area.

The estimation of a foreign portfolio investment for European countries confirms the general idea under the asymmetric information hypothesis. The EMU variable is statistically significant, indicating that there is a "regional bias" for European portfolio holdings. That result indicates that European investors prefer to invest regionally (at the Euro currency area) than internationally, given basically the lower transaction costs and familiarity aspects common to member countries. Besides, the results show that investors behave negatively to exchange rate uncertainty, indicating that a currency area and exchange rate arrangements might be preferable to other systems where the instability is inherently higher. The gravity variables also give support to the asymmetric information assumption since both geographic distance and institutional distance depress foreign portfolio investment. That is, the farther and the less reliable the host country, the higher the transaction and informational costs, and, therefore, the lower the cross-border portfolio holdings.

In addition, foreign portfolio investment from European countries was found to be positively influenced by the relative size of the host country economy – which ratifies the empirical appeal of the gravity model also for portfolio holdings. The non-significance of interest rate differentials and exchange rates might be seen as an indication that portfolio investments are less prone short-run macroeconomic changes, being driven by long-run fundamentals.

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Appendix

Table A.1 ARCH Test for selected currencies against the Euro and the British Pound – Jan./2001-Dec./2005

Host Country	ARCH Test against the Euro		ARCH test against the B. Pound	
	χ^2	p-value	χ^2	p-value
Euro Area			1.856	0.7620
UK	1.856	0.7620		
USA	1.265	0.8671	0.798	0.9386
Japan	14.567	0.0056	3.157	0.5318
Czech Republic	20.132	0.0004	1.423	0.8401
Hungary	1.077	0.8978	0.697	0.9515
Poland	0.403	0.9821	0.703	0.9508
Brazil	11.880	0.0182	4.197	0.3799
Korea	9.241	0.0553	3.894	0.4204
India	0.401	0.9823	2.881	0.5779
Mexico	8.825	0.0656	0.645	0.9578

Notes: The null hypothesis is that there is no ARCH. The test statistic TR^2 follows χ^2 distribution with *q* degrees of freedom.

Table A.2 Partial Correlations between the institutional variables

Government Effectiveness	1.000					
Rule of Law	0.948	1.000				
Control of Corruption	0.961	0.950	1.000			
Regulatory Quality	0.929	0.860	0.890	1.000		
Political Stability	0.684	0.686	0.649	0.771	1.000	
Voice and Accountability	0.877	0.908	0.875	0.891	0.720	1.000

Authors' calculations based on Kaufmann, Kraay and Zoido-Lobatón (1999).