A dynamic gravity model for global bilateral investment holdings

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Abstract

Global bilateral investment holdings are characterized by a substantial number of zeroes and strong serial persistence. Based on a gravity setup, we consider investment behavior at the extensive (participation) margin and employ dynamic first-order Markov probit models, controlling for unobserved cross-sectional heterogeneity and serial correlation in the transitory error component, in order to explore the sources of persistence. The data support that the strong persistence is driven by true state dependence, implying that past investment experiences strongly impact on the trajectory of future investment holdings. This suggests that inward-investment stimulating policy measures could have a more pronounced effect, since they are likely to induce a permanent change to the future trajectory of inward investment.

Keywords: Bilateral Investment Holdings, Gravity Model, Initial Conditions, State Dependence

JEL: F21, F34, G11, C25, C35

1. Introduction

The accelerating process of financial globalization in the last decades provides countries with an important opportunity for wider portfolio diversification by investing in a large variety of financial assets available in capital markets worldwide (Lane and Milesi-Ferretti, 2004). This process is an integral part of capital mobility, providing vital access to international capital for developing countries. From this point of view, international asset trading is of great importance for efficient risk sharing and economic development. It is therefore of great interest to investigate the determinants of the global financial capital geography, and especially the factors behind the potential of a country issuing securities (host country) to attract international capital by selling financial assets to foreign investors. The unveiling of the crucial factors rendering a country attractive for international financial capital is a prerequisite for designing effective policy plans that aim to facilitate capital inflows and consequently instigate economic development through enhanced access to external financing for investment projects in the host country. Moreover, examining the dynamics characterizing the source country's decision to invest abroad provides grounds for evaluating the effects of policy in time – that is, we can ask whether the policy followed today to attract foreign investment could have persistent effects on the future capital inflows the host country will experience.

There is now a body of empirical work employing gravity equations, formerly only used to model bilateral trade in goods, to explain bilateral trade in financial assets (equity and bonds). The empirical success and analytical tractability of gravity models has established them as a standard reference model in international finance (for an influential paper on the empirical estimation of financial gravity equations see Portes and Rey (2005)). Theoretical foundations for financial gravity equations can stem from a variety of modeling assumptions. Obstfeld and Rogoff (2001) demonstrate how frictions in product markets can explain home bias in equity positions, even when global financial markets are complete. Martin and Rey (2003) focus on transactional frictions in asset markets, developing a model of incomplete financial markets reaching a gravity equation for bilateral investment holdings. Recently, Van Wincoop (2012) established in a generalized framework the theoretical foundations necessary to generate a gravity model equation in financial transactions.

The gravity equation framework roughly states that under certain modeling assumptions, the level of bilateral investment is positively affected by some measure of host and source country sizes, and is negatively related to bilateral trading costs between host and source countries. Trading costs are interpreted in the literature as informational costs entailed in asset trading, reflecting uncertainty, informational asymmetries and familiarity, cultural and trust factors (Portes and Rey (2005)). Empirical studies have also established that relevant host country factors affecting its appeal for international capital inflows are: (1) the level of host country's institutional quality (Papaioannou 2009), and (2) the level of host country's (financial) market development (Wei and Shleifer 2000; Portes *et al*., 2001; Wei 2002; Buch 2003; Rose and Spiegel 2004; Gelos and Wei 2005; Portes and Ray 2005; Aviat and Coeurdacier 2007; Egger and Merlo 2007; Guiso *et al*., 2007; Stein and Daude 2007; Alfaro *et al*., 2008; Daude and Fratzscher 2008; Lane and Milesi-Ferretti 2008; Fratzscher and Imbs 2009).

The standard gravity literature examines variations of the gravity equation for (the levels of) bilateral investment holdings in country pairs for a sample period, and thus is occupied with examining only the observations where positive (i.e. non-zero) level of investment has been observed. This empirical strategy, simplifying and straightforward as it may be, ignores the underlying selection mechanism which determines whether investment actually takes place or not in a given time period, and thus entails a danger of endogeneity-like bias in the estimates of the coefficients for the gravity factors affecting the level of investment from sender to host country. Moreover, no light is shed on the selection equation itself, which, as discussed above, is of significance in its own right for policy making.

Another unexplored feature of the data so far has been the serial persistence characterizing the discrete zero-one investment decision. Zeros tend to be followed by zeros, and ones tend to be followed by ones. An important question from a policy perspective is whether we can attribute the serial persistence to a causal mechanism from previous investment decision to the current, or if it is an artifact originating from the presence of unobserved pair heterogeneity or even transitory factors correlated between time periods.

This paper aims to fill both gaps: We employ dynamic random effects discrete choice models to investigate the factors affecting the decision to enter a foreign asset market. The discrete panel setting is appropriate since it allows us to estimate consistently both time varying and invariant factors and also incorporate unobserved pair-specific heterogeneity. Furthermore, it allows us to utilize a substantial part of the data for countries which for confidentiality reasons do not report levels of investment but only whether investment has taken place or not. In addition, the models we employ allow for both the presence of genuine state dependence and unobserved heterogeneity as well as serial correlation in the unobserved transitory errors, enabling us to distinguish among different sources of serial dependence and conclude on the nature of this persistence with a view on implications on the impact of investment-enhancing policies.

We use data from the Coordinated Portfolio Investment Survey (CPIS hereafter), a comprehensive dataset compiled by the IMF, providing information about the investment holdings of a large number of source countries over several years, broken down by host country. Our dataset is a panel consisting of country pairs (source-host) observed from 2001-2007, where we observe whether the source country has invested in the host for each period (a discrete zero-one decision) and a variety of source and host specific gravity-like covariates potentially affecting this discrete choice. The countries involved in the CPIS report investment holdings by end-investors and custodians of assets issued by foreign countries broken down in bonds (short and long-term) and equity holdings. The CPIS features a broad coverage of countries with 73 reporting source countries in 2007, and, contrary to the also widely used Bank of International Settlements (BIS) dataset, is not restricted to the banking sector. More importantly, the seven year panel structure of the data allows us to perform the analysis on both cross-country and time dimensions to control for variation across country pairs and within country pairs through time. Dynamics of cross-border investment holdings can be introduced in a natural fashion in this panel data framework, and well-known dynamic discrete choice methodology is used to distinguish among conceptually very different (albeit observationally similar) sources of serial persistence in the data.

Our findings may be summarized as follows: Among the various gravity factors that have been examined in the literature, we find very significant negative effects for distance which are robust under various specifications, validating in the discrete choice framework a familiar gravity literature finding that informational frictions play a crucial role in explaining bilateral asset trade. Familiarity effects and cultural affinities are also shown to be positive determinants of investment in our results. Moreover, Institutional quality of the issuing country emerges as a significant factor in attracting foreign capital, again in full accordance with the existing literature on international financial flows determinants. Unobserved pair heterogeneity is shown to capture a significant part of the unobserved variation, pointing to the many unobservable factors governing investment decisions. Finally, there is strong evidence supporting the existence of genuine state dependence, so that a successful policy that enhances the probability for positive foreign capital inflows today is even more beneficial in view of the fact that positive investment induced today will enhance the probability of positive investment in the future as well. The dynamic analysis of the discrete decision taken in this paper makes a contribution to the literature not only by stressing the factors relevant for policy designing, but also empirically investigating the intertemporal value of such policy measures.

The rest of the paper is organized as follows: Section 2 describes the data used, and provides motivation for the main analysis. We explain the econometric methodology in section 3, and section 4 presents the results. Section 5 concludes.

2. The Data and Motivation

2.1 Bilateral Investment Decision and State Dependence

Our dataset comes from the CPIS, and covers the time period 2001-2007. For this time span we have observations consisting of 54 source countries (i.e. countries investing abroad and buying foreign securities) and 166 host countries (i.e. countries selling the securities). After eliminating observations with missing values for any of our variables, we are left with the same group of 54 sender countries, but with less receiver countries (94 remain) and an unbalanced panel in which each pair of host-receiver is observed for only those periods where all variables are observed. This unbalanced panel constitutes a sample of 17.178 observations.

The variable we examine in this paper is an indicator variable assuming the value one if a source country holds positive investment (combined bonds and equity) in a host country at time t and zero if it holds no investment. Table 1 shows that the percentage of zeros in the bilateral investment decision for both the whole sample and individually for each and every time period is strikingly high (over 60% in some sample years). This makes apparent the need to analyze the binary decision to invest or not in any given time period, if one is to avoid potentially serious bias in gravity equation coefficient estimates. In this paper, we have the opportunity to analyze this binary choice using all available data (that is including the observations in which bilateral investment is zero in levels) in a panel data setting for a dataset consisting of many country pairs with varying host and sender political and financial conditions allowing us to study the impact of these factors in the attractiveness of a host country over time to attract investment from abroad.

While the CPIS dataset is rich enough, there are a number of problems associated with it that need to be mentioned. For instance, there is the possibility of under-reporting of assets which can be due to incomplete institutional coverage of the survey. However, this does not pose a problem to our analysis since we do not model the level of investment, but rather we treat investment holdings as a dichotomous variable. In addition, there are several instances where investment holdings data for certain country pairs are confidential. The dichotomous nature of our variable again surpasses this problem. Even though the exact amount is undisclosed for the purposes of our analysis we know it clears the zero threshold.. These shortfalls notwithstanding, the CPIS provides a unique perspective on cross-country investment positions that warrants a detailed analysis.

The strong persistence characterizing cross-country investment holdings becomes apparent in Panel B. In particular, while the unconditional average probability of positive investment is about 41%, it increases to 95%, when it is conditioned on positive investment holdings in the previous year. Similarly, while the unconditional probability of zero investment holdings is about 59%, when conditioning on zero investment holdings in the previous year it becomes 94%. These figures indicate that the cross-border investment process exhibits strong persistence, a property that has important policy implications for host countries aiming to attract foreign capital to fund their investment projects. If this persistence can be shown to be true state dependence, meaning that positive investment holdings at one period in time affect the probability of positive investment in later periods, so that current positive investment is taking place *because* of past positive investment, this points to a specific mechanism that translates a positive investment in the previous period into a higher probability of positive investment in the present period as well.

From a theory perspective, the large number of zeros as well as the strong persistence can be explained by the fact that entry in a foreign financial market involves a sunk cost that has to be incurred by the sender country investor, and this cost makes the investment decision partially irreversible (see Daveri 1995). This cost includes explicit taxes, authorization and registration procedures required, but more importantly the cost of acquiring the information needed to assess the attractiveness of a foreign market in order to decide on entry or not, such as host country legislation, the quality of institutions, level of investor protection and political stability. This cost can be seen as a one-off incurred cost, which is no longer present in subsequent periods. This means previous investment in a host country makes future investment there more probable: it is now less costly to reinvest in a given host than incur costs to find a new host country. In our estimations, state dependence is strongly present and robust under several specifications, pointing to a mechanism with the description given above.

(Table 1 here)

Table 1. Regime-specific and transition probabilities of bilateral investment holdings

	2001	2002	2003	2004	2005	2006	2007	All years
Panel A. Unconditional probabilities								
$\Pr(H_{i,t} > 0)$	0.368	0.398	0.395	0.393	0.430	0.417	0.452	0.409
$\Pr(H_{i,t} = 0)$	0.631	0.601	0.604	0.606	0.569	0.582	0.547	0.590
Panel B. Conditional probabilities								
$\Pr(H_{i,t} > 0 \mid H_{i,t-1} = 0)$	-	0.047	0.045	0.044	0.068	0.072	0.067	0.057
$\Pr(H_{i,t} = 0 \mid H_{i,t-1} = 0)$	-	0.953	0.954	0.955	0.931	0.927	0.932	0.942
$\Pr(H_{i,t} > 0 \mid H_{i,t-1} > 0)$	-	0.935	0.950	0.954	0.960	0.963	0.950	0.952
$\Pr(H_{i,t} = 0 \mid H_{i,t-1} > 0)$	-	0.065	0.049	0.045	0.039	0.036	0.049	0.047

Notes: **Probabilities may not sum to one due to rounding errors.**

3.1 Empirical Strategy

To model the bilateral cross-country investment holdings decision we employ a dynamic binary choice panel data model of the form:

$$Inv_{it} = 1\{\gamma * Inv_{i,t-1} + X_{it}^{'}\beta + u_{it} > 0\} \quad \textbf{(1)}$$

$$i = 1,..., N \; ; \; t = 1,...T$$

Our setup is a panel data model with two dimensions: The cross-sectional dimension is a pair i of source-host countries, and the time dimension where we observe investment and other covariates characterizing the host and source countries within each pair for every time-period t. The indicator function $1\{\}$ takes the value one if the event within the braces has occurred, and zero otherwise. The dependent variable Inv_{it} is a dichotomous variable assuming the value one if positive investment holdings are observed by the source country in host country's assets for pair i in period t, and zero otherwise. We thus model the binary investment choice for each time period employing a threshold-crossing binary choice setup.

We use an array of covariates in vector X_{it} to model the discrete choice to enter in a foreign financial market. The subscripts in variables denote in order the pair, country (source or host) and time period of the observation. Thus, a variable $x_{i,h,t}$ in X_{it} is a covariate for pair i, characterizing the host-country (h), observed for time period t. Accordingly, $x_{i,s,t}$ is a covariate of pair i, characterizing source-country (s) and is observed for time-period t. Variables that describe pair-specific characteristics, i.e. a relation between source-host countries within a pair (like common language or common legal origin) and distance between source-host countries (which characterizes the pair participating in a transaction rather than each one participating in it) are denoted just by x_i, meaning pair i specific characteristics. Note that these characteristics are also invariant in time dimension, so no subscript t is needed.

We use the per capita GDP of the host ($GDP_{i,h,t}$) and source ($GDP_{i,s,t}$) countries measured in year 2000 dollars to control for country size.

To proxy informational costs between source and host country in a country pair, we use the logarithm of distance between host and sender ($\log dist_i$), a dummy variable for whether the two countries share a common official language ($comlang\_off_i$), a dummy for three legal origins (U.K., French and German), and finally a dummy for the two countries sharing a common legal origin ($commonlaw_i$). These variables account for cultural differences and affinities which play an important role in foreign investment decisions (see for example Guiso (2001)). Openness of the host economy in trade in general can also be a factor of attractiveness for equity investment (see Aviat and Coeurdacier (2007) for the role of goods trade in financial trade), so we also include a variable defined as the percentage of the value of goods trade (exports+imports) in host country GDP.

It is now well-documented in the international finance literature that institutional quality of the host country plays an essential role in facilitating foreign capital investment in the country's financial assets (see Papaioannou (2009)). Institutional quality consists of a variety of factors, more prominently legislation regarding investor protection (e.g. protection from expropriation), political stability, rule of law and general socioeconomic conditions. The role of investor protection in particular and more generally of better legislation regarding foreign investment is elegantly analyzed in the illuminating model by Wolfenzon and Shleifer (2002) where it is shown that countries with better investor protection laws have more valuable firms with lower share concentration, a bigger diversity in investment opportunities and also have higher interest rates. The same paper also provides a possible explanation for the Lucas paradox of capital not flowing from the rich to poorer countries: Better investor protection leads to higher interest rates and eliminating the incentive for capital to flow to a country with worse investor protection. Also, Daveri (1995) uses a simple model to conclude that better investor protection and political stability is consistent with more capital inflows from other countries.

We control for host country institutional quality via a composite index ($polrisk_{i,h,t}$) described in the appendix) from ICRG where countries are graded from 1 to 100, with a larger grade meaning a smaller risk, and better conditions for investment. Moreover, an index again from ICRG measuring host country's financial sector quality ($finrisk_{i,h,t}$), is included in estimations.

Finally, domestic credit as percentage of GDP ($domcred_{i,h,t}$) and stock turnover ratio ($stockturn_{i,h,t}$) are used to describe the host country's financial sector development and sophistication. Descriptive statistics of all the above covariates are given in the appendix.

We use time-period specific effects to control for any circumstances that are special for the years included in the data, and affect the global investment conditions. Moreover, we need to control for the "multilateral resistance" term (Anderson and Van Wincoop (2004), Baldwin and Taglioni (2006)).

As in the trade literature, this term can be interpreted as a price index of all financial assets competeng with an imported asset (see Coeurdacier and Martin (2009)). Omission of this term could lead to biases in the estimated coefficients for our transaction costs variables. We employ two alternative specifications to deal with this empirically: we use either regional dummies for the continent of source and host country (Europe, Asia, Oceania, America), or a full set of source and host specific dummies. The former methodology is not as inclusive as the latter, but nevertheless allows us to keep a reasonable number of parameters to estimate. The latter, albeit being more in accordance with the theory, poses many estimation problems in a non-linear maximum likelihood estimation framework used here due to the large number of parameters needed (as many as the sum of host and source countries). In our estimations, we use both when possible and report both sets of estimates in the tables.

3.2. Econometric methodology

In this section we present the econometric methodology and specific model assumptions we make to estimate equation (1). The model is the discrete choice panel model first proposed and analyzed by Heckman (1981,a,b) and fits the purpose of this paper as it allows dynamics through the inclusion of the lagged investment decision as an explanatory variable, thus introducing genuine state dependence as a structural feature of the model. In addition, it allows the decomposition of the error term into a country pair-specific random effect component a_i and a transitory error term, in the following form

$$u_{it} = a_i + \varepsilon_{it} \quad \textbf{(1)}$$

It thus allows an additional source of serial persistence through the presence of a random time invariant unobservable component in every country pair. Serial persistence stemming from this feature of the model is described as spurious state dependence, as it produces the same data features that genuine structural state dependence would, only the underlying cause is rooted in heterogeneity and unobservable factors rather than a structural causal effect. Qualitatively, such a distinction makes a significant difference for policy, as the scope of measures encouraging capital inflows makes sense in the presence of true state dependence, where policy taken can take advantage of a mechanism translating positive investment today into higher probability of experiencing foreign capital inflows in the future as well. On the other hand, policy can hardly play any part if serial persistence is caused by unobservable idiosyncratic effects. We will also use in the most general model specification the assumption that the transitory errors are serially correlated, thus adding a third competing explanation of serial persistence.

Estimation of non-linear panel data models with unobserved heterogeneity is highly dependent on the assumptions we are willing to make. A fixed effects approach makes no assumption about the distribution of the heterogeneity and its statistical relation to the covariates, and thus is more attractive by ensuring that the conditional distribution of the effects does not play a role in the identification of the parameters of interest[1]. However, fixed effects methods have stringent requirements on the covariates while they do not deliver estimates of coefficients of time-invariant variables nor predictions, and hence are less used in practice. On the other hand, random effects methods that fully specify the distributional properties of heterogeneity lead to standard maximum likelihood estimation and any computational burden impeding the estimation of the parameters has been lifted considerably by the use and development of simulation methods. We take a fully parametric random effects approach in this paper, in the spirit of Hyslop (1999) and Heckman (1981) and we specify the distribution of the random effects and the transitory error term.

Random effects require that the distributional properties of a_i and ε_{it} as well as their statistical relationship to the covariates be specified, along with the initial conditions of the dynamic process (see Hsiao (2003). In all specifications we will assume that the transitory error term ε_{it} is independent of the gravity covariates and of the a_i and normally distributed. To model the pair-specific unobserved heterogeneity, a_i, we will make two alternative hypotheses. In the first case a_i is considered independent of all observed covariates, while in the latter case, a more flexible assumption for the conditional mean of the random effects is assumed. Following Mundlak (1978) and Chamberlain (1984), its conditional mean is assumed to be a linear function of the longitudinal averages of some of the gravity covariates, $\overline{X}_i$, and an independent normally distributed error term v_i. The latter correlated random effects assumption is specified as:

$$\begin{aligned} a_i &= \overline{X}_i\delta + v_i \\ v_i \mid X, \varepsilon &\sim \mathrm{N}(0, \sigma_v^2) \end{aligned} \qquad \textbf{(2)}$$

The intuition behind the latter specification is that cross-sectional differences in longitudinal averaged characteristics carry information for the permanent unobserved country pair-specific characteristics. More specifically, we could suspect that the unobserved pair heterogeneity is statistically correlated with some of the observable host characteristics we use as covariates. These pair-

[1] . For a comprehensive review of available estimation methods of this type see Hsiao (2003), Arellano and Carasco (2003), Honore and Kyriazidou (2000).

specific unobserved characteristics could possibly be behind the realizations of institutional quality and financial market development of the host country. Omitted (and possibly difficult to quantify) factors, like attitude of a country pair towards obeying the law, or even disposition towards liberalization of the economy, that are present in the unobserved pair-effect, are very likely to be correlated with political and financial risk indices, as well as with variables reflecting the host's financial markets development. Thus, we allow pair-specific means of the host's political and financial risk variables ($polrisk_{i,h,t}$, $finrisk_{i,h,t}$) and financial markets development ($domcred_{i,h,t}$, $stockturn_{i,h,t}$) to be included in $\overline{X_i}$. In both cases, the distribution of the unobservable composite error, $a_i + \varepsilon_{it}$ in the uncorrelated case and $v_i + \varepsilon_{it}$ in the correlated case, is therefore normal and independent of X_{it} . In the absence of state dependence ($\gamma = 0$) and of serial correlation in the transitory error component, ε_{it} ,that is in a static model, parameters of interest are estimated via Maximum Likelihood using Gaussian Quadrature to compute the univariate integral involved in the evaluation of the likelihood function. A simple test for the presence of correlation between the individual effect and the observed covariates can be carried out by testing the null hypothesis that $\delta = 0$.

The presence of the lagged investment decision ($Inv_{i.t-1}$) in our dynamic specifications brings us to the initial conditions problem: we need to specify the statistical relationship between the initial investment decision $Inv_{i.0}$ (in our setting initial period is 2001) and the unobserved heterogeneity a_i . A simple approach would be to assume that Inv_{i0} is exogenous and can therefore be treated as fixed, as for example might be the case if the process were observed from its initialization. Clearly this assumption is not realistic and unlikely to hold in our context. We use two standard sets of assumptions to tackle the initial conditions problem. The first one is Heckman's approach (see also Stewart 2007; Arulampalam and Stewart 2009) which specifies a flexible reduced form approximation to the initial conditions:

$$\begin{aligned} Inv_{i0} &= 1\{Z_{i0}\zeta + u_{i0} > 0\} \\ u_{i0} &= \theta a_i + w_{i0} \end{aligned} \qquad \textbf{(3)}$$

where Z_{i0} includes members of X_{i0} and w_{i0} is assumed to be uncorrelated with ε_{it} the for t=1,..,T and to follow the normal distribution. This method essentially tackles the issue of initial conditions by assuming a distribution for the initial condition conditional on the random effects and the covariates in the initial period. Under this specification, u_{it} is equicorrelated with u_{i0} and a test of exogeneity of the initial conditions can then be conducted by testing whether this correlation is zero, i.e. testing the null hypothesis $\theta = 0$.

An alternative approach to the initial conditions problem is proposed by Wooldridge (2005). Instead of specifying a model for the initial conditions given the observed covariates and the unobserved effect, a model is specified for the unobserved effect given observed covariates and the initial conditions. In particular it is assumed that:

$$a_i = \xi_0 Inv_{i0} + v_i \quad \textbf{(5)}$$

The error term v_i is independent of everything else and normally distributed. Substituting back into (1) gives:

$$Inv_{it} = 1\{X_{it}\beta + \gamma Inv_{it-1} + \xi_0 Inv_{i0} + \overline{X}_i \xi_1 + v_i + \varepsilon_{it} > 0\} \quad \textbf{(6)}$$

which again becomes a two factor probit model that can be easily estimated my ML using Gaussian quadrature procedures. The essential difference is that (5) allows us to form a likelihood for $\{Inv_{i1\ldots} Inv_{iT}\}$ conditional this time not only on a_i but also on Inv_{i0} as well. Using Wooldridge's method, the exogeneity of the initial condition is tested by the significance of the coefficient ξ_0.

In the most general specification, serial persistence in Inv_{it} may be due not only to the presence of the lagged dependent variable Inv_{it-1} and/or the presence of permanent unobserved heterogeneity a_i in the model, but also to the fact that the transitory error term ε_{it} may be serially correlated. To allow for this possibility, we specify a first-order autoregressive (AR (1)) model:

$$\varepsilon_{it} = \rho\varepsilon_{it-1} + \eta_{it} \quad \textbf{(7)}$$

where η_{it} is an independent normal error term. Estimation now becomes computationally cumbersome, since observations across time for a given pair are no longer independent conditional on the unobserved heterogeneity, thus the probability of a string of observations for a pair is now a rectangle of T-dimensional normal distribution. The GHK (Geweke – Hajivassileiou – Keane) simulator is the best way to simulate this probability, and we perform Maximum Simulated Likelihood maximizing the simulated likelihood function for the parameters. For more details on MSL see for example Hajivassiliou and Ruud (1994).

4. Empirical Analysis

4.1 Static Random Effects models of bilateral Investment holdings

First we focus on static random effects probit models, that is, we do not allow for sources of dynamics to enter the model. We assume no state dependence and no serial correlation in the transitory errors. In Table 2 we employ both correlated and uncorrelated random effects assumptions, and estimate this model by Gaussian quadrature with 24 points of integration. Standard errors are obtained by the inverse of the numerically approximated Hessian (using finite differences) of the likelihood function, and when this is not possible we use the last BFGS step approximation of the hessian to obtain standard errors. The sample size is 17178 observations (after dropping observations containing missing values for any of our covariates), and the time span varies for each pair observation (i.e. we have an unbalanced panel with time span from 2001-2007). Note that the static nature of this model allows us to use an unbalanced panel since gaps in time observations do not pose a problem for estimation. The 3821 pairs are consisted of 54 sender and 94 host countries.

(Table 2 here)

Table (2) reports results from static random effects probit models, with gravity covariates of host and source characteristics. No correlation is allowed between unobserved pair heterogeneity and explanatory variables. The static framework allows us to focus solely on the roles of institutional quality, informational costs and financial development of the host country, and how their evolution over time in a panel framework affects the probability of positive investment. Time-specific fixed effects are included to capture the particular to the time period global investment conditions affecting both the source and host countries. Dummy variables for the continent of host and source are used to control for multilateral resistance terms, as well as a dummy for the host and source residing in a common continent. The random effects heterogeneity assumption captures unobserved pair-specific social linkages and trust factors that cannot be captured by other covariates.

Table 2.			
Static Random Effects Models of Bilateral Investment		**Model**	
Covariates	**RE Probit**	**RE Probit**	**CRE Probit**
Coefficient and z-scores	**(1)**	**(2)**	**(3)**
$logdist_i$	-0.634***	-1.203***	-0.840***
Log distance between "sender" and "host"	(-6.859)	(-13.646)	(-8.225)
$comlang\_off_i$	1.960***	0.784***	2.176***
Dummy for a common official language	(7.694)	(3.193)	(8.470)
$commonlaw_i$	-0.028	0.235**	-0.018
Dummy for Common legal origin	(-0.209)	(1.928)	(-0.153)
$tradegdp_{h,i,t}$	-0.424***	-0.460***	-0.109***
Trade as % of host GDP	(-8.000)	(-3.379)	(-2.118)
$gdpcap00us_{h,i,t}$	0.937***	0.086	0.536***
Host Country GDP	(11.254)	(0.354)	(6.141)
$gdpcap00us_{s,i,t}$	1.369***	0.069	1.685***
Source country GDP	(22.396)	(0.226)	(24.154)
$polrisk_{h,i,t}$	0.274***	0.286***	0.289***
Index of host Institutional Quality	(4.022)	(3.549)	(2.732)
$finrisk_{h,i,t}$	0.017	-0.143***	-0.116***
Index of host Financial Risk	(0.452)	(-2.171)	(-2.284)
$domcred_{h,i,t}$	0.552***	0.104*	0.106*
Domestic credit as % of host GDP	(9.938)	(1.130)	(1.301)
$stockturn_{h,i,t}$	0.326***	0.011	0.034
Host stock Turnover ratio	(8.929)	(0.178)	(0.701)
Observations	17.178	17.178	17.178
Sender Countries	54	54	54
Host Countries	94	94	94
Time Fixed Effects	Yes	Yes	Yes
Sender country fixed effects	No	Yes	No
Host country fixed effects	No	Yes	No
Geographical Dummies	Yes	No	Yes
Country Pair Random effects	Yes	Yes	Yes

The dependent variable is $Inv_{i,t}$, a binary variable assuming the value 1 for positive investment in pair i between source and host country h in time period t. The pairs contain 54 sender and 94 host countries. Time fixed effects are included in all models. Model (1) contains also geographical dummy variables for the continent of sender and host and a dummy for common continent of host and source. Model (2) contains also sender and host specific fixed effects dummies. Model (3) assumes Mundlack-Chamberlain correlated Random effects, and is estimated with additional regressors for the means of $polrisk_{i,h,t}$, $finrisk_{i,h,t}$, $domcred_{i,h,t}$, $stockturn_{i,h,t}$ for every pair i. Z-scores are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively. Models were estimated in *MATLAB* by *Gaussian Quadrature* with 24 integration points. Standard errors were obtained in models (1) and (3) by the inverse of the approximated Hessian of the Likelihood function at the optimum, using finite differences. In model (2), the last BFGS approximation of the Hessian was used. A detailed description of all the covariates used is available in the Appendix.

The results are consistent with the findings of the financial gravity literature (Portes and Rey (2005), Aviat and Coeurdacier (2007) and Lane and Milesi-Ferretti (2004)). The standard result of distance affecting negatively the levels of bilateral investment is also present in the discrete choice framework: distance enters with a negative coefficient, thus implying a negative effect on the probability of investing on a distant host country. Distance is a proxy for informational asymmetries, reflecting non-standard costs (Papaioannou (2009), Portes, Rey and Oh (2001)) negatively affecting the probability of positive investment in a host country. Cultural linkages and familiarity effects (see Portes and Rey (2005), Guiso (2007)) also appear very significant, and the common language dummy enters with a large positively signed coefficient. We thus find that in a static model, informational costs (mirroring transportation costs in goods trade) are a significant barrier to asset trading over time. Host country size appears, not surprisingly to have a positive effect on the probability of attracting foreign investment, which is in accordance with the Lucas paradox of richer countries attracting foreign capital rather than poorer ones. The institutional quality of the host country, captured in the political risk index, is positively signed and statistically significant, confirming the finding in the literature on the enhancing effect of investor-friendly legislation and political stability on the attractiveness for capital inflows. The development of financial markets also appears to be a positive influence on attracting capital, as the positive domestic credit as % of GDP and stock turnover ratio coefficients suggest. In model (3), correlation between the unobserved pair random effect and some of the covariates is allowed. The results are roughly the same as model (1) qualitatively, but with financial risk now appearing significant at 5% level of confidence.

In column (2) we maintain the same static framework, but instead of accounting for host and source-specific fixed effects by geographical dummies, we include a full set of dummies for each of the 54 source countries and 94 host countries. The full set of dummies for source countries captures the multilateral resistance term (Anderson and Van Wincoop (2004), Baldwin and Taglioni (2006), Coeurdacier and Martin (2009)). With host dummies we control for unobservable country factors that affect international asset holdings. This modeling approach somewhat alters the obtained results. The distance coefficient is now amplified by more than two times its previous value, reinforcing its importance as a proxy of informational costs when we can properly control for multilateral resistance, as well as pair-specific heterogeneity. The presence of a common language is now less stressed in magnitude, but its coefficient remains positive and strongly significant. An important difference is that the presence of a common legal origin turns positive and statistically significant – which is more intuitively appealing since similarities in the legislative environment between host and source country should encourage investment, through reduction of informational costs and uncertainty. The coefficient of trade openness of the host country is negative and statistically significant, unchanged from column (1) results. This is a counter intuitive result since one would expect more open countries, in terms of trade, to attract more investment. The host institutional quality as measured by the Political risk index, maintains a positive virtually unchanged in magnitude coefficient, which is strongly statistically significant even at a 1% confidence level. Financial development variables coefficients appear insignificant in this set of estimates, overturning the previous results obtained with geographical dummies.

Table 3 presents specification tests on the estimated models of Table (2). We perform joint Wald tests for joint significance of the covariates categorized in groups suggested by the content of those variables. Specifically, we include distance and common language in the category of variables expressing informational frictions. The dummies regarding legal origins and the presence of a common legal origin, alongside the indices of political and financial risk are put on a different group under the general description of institutional quality. Lastly, domestic credit and stock turnover ratios are included under the general category of variables describing financial development. We test the joint significance of the variables in each of the three groups. Informational frictions variables are strongly jointly significant across all three specifications, with a p-value of practically zero. The same is true for institutional quality variables, where the hypothesis of joint insignificance of political risk, financial risk, legal origins dummies and common legal origin is strongly rejected across all three models. Financial markets development appears to be significant only in model (1). The joint tests reaffirm our findings that informational frictions and host country institutional quality are the factors mainly behind the attractiveness for international capital inflows, restating the familiar findings of the empirical gravity research in a discrete choice framework.

An advantage of random effects specification is that we can relax the assumption of the independence of unobserved heterogeneity and observed covariates in a simple tractable manner following Chamberlain's correlated random effects assumption[2]. We do so in model (3): In our fully parametric approach we assume that the conditional mean of the unobserved pair-effects is a linear function of the means of political risk, financial risk, domestic credit and stock turnover ratio variables. The assumption that the coefficients of the variables in means are jointly zero is strongly rejected in this

[2] In a semi-parametric framework Arellano and Carrasco (2003) also relax this assumption but at the cost of a much more complicated estimation method.

static model pointing to a more complex statistical relationship between unobserved effects and covariates. However, due to the incomplete way in which the geographical dummies cover host and source specific fixed effects (i.e. unobserved factors of the source and host and multilateral resistance of the source country) could be behind this result since the random effect is not properly “cleaned” of these fixed effects and thus exhibits correlation with the observed covariates. In support of this explanation in a regression not reported in the table we allowed for a full set of dummies alongside correlated random effects and the CRE assumption was rejected. Moreover, the variance of the unobserved effects captures a large portion of total variance, roughly 89% in model (1) and 88% in model (3). The inclusion of host and sender-specific fixed effects in model (2) is naturally decreasing this percentage to a modest 65%, which is expected given that less space is left for pair heterogeneity when we proliferate in fixed effects.

(Table 3 here)

Table 3.

Diagnostic Tests for Static Random Effects Models	Model		
Values of Test-statistics	**RE**	**RE**	**CRE**
(p-values in parentheses)	**(1)**	**(2)**	**(3)**
Test for Informational Frictions	80.25	223.78	126
$\log dist_i, comlang\_off_i$ **jointly insignificant**	(0.000)	(0.000)	(0.000)
Test for Host Institutional Quality	89.82	43.12	132.2
$polrisk_{i,h,t}, finrisk_{i,h,t}, legor(uk, fr, ge), commonlaw_i$ **jointly insignificant**	(0.000)	(0.000)	(0.000)
Test for Host Financial Market Development	189.20	1.31	2.28
$domcred_{i,h,t}, stockturn_{i,h,t}$ **jointly insignificant**	(0.000)	(0.519)	(0.319)
Test for Correlated Random Effects	Does not apply	Does not apply	269.9
Means of $polrisk_{i,h,t}, finrisk_{i,h,t}, domcred_{i,h,t}, stockturn_{i,h,t}$ **jointly insignificant**			(0.000)
% of Random effects variance in Total error Variance	89%	65.6%	87.8%
Log-likelihood	-5083.2	-3709.7	-4956.8

All models were fitted in *MATLAB* using *Gaussian Quadrature* with 24 integration points. Asymptotic Wald tests were conducted using the variance-covariance matrix as computed by the inverse of the (numerically approximated by finite differences) Hessian of the likelihood function at the optimum. For model (2) we used standard errors from the last Quasi-Newton BFGS algorithm step.

4.2 Dynamic Random Effects models of bilateral Investment holdings

Serial persistence in the data raises the issue of investigating the possible underlying explanations in the framework provided by our econometric specification. Disentangling the effects of unobserved heterogeneity and serial correlation from genuine state dependence is of increased interest for policy makers. Primarily, we are interested in the presence of genuine state dependence which would imply a mechanism through which lagged investment decision affects the probability of positive one occurring in the present in a given pair of source-host countries. On a different layer, we examine the robustness of the results obtained by the previous section's static models in the presence of dynamic effects. We proceed in this section with an analysis of the dynamic specification.

In table 4 we present estimation results. In the first column (1), we allow for state dependence through the introduction of the lagged investment decision $Inv_{i,t-1}$ as an explanatory variable in addition to pair random effects, time specific effects and geographical fixed effects for source and host country. The coefficients on distance and linguistic ties enter statistically significant even at 1% confidence level. The coefficient on distance is somewhat reduced and negative, and the same holds for the effect of common language which is positive but also a bit dampened. In view of the above, we conclude that the dynamic specification leaves unchanged the previously documented significance of informational frictions. The important difference to note is that political risk index in the presence of state dependence alongside pair-specific heterogeneity is now entering with a lower coefficient that is not statistically significant, and the same applies for the financial risk index. Moreover, we document that the state-dependence parameter γ is strongly positive, statistically significant and large in magnitude, pointing to a genuine state dependence effect, i.e. a structural causal effect from positive past investment decision. This finding is of significance for policy making: it suggests that increasing the attractiveness of a host country via reforms that increase investor protection and create a safer environment for foreign capital investment is not only helping to open the door to facilitate entry for foreign capital inflows, but also helps keep these inflows coming in the future. The fixed costs involved in foreign asset investment and in general costs of entering and leaving foreign financial markets have been recognized in the literature as factors that render investment partially irreversible (see Daveri (1995)). If we think of fixed costs as the resources (both pecuniary and non pecuniary) needed for the foreign investor to familiarize herself with the conditions, both political and financial which are intertwined, that characterize a given investment opportunity in an unknown territory, once these costs are incurred it becomes easier to invest again in the same place, if the environment has not changed dramatically. The usual gravity covariates regarding country sizes also appear statistically significant.

(Table 4 here)

Table 4. Dynamic Models of Bilateral Investment				
	Model			
Covariates **Coefficient and z-scores**	**CRE SD(1) Heckman (1)**	**CRE SD(1) Heckman (2)**	**CRE SD(1) Wooldridge (3)**	**CRE+AR(1)+SD(1) Heckman (4)**
$logdist_i$	-0.445***	-0.651***	-0.211***	-0.443***
Log distance between "sender" and "host"	(-3.578)	(-3.158)	(-1.896)	(-3.240)
$comlang\_off_i$	1.241***	0.468	0.489***	1.003***
Dummy for a common official language	(4.147)	(0.514)	(2.219)	(3.391)
$commonlaw_i$	0.075	0.034	0.122	0.006
Dummy for Common legal origin	(0.505)	(0.085)	(0.975)	(0.036)
$tradegdp_{h,i,t}$	0.009	-0.555***	0.004	-0.113*
Trade as % of host GDP	(0.134)	(-1.801)	(0.060)	(-1.357)
$gdpcap00us_{h,i,t}$	0.212**	0.603*	0.192***	0.460***
Host country GDP	(1.882)	(1.505)	(1.694)	(3.087)
$gdpcap00us_{s,i,t}$	0.558***	-	0.557***	0.580***
Source country GDP	(7.686)	-	(7.757)	(8.091)
$polrisk_{h,i,t}$	0.152	0.200	0.144	0.364**
Index of host Institutional Quality	(0.830)	(0.325)	(0.778)	(1.757)
$finrisk_{h,i,t}$	-0.108*	-0.119	-0.112*	-0.061
Index of host Financial Risk	(-1.337)	(-0.242)	(-1.378)	(-0.592)
$domcred_{h,i,t}$	0.049	-0.072	0.052	-0.076
Domestic credit as % of host GDP	(0.354)	(-0.159)	(0.377)	(-0.283)
$stockturn_{h,i,t}$	-0.065	-0.054	-0.064	-0.090
Host stock Turnover ratio	(-0.857)	(-0.145)	(-0.835)	(-1.096)
State Dependence (γ)	1.651***	1.599***	1.619***	1.820***
Lagged Investment Decision	(15.380)	(3.445)	(14.540)	(13.566)
AR(1) Parameter (ρ)	Does not apply	Does not apply	Does not apply	-0.130
Transitory Error AR(1)				-1.540*
Initial Conditions Parameter	2.040***	0.116	1.979***	1.958***
θ **or** Inv_{i0}	(4.507)	(0.987)	(8.535)	(8.091)
Observations	10.276	10.276	10.276	8029
Sender Countries	49	49	49	44
Host Countries	81	81	81	57
Initial Conditions Specification	Heckman	Heckman	Wooldridge	Heckman
AR(1) in Transitory Error term	No	No	No	Yes
State Dependence SD(1)	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Sender country fixed effects	No	Yes	No	No
Host country fixed effects	No	Yes	No	No
Geographical Dummies	Yes	No	Yes	Yes

The dependent variable is $Inv_{i,t}$, a binary variable assuming the value 1 for positive investment in pair i between source and host country h in time period t. For models (1), (2), and (3) estimates were obtained with 49 sender and 81 host countries, using an unbalanced panel with a common initial period at 2001 and no gaps, and a varying endpoint year. For model (4), 44 sender and 57 hosts countries were used in a balanced Panel, from 2001-2007 with no gaps. Gaussian quadrature with 24 integration points was used for models (1)-(3). Model (4) was estimated via the GHK simulator, with Maximum Simulated Likelihood, at 100 replications. Time fixed effects are included in all models. Models (1), (3) and (4) contain also geographical dummy variables for the continent of sender and host and a dummy for common continent of host and source. Model (2) contains also sender and host specific fixed effects dummies. All models assume Mundlack-Chamberlain correlated Random effects, and include additional regressors for the means of $polrisk_{i,h,t}$, $finrisk_{i,h,t}$, $domcred_{i,h,t}$, $stockturn_{i,h,t}$ for every pair i. Z-scores are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% level, respectively. Standard errors were obtained in models (1), (3) and (4) by the inverse of the approximated Hessian of the Likelihood function at the optimum, using finite differences. In model (2), the last BFGS approximation of the Hessian was used. A detailed description of all the covariates used is available in the Appendix.

In column (2) of table 4 we repeat the same estimation but include a full set of source-host fixed effects alongside time-specific effects[3]. The results are qualitatively unchanged for the distance coefficient, which remains negative and significant, and is now larger in magnitude. The common language effect is insignificant in the presence of the full set of fixed effects. State dependence is a slightly lower but again statistically significant and large in magnitude. Notice that in both models (1) and (2) we employed the Heckman approach to initial conditions, specifying a distribution for the initial period investment given the unobserved heterogeneity random effect. To further investigate the robustness of our results we repeat the same analysis employing Wooldridge's approach to the initial conditions problem, where a distribution is specified instead for the pair-heterogeneity random effect given the initial period and covariates. As illustrated in model (3), the results are qualitatively identical, excluding the reemergence of common language as statistically significant. We therefore document insensitivity of the qualitative findings to the assumption undertaken on the initial conditions.

Two sources of serial dependence have been introduced so far: Genuine state dependence and unobserved heterogeneity. As discussed before, a third remains to be explored: serial correlation in the transitory error component. This is introduced in model (4) alongside the other two sources and the model is estimated using simulation. Initial conditions are endogenous Heckman-type. The distance coefficient is highly significant, large in magnitude and negative, whereas in this most general specification common language retains its significance even at 1% level. State dependence appears larger in magnitude and highly significant, even as we allow for all three sources of dynamics to be present. The political risk variable retains its statistical significance at 5% level, stressing the importance of institutions for attracting investment. The correlation coefficient for the transitory error component is negative and statistically insignificant at 5%, thus it appears that the dynamics specified are enough to fit the data.

Table (5) provides specification tests for the dynamic models of table (4). The same strategy of joint significance testing for three groups of variables is employed here as well. Informational frictions covariates are jointly significant across all four specifications. Institutional quality variables are jointly significant in models (1) and (3) where no serial correlation in the error term is allowed, and turn insignificant in the full dynamic specification in model (4). However, we stress that the Institutional quality as expressed through the political risk variable is significant when taken on its own, pointing to

[3] We could not get meaningful standard errors when all dummies were introduced and the GDP of the source was included. We report instead a reliable set of results without this variable in the table.

the importance of political stability and confirming in the discrete choice framework the findings of the literature (see e.g. Papaioannou (2009) on the institutional quality importance for investment). Financial market development is not significant at 5% in any specification. Correlation between unobserved heterogeneity and covariates (i.e. Chamberlain's CRE assumption) is rejected in our most general specification when all dynamics are allowed for, however it is not rejected in models (1) and (3), supporting the explanation that geographical dummies do not properly control for fixed effects and multilateral resistance terms – the CRE assumption is rejected in the model equipped with a full set of dummies (model (2)). Initial conditions are found to be indeed endogenous in the most general of our specifications and 68.3 % of the heterogeneity is captured by random effects.

(Table 5 here)

Table 5.

Diagnostic Tests for Dynamic Random Effects Models	Model			
Values of Test-statistics (p-values in parentheses)	**CRE SD(1) Heckman (1)**	**CRE SD(1) Heckman (2)**	**CRE SD(1) Wooldridge (3)**	**CRE+AR(1)+SD(1) Heckman (4)**
Test for Informational Frictions	27.25	10.188	9.046	27.20
$\log dist_i, comlang\_off_i$ **jointly insignificant**	(0.000)	(0.006)	(0.010)	(0.000)
Test for Host Institutional Quality	19.44	1.327	21.19	6.848
$polrisk_{i,h,t}, finrisk_{i,h,t}, legor(uk, fr, ge), commonlaw_i$ **jointly insignificant**	(0.003)	(0.970)	(0.001)	(0.335)
Test for Host Financial Market Development	0.85	0.061	0.833	1.145
$domcred_{i,h,t}, stockturn_{i,h,t}$ **jointly insignificant**	(0.65)	(0.970)	(0.659)	(0.563)
Test for Correlated Random Effects	14.31	3.965	14.12	6.932
Means of $polrisk_{i,h,t}, finrisk_{i,h,t}, domcred_{i,h,t}, stockturn_{i,h,t}$ **jointly insignificant**	(0.006)	(0.410)	(0.006)	(0.139)
Test for endogeneity of Initial Conditions*	2.040	0.116	1.979	1.958
parameter θ **or coefficient on** Inv_{i0} **equal to zero**	(0.020)	(0.453)	(0.023)	(0.05)
% of Random effects variance in Total error Variance	54.8%	53.27%	49.60 %	68.3%
Log-likelihood	2258.3	1935.7	1249.3	1514

Models (1), (2) and (3) were fitted in *MATLAB* using *Gaussian Quadrature* with 24 integration points. Model (4) was estimated using the GHK Simulator with 100 replications and Maximum Simulated Likelihood was then employed to obtain coefficients. Asymptotic Wald tests were conducted using the variance-covariance matrix as computed by the inverse of the (numerically approximated by finite differences) Hessian of the likelihood function at the optimum. For model (2) we used standard errors from the last Quasi-Newton BFGS algorithm step. (*)Endogeneity of initial conditions tests are t-tests and the number in parenthesis is the p-value.

5. Conclusions

This paper's contribution to the literature is two-fold. First, departing from the usual analysis of the levels of cross border investment between countries, we investigate empirically the determinants of international asset trading focusing on the discrete decision to enter a foreign asset market. We use an extended panel dataset from the CPIS for seven time periods from 2001-2007 to estimate several random effects probit models. Drawing from the recent gravity models in the asset trading literature, and also research investigating the impact of institutional quality on the attractiveness of a country for foreign investment, we control for relevant determinants of investment flows including country size, informational asymmetries and the development and quality of financial and political institutions in the host country. Secondly, we look at the data from a dynamic perspective and analyze the serial persistence evident in the decision to invest in a host country over time. We consider a general specification allowing for genuine state dependence alongside unobserved pair heterogeneity and serial correlation in order to assess the source of this persistence and consequently evaluate policies that encourage capital inflows in the light of this analysis.

Our results largely agree with the literature in identifying the significant determinants of bilateral asset trading. In a static model framework the informational costs, as proxied by distance, are shown to be negatively related to bilateral investment, and this finding is unaltered as we examine many specifications. Moreover, evidence that cultural links play an enhancing role in encouraging bilateral asset trade is found. More specifically, the presence of a common official language between host and source countries is found statistically significant and positive across all specifications. Institutional quality and development is confirmed in static specifications to play an important role in encouraging investment as shown by the positive coefficient of the relevant indices for political as well as financial institutions development indices. The usual gravity factors appear to have the sign and effect predicted by the theory. Unobserved pair heterogeneity is found to occupy large portion of the variance in the error term as well, implying that there is some space for the effect of factors like trust or other difficult to observe social linkages in explaining bilateral asset trade.

A close look at the data implies that there is significant persistence in the decision to invest in a foreign financial market. We thus allow for dynamics to be present through three statistically and conceptually different routes, that is besides pair-specific random effects we allow for true state dependence and serially correlated errors. Genuine state dependence is statistically significant across all dynamic specifications, suggesting that policies to encourage foreign investment could have a lasting effect, given the positive effect of past investment on future investment as well. Informational costs and country sizes are as predicted by the gravity model theory still significant in the presence of dynamics although their effect is dampened compared to the static specifications.

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Appendix A: Countries

List of host countries in sample:

Angola, Albania, Argentina, Armenia, Antigua and Barbuda, Austria, Australia, Azerbaijan, Bangladesh, Barbados, Belarus, Belize, Belgium, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Brunei, Cambodia, Cameroon, Canada, Cape Verde, Chad, Chile, China, Central African Republic, Cote d' Ivoire, Congo Dem. Rep. Congo, Rep. Colombia, Comoros, Costa Rica, Croatia, Czech Republic, Djibouti, Dominica, Denmark, Dominican Rep., Algeria, Ecuador, Egypt, El Salvador, Eritrea, Estonia, Ethiopia, Finland, France, FYROM, Gabon, Germany, Georgia, Ghana, Guinea, Gambia, Guinea-Bissau, Equatorial Guinea, Greece, Grenada, Guatemala, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Korea Rep., Kyrgyz Rep., Kuwait, Laos, Liberia, Libya, Lesotho, Lithuania, Latvia, Madagascar, Maldives, Mexico, Marshall Islands, Malawi, Malaysia, Mali, Mauritania, Micronesia, Moldova Mongolia, Morocco, Mozambique, Namibia, Netherlands, Nepal, New Zealand, Niger, Nigeria, Nicaragua, Norway, Oman, Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Rwanda, Samoa, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Tanzania, Thailand, Tajikistan, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States of America, Uruguay, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

List of source countries in sample:

Argentina, Australia, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kazakhstan, Korea, Kuwait, Latvia, Malaysia, Mexico, Netherlands, New Zealand, Norway, Pakistan, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovakia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom, United States of America, Uruguay, Venezuela.

List of countries excluded:

(*Off shore and small financial centers*): Aruba, Bahamas, Bahrain, Bermuda, Cayman Islands, Cyprus, Guernsey, Isle of Man, Jersey, Lebanon, Luxemburg, Macao, Malta, Mauritius, Netherlands Antilles, Panama.

(*Data unavailability*): Afghanistan, American Samoa, Andorra, Anguilla, British Indian Ocean Territory, Christmas Island, Cocos (Keeling) Islands, Cook Islands, Cuba, Falkland Islands, Faroe Islands, Fiji, French Guyana, French Polynesia, French Southern Territory, Gibraltar, Greenland, Guadeloupe, Guam, Iraq, Korea, Democratic Rep., Lichtenstein, Martinique, Mayotte, Monaco, Montserrat, Myanmar, Nauru, New Caledonia, Niue, Norfolk Island, Palau, Pitcairn, Puerto Rico, Reunion, San Marino, Sao Tome and Principe, Serbia and Montenegro, Somalia, St. Helena, St Pierre and Miquel, Taiwan, Timor Leste, Tokelau, Turks and Caicos islands, Tuvalu, United States Minor Outlying Islands, Vanuatu, Vatican City, Virgin Islands, Wallis and Fortuna Islands, West Bank, Western Sahara.

Appendix B: Description of control variables

<u>**Variables used in baseline model**</u>

Proxies for Informational frictions

- **(Log-) distance between the capital cities of the host and source country** (source CEPII): calculated using latitudes and longitudes of the geographic coordinates.
- **Common language** (source CEPII): a dummy variable attaining the value of unity if the source and host countries have the same official language.

Proxies for Institutional quality

- **Political Risk** (source: ICRG): an index ranging from 0 to 100, with higher values denoting lower political risk. It is calculated as the sum of the following components: (a) government stability, (b) socioeconomic conditions, (c) investment profile, (d) internal conflict, (e) external conflict, (f) corruption, (g) military in politics, (h) religion in politics, (i) law and order, (j) ethnic tensions, (k) democratic accountability, (l) bureaucracy quality.

- **Financial Risk** (source: ICRG): an index ranging from 0 to 50 with higher values denoting lower financial risk. It is calculated as the sum of the following components: (a) foreign debt as a % of GDP, (b) foreign debt service as a % of exports, (c) current account as a % of exports, (d) net liquidity as months of import cover, (e) exchange rate stability.

- **Type of Legal Origin** (source La Porta *et al*., 1998): a set of dummy variables identifying English, French or German legal origin.

Proxies for Financial market development

- **Domestic credit to private sector as a % of GDP** (source World Bank Development Indicators).

- **Stocks traded turnover ratio** (source World Bank Development Indicators): total value of shares traded during the period divided by the average stock market capitalization during the period.

Appendix C: Descriptive statistics of control variables

Variable	Mean	Std. Dev.	Min	Max	Obs
In baseline model					
Log (distance)	8.720	0.801	4.088	9.892	62370
Common language	0.110	0.313	0.000	1.000	62370
Investment treaty	0.271	0.444	0.000	1.000	62370
(inverse) Political risk	67.930	12.621	34.291	96.083	47250
(inverse) Financial risk	36.797	5.996	11.500	50.000	47250
English legal origin	0.326	0.468	0.000	1.000	61236
French legal origin	0.528	0.499	0.000	1.000	61236
German legal origin	0.116	0.320	0.000	1.000	61236
Scandinavian legal origin	0.030	0.171	0.000	1.000	61236
Domestic credit (as % of GDP)	46.109	44.488	0.682	319.721	59568
Stocks traded (turnover ratio)	53.325	63.845	0.000	497.380	33061