

Relative Factor Endowments and International Portfolio Choice*

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Abstract

This paper presents a model of international portfolio choice based on cross-country differences in relative factor abundance. Countries have varying degrees of similarity in their factor endowment ratios, and are subject to aggregate productivity shocks. Risk averse consumers can insure against these shocks by investing their wealth at home and abroad. In a many-good setup, the change in factor prices after a positive shock in a particular country provides insurance to countries that have dissimilar factor endowment ratios, but is bad news for countries with similar factor endowment ratios, since their incomes will worsen. Therefore countries with similar relative factor endowments have a stronger incentive to invest in one another for insurance purposes than countries with dissimilar endowments. The importance of this effect obviously depends on the size of countries. Empirical evidence linking bilateral international equity investment positions to a proxy for relative factor endowments supports our theory: the similarity of host and source countries in their relative capital-labor ratios has a positive effect on the source country's investment position in the host country. The effect of similarity is enhanced by the size of host countries as predicted by the theory.

Keywords: international portfolio equity investment; factor endowments

JEL codes: F21, F34, G11

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1 Introduction

This paper presents a model of international portfolio choice based on cross-country differences in relative factor abundance. Countries have varying degrees of similarity in their factor endowment ratios, and are subject to aggregate productivity (country-specific) shocks. Risk averse consumers can insure against these shocks by investing their wealth at home and abroad. In a many-good setup, the change in factor prices after a positive shock in a particular country provides insurance to countries that have dissimilar factor endowment ratios, but is bad news for countries with similar factor endowment ratios, since their incomes will worsen. A positive productivity shock in a capital-abundant country, for example, will raise wage rates and reduce the return to capital, thus raising the incomes of labor-abundant countries and harming the incomes of other capital-abundant countries. Therefore countries with similar relative factor endowments have got a stronger incentive to invest in one another for insurance purposes than countries with dissimilar endowments.

Since our theoretical mechanism works through the effects of shocks on prices, the size of the country suffering the shock (and selling assets) is obviously a relevant consideration. In a generalization of our model, we study how endowment similarity interacts with country size. We show that under standard assumptions a country invests relatively *more* in a large-similar country than in a small-similar country, and relatively *less* in a large-dissimilar country than in a small-dissimilar country.

We first frame this intuition within a complete asset markets setup, in which countries trade Arrow-Debreu securities prior to the realization of uncertainty. However, our results do not hinge on many of the strong assumptions (Arrow-Debreu securities, complete asset markets, absence of home bias in portfolios) we make for tractability purposes. When we replace the Arrow-Debreu setup with a more ‘realistic’ financial side, the model yields predictions similar to those of our stylized model: we assume that countries can exchange claims on their GDPs before uncertainty is realized, and that investing abroad is subject to frictions that reduce the expected return of foreign assets. This obviously generates a home bias in the portfolios of countries. By the same line of reasoning as above, investing in countries with similar factor endowment ratios provides better insurance to a country with a home-biased portfolio.

Empirical evidence linking bilateral international portfolio investment positions to a proxy for relative factor endowment similarity supports our theory: after controlling for commodity and asset market frictions, the similarity of host and source countries in their relative capital-labor ratios is estimated to have a positive effect on the source country’s investment position in the host country. The magnitude of this effect depends on the host country’s GDP size, as larger countries have a stronger effect on prices.

Graphs 1 and 2 show the relationship between bilateral equity investment (vertical axis) and similarity in factor endowments (horizontal axis), after con-

trolling for country fixed effects and a set of standard controls.¹ Graph 1 illustrates the case of small host countries: the similarity in factor endowments between the source and the host country does not seem to be a determinant of equity investment. The coefficient describing how changes in similarity affect equity investment is statistically insignificant and close to zero. In other words, for countries that cannot significantly change world relative prices, it does not seem to be relevant whether investor and recipient countries are similar or not. Graph 2 illustrates the case for large host countries. We obtain a positive and statistically significant coefficient: conditional on the host country being relatively large, increases in factor endowment similarity lead to greater equity investment positions of the source country into the host country.

The idea that relative price changes may act as an insurance mechanism can be traced back to Cole and Obstfeld [7], who argued this might explain the lack of international diversification of country portfolios. In their model, two completely specialized countries trade with each other in assets and outputs. But asset trade is almost redundant, as changes in the terms of trade after a shock act as insurance. By allowing for many countries with varying degrees of factor endowment similarity, we turn this intuition into a theory of international portfolio choice. Unlike Cole and Obstfeld [7], however, the emphasis of our model is not on the terms of trade, but on factor prices. Think of the standard indeterminacy problem of the production structures of countries in a Heckscher-Ohlin model with more goods than production factors. In that environment, it is impossible to talk about the terms of trade of countries, as the latter depend on the countries' production structures. But the model does have instead unambiguous predictions about the behavior of factor prices, as these do not depend on production structures.

On the empirical side, an additional problem associated to terms of trade movements is the difficulty to isolate the extent to which the comovement of the terms of trade of two countries is due to their similarity in factor endowment ratios from, among others, other common sources of comparative advantage; the occurrence of sectoral shocks; the correlation of aggregate productivity shocks; or exchange-rate movements. Working with proxies for factor endowment similarity, as we do, has the advantage to bypass these thorny issues, as it relates our endogenous variable, the portfolio positions of countries, to its 'primitive' determinant (according to our theory).

Our model consists of endowment economies as in Lucas [22] and Svensson [30]. We allow countries to differ in their patterns of specialization according to their relative factor endowments, in a manner similar to Helpman and Razin [12] and Helpman [11]. In comparison with these references, however, we only

¹Small countries are those with GDP below the median of our sample. The vertical axis is the residual of an OLS regression of bilateral equity investment on source- and host- country fixed effects, log of bilateral trade, log of distance, common legal origin, common border, common language, colony dummy, regional trade agreement, correlation in GDP per capita, and a number of controls on equity markets and informational frictions. (See the controls used in Table 4, column (12).) The horizontal axis is the residual of an OLS regression of similarity in factor endowments (as we define in section 3 below) on the same set of control variables.

allow for country-specific aggregate productivity shocks in our analysis.

Our work adds to a growing body of research that attempts to explain the international portfolio choices of countries. Obstfeld and Rogoff [26] and Lane and Milesi-Ferretti [21] have put emphasis on commodity trade costs; Martin and Rey [23] and [24] have focused on the role of size; and Portes and Rey [27] have highlighted the importance of informational costs for investment flows.² In comparison with these references, our paper highlights that bilateral portfolio positions not only depend on frictions between countries, but also on other country-pair specific characteristics: in our theory, even when bilateral frictions (and productivity shocks) are equally correlated across all country-pairs is it possible that a country finds it optimal not to invest the same amount across countries.

Finally, the causal direction from asset trade to production specialization has been addressed by Kalemli-Ozcan *et al.* [13] and Koren [14]. Both argue that international asset market integration favors specialization in production, as it enables countries to insure against sector-specific productivity shocks. Our paper complements this literature by pointing that causality might also run in the opposite direction: the real side of the economy also determines the international portfolio positions of countries.

The rest of the paper is structured as follows: Section 2 discusses a stylized model linking production specialization and international portfolio choice, and lays the ground for the empirical analysis. Section 3 discusses our empirical strategy, while Section 4 discusses empirical evidence supportive of the model. Some concluding remarks follow. Finally, the appendix provides proofs and extensions of the model discussed in Section 2.

2 The Model

Let us denote countries with $j \in J$. Abusing notation, we will also use J to denote the number of countries. Each country has got a representative consumer, who maximizes expected utility $E[U(C_j)]$. $E(\cdot)$ is the expectations operator, and $U(\cdot)$ is the utility function, which we assume concave: $U'(\cdot) > 0$, $U''(\cdot) < 0$. C denotes consumption of a freely traded final composite good $C_j = C_{1j}^{\frac{1}{2}}C_{2j}^{\frac{1}{2}}$, where C_{ij} denotes country j 's consumption of freely traded intermediate good i , $i = 1, 2$.³ Preferences are identical across countries.

Technologies in the intermediate good industries are also identical across countries. We simplify by assuming linear production functions:⁴ $y_{1j} = A_j K_j$ and $y_{2j} = A_j L_j$, where y_{ij} denotes production of good i in country j , and $A_j > 0$ denotes country j 's aggregate productivity level. We can think of $A_j K_j$

²For other approaches to international portfolio choice, see also Kraay and Ventura [16] and [17], Kraay *et al.* [15], and Lane and Milesi-Ferretti [19] and [20].

³We constrain the elasticity of substitution to be equal or larger than one, so as to avoid 'immiserizing growth' issues. The Cobb-Douglas assumption is made here for tractability. As we discuss below, most of our results do not depend on it.

⁴In Appendix B we show that this assumption is harmless: a model with neoclassical production functions yields similar insights.

and $A_j L_j$ as production factors (capital and labor) measured in efficiency units. We assume perfect competition.

Each country has got exogenously given endowments of the two production factors, which are internationally immobile and supplied inelastically. We distinguish two subsets of countries, which we denote with k and l : $J_k \cup J_l = J$, $J_k \cap J_l = \emptyset$.⁵ For all $k \in J_k$, $l \in J_l$,

$$K_k = \phi_k (1/2 + \mu), \quad (1)$$

$$L_k = \phi_k (1/2 - \mu), \quad (2)$$

$$K_l = \phi_l (1/2 - \mu), \quad (3)$$

$$L_l = \phi_l (1/2 + \mu). \quad (4)$$

$\mu \in [0, 1/2]$. Notice this implies countries in J_k have their production structures biased towards good 1 relative to countries in J_l . For the sake of simplicity, we assume an equal number of countries of each type: $J_k = J_l = J/2$. The parameter $\phi_j > 0$ is a scaling factor that allows for cross-country differences in size. We assume that the distributions of this scaling factor within J_k and J_l are symmetric.

A_j is *ex-ante* uncertain. We assume there are J states of nature (denoted by s , $s = 1, \dots, J$), each with identical probability $\pi(s) = 1/J$. States of nature are characterized by productivity level vectors $A(s) = [A_1(s), A_2(s), \dots, A_J(s)]$. In particular,

$$A(1) = (1 + a, 1, \dots, 1),$$

$$A(2) = (1, 1 + a, \dots, 1),$$

...

$$A(J) = (1, \dots, 1, 1 + a),$$

where $a > 0$ is a constant.⁶

There is a world market in which agents can buy or sell Arrow-Debreu contingent claims before uncertainty is realized. These claims have payoffs that depend on the state of nature: the owner (seller) of the security receives (pays) worth one unit of the final good if state s occurs, but nothing in any other state. We assume asset-market completeness.

2.1 Goods Market Equilibrium

Given the homotheticity of $C(\cdot)$, relative demands depend only on relative prices. Goods market equilibrium is therefore determined by

$$\frac{y_{1W}}{y_{2W}} = \frac{C_{1W}}{C_{2W}} = \frac{C_{1j}}{C_{2j}} = \frac{p_2}{p_1} = \frac{w}{r}, \quad (5)$$

⁵To avoid confusion, we will spare the indices j and j' for when we refer to any country in J ; we will use k and k' to refer to countries in J_k ; and l and l' to refer to countries in J_l .

⁶This is similar to what Acemoglu and Zilibotti [1] and Martin and Rey [23], [24] assume in different contexts.

where $C_{iW} \equiv \sum_{j \in J} C_{ij}$ and $y_{iW} \equiv \sum_{j \in J} y_{ij}$. Notice that p_i is also the price of the factor used in industry i when factors are measured in efficiency units. This can be seen from the equilibrium pricing conditions: $p_1 = r$ and $p_2 = w$, where r and w denote, respectively, the price of factor AK and factor AL . Taking the final good as the numeraire,

$$r = \frac{1}{2} \left(\frac{L_W}{K_W} \right)^{\frac{1}{2}}, \quad (6)$$

$$w = \frac{1}{2} \left(\frac{K_W}{L_W} \right)^{\frac{1}{2}}, \quad (7)$$

where $K_W \equiv \sum_{j \in J} A_j K_j$ and $L_W \equiv \sum_{j \in J} A_j L_j$. Obviously, $w/r = K_W/L_W$. Notice that free trade and the pricing conditions imply factor price equalization across countries, as in Trefler [31] and Ventura [32].

2.2 Asset Market Equilibrium

Let $B_j(s)$ denote country j 's net purchase of state- s Arrow-Debreu securities. Let $p(s)$ denote the price of one such security. Each country's utility maximization problem can be expressed as

$$\max_{\{B_j(s)\}_{s=1}^J} \sum_s \pi(s) U[Y_j(s) + B_j(s)], \quad (8)$$

subject to budget constraints $\sum_s p(s) B_j(s) = 0$ and $C_j(s) = Y_j(s) + B_j(s)$. Manipulating the first order conditions for states s and s' ,

$$\frac{\pi(s) U'[C_j(s)]}{\pi(s') U'[C_j(s')]} = \frac{p(s)}{p(s')}. \quad (9)$$

Market clearing requires $\sum_j B_j(s) = 0$ and $Y_W(s) = \sum_j C_j(s)$ for all s , where Y_W denotes world production of the final good. Finally, we close the model with the no-arbitrage condition $\sum_s p(s) = 1$.

Under log-utility ($U(C) = \ln(C)$), for example, the model yields the following equilibrium asset prices and portfolio choices:

$$p(s) = \frac{[Y_W(s)]^{-1}}{\sum_{s'} [Y_W(s')]^{-1}}, \quad (10)$$

$$B_j(s) = \frac{1}{J} \left[\sum_{s'} \frac{Y_j(s')}{Y_W(s')} \right] Y_W(s) - Y_j(s). \quad (11)$$

The intuition underlying these expressions is rather straightforward. The price of a security $p(s)$ depends negatively on the relative abundance of the final good in the corresponding state of nature. Regarding the first term on the right-hand side of equation (11), the term in square brackets reflects the fact that the size of country j 's portfolio will be larger the higher its average output

relative to the world's output. That is, a country's wealth and its consumption possibilities are a positive function of its expected output. The term $Y_W(s)$ captures the fact that countries will be able to consume more in states of nature with high world output. As for the second term, country j 's purchase of state- s security is inversely related to country j 's state- s final-good output due to the representative agent's interest in smoothing consumption across states of nature.

2.3 International Portfolio Choice

We now discuss the effects of *ex-ante* uncertainty in the goods markets on the portfolio choices of countries. To build up intuition, we discuss the model's implications on endowment similarity and country size separately. We start by assuming that all countries are of equal size. We then relax this assumption.

2.3.1 The Role of Endowment Similarity

Let us initially simplify the model by assuming away country-size effects: $\phi_j = 1$ for all $j \in J$. Define a country's gross domestic product as $Y_j = rA_jK_j + wA_jL_j$. Without loss of generality, consider country $k \in J_k$. In states of nature in which any country $l \in J_l$ has got a high productivity level, country k 's GDP improves due to a price effect, whereas states of nature in which any country $k' \in J_k$, $k' \neq k$, has got a high productivity draw bring about a negative effect on country k 's income through the resulting change in factor prices. Country k 's GDP is highest when its own productivity level is high: the negative effect of the change in factor prices is smaller than the positive effect on output induced by the productivity increase. Appendix A shows

$$Y_k(k) > \frac{1}{J}Y_W > Y_k(l) > Y_k(k'), \quad (12)$$

where $Y_W \equiv \sum_j Y_j(s)$ is constant across states of nature due to the model's symmetry. A country therefore has got a stronger incentive to insure against states of nature in which countries with similar factor endowment ratios have got a high productivity level. And the obvious provider of such insurance is the country that experiences high productivity: the model's symmetry implies $Y_{k'}(k') > \frac{1}{J}Y_W > Y_l(k') > Y_k(k')$.⁷

Given the model's symmetry and the absence of aggregate uncertainty, we conjecture the equilibrium exhibits full insurance. It is easy to find asset prices, consumption and portfolio allocations such that all the equilibrium conditions hold and countries manage to fully insure: $p(s) = 1/J$, $C_j(s) = \frac{1}{J}Y_W$, and

$$B_j(s) = \frac{1}{J}Y_W - Y_j(s), \quad (13)$$

⁷Notice that the model points to a negative correlation between the incomes of similar countries. However, this is not due to a negative correlation between productivity shocks as a negative correlation between real outputs (that is, outputs measured at constant prices) would show, but to the effect of country-specific shocks on world prices.

for all j, s . It is worth noting that this result not only holds for log-utility, but for any concave utility function.

We can now characterize the international portfolios of countries. Consider state of nature k' . From (12) and (13), $B_k(k') > B_l(k') > 0 > B_{k'}(k')$ for $\mu > 0$: country k' sells insurance against state k' to all other countries. The model's symmetry implies $B_k(k') > B_k(l) > 0 > B_k(k)$: the share in country k 's international portfolio is larger for assets issued by a country with a similar factor endowment ratio than for assets issued by the other type of country. In Appendix A we show $B_k(k') - B_l(k') = Y_l(k') - Y_k(k') = \frac{2a}{Y_W} \mu^2 \geq 0$. Thus, for $\mu = 0$, $B_k(k') = B_l(k')$: when relative factor endowment differences are small, countries k and l do not differ in their investment decisions regarding country k' . For low values of μ , all countries are very similar in their relative factor endowments. Thus, a shock to any particular country will hardly have an important effect on factor prices; in this case, any two countries will take identical positions in any third country.⁸

Define the following elasticity:

$$\beta \equiv \frac{\frac{B_k(k') - B_k(l)}{B_k(l)}}{\frac{\left| \frac{K_{k'}}{L_{k'}} - \frac{K_k}{L_k} \right| - \left| \frac{K_l}{L_l} - \frac{K_k}{L_k} \right|}{\left| \frac{K_l}{L_l} - \frac{K_k}{L_k} \right|}} > 0. \quad (14)$$

β measures the responsiveness of country k 's portfolio position to a rise in endowment similarity from country-pair kl to country-pair kk' . It is easy to show that the elasticity β rises with μ : $d\beta/d\mu > 0$.⁹ As μ increases, differences in factor endowment similarity between country pairs become more pronounced; since in this case the effects of shocks on relative prices become stronger, country k invests a larger share of its wealth in country k' , and a smaller one in country l .

Finally, one can also show that for $\mu = 1/2$, $B_l(k') = 0 < B_k(k')$; or, by symmetry, $B_k(l) = 0 < B_k(k')$: with complete specialization and a unitary elasticity of substitution, relative prices offer complete insurance against shocks in countries with different specialization patterns. However, this result is particular to the Cobb-Douglas assumption on preferences: when we simulate the model with $C_j = \left[(C_{1j})^{\frac{\varepsilon-1}{\varepsilon}} + (C_{2j})^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}$, where $\varepsilon > 1$ is the (constant) elasticity of substitution between goods 1 and 2, the model yields a positive $B_l(k')$, as higher elasticities of substitution imply a lower response of prices to productivity shocks. The rest of our results, however, are robust to values of ε larger than one.¹⁰

In this two-good two-factor model there is an obvious equivalence between factor endowment similarity, production structure similarity, and terms of trade

⁸For $\mu = 0$ (or for ε infinite) our model is similar to the one-good standard textbook treatment. See, for example, Obstfeld and Rogoff [25], chapter 5.

⁹Expressions for $B_k(k')$ and $B_k(l)$ can be found in Appendix A.

¹⁰We assumed $J = 4$ and $a = 0.02$, and allowed ε and μ to vary in the ranges $(1, 16]$ and $[1/16, 1/2]$, respectively. The corresponding results are available upon request.

correlations. As we discuss in Appendix B, however, this is a particular feature of the 2x2 model that breaks down if there are more goods than factors; in this case, the production structures of countries and thus their terms of trade are undetermined, but the implications of our model for factor prices remain unaltered.¹¹

2.3.2 The Role of Size

We now allow for differences in country size, as we assumed initially. For tractability purposes, we consider the log-utility case (see equations (10) and (11)). For a given level of endowment similarity, we study how the host country's size affects the positions of investor countries. For this purpose, we compare the portfolio choices of two investor countries, $k \in J_k$ and $l \in J_l$, with the same size ($\phi_k = \phi_l$) across host countries $k', k'' \in J_k$ with different sizes ($\phi_{k'} < \phi_{k''}$).

From (10) and (11),

$$p(k') [B_k(k') - B_l(k')] = \frac{1}{\sum_{s'} [Y_W(s')]^{-1}} \left[\frac{Y_l(k') - Y_k(k')}{Y_W(k')} \right], \quad (15)$$

where $k' \in J_k$. The term $\sum_{s'} [Y_W(s')]^{-1}$ is constant. Hence, all we need to analyze is the behavior of the term

$$\frac{Y_l(k') - Y_k(k')}{Y_W(k')} = \frac{1}{2} (L_l - L_k) \left[\frac{1}{L_W(k')} - \frac{1}{K_W(k')} \right] > 0, \quad (16)$$

as $L_l > L_k$, and $L_W(k') < K_W(k')$ for all $k' \in J_k$. (See Appendix A.) Hence, $p(k') [B_k(k') - B_l(k')] > 0$. This result simply restates the role of endowment similarity discussed above.

The inequality $p(k'') [B_k(k'') - B_l(k'')] > p(k') [B_k(k') - B_l(k')]$ holds if $\frac{1}{L_W(k'')} - \frac{1}{K_W(k'')} > \frac{1}{L_W(k')} - \frac{1}{K_W(k')}$. A sufficient condition for this is

$$\left(\frac{1}{4} - \mu^2 \right) a^2 < \frac{(\sum_{k \in J_k} \phi_k)^2}{\phi_{k''} \phi_{k'}}. \quad (17)$$

Two opposite effects are at stake here. A shock to a larger country has a stronger effect on relative factor prices, leading to a larger difference in the security purchases by countries k and l . Country k will want to take a larger position to insure against the negative effect of the shock on its income, whereas country l will take a smaller position due to the implicit insurance it receives through the change in relative prices. (We call this the *quantity effect*, since it relates to the term $B_k(k'') - B_l(k'')$.) At the same time, a shock to a larger country raises world output by more in the corresponding state of nature, leading to a lower price of the associated security. (We call this the *price effect*, since it relates to the term $p(k'')$.)

¹¹In our empirical work below, we control for country-pair similarity in production structures anyway.

The sufficient condition (17) makes sure that the quantity effect is stronger than the price effect. Notice that, for given values of ϕ_j , a higher μ implies a larger quantity effect, as the productivity shock on the large country will translate into a large effect on relative factor prices. As μ decreases, the highest a compatible with the sufficient condition decreases: the less dissimilar countries k and l , the smaller the quantity effect. This sufficient condition is very weak, as the term on the right-hand side of equation (17) is larger than one; the term in parenthesis on the left-hand side is smaller than one; and realistic values for a , the percentage increase in productivity experienced by a country in the event of a shock, are far less than one.

2.4 International Portfolio Choice without Arrow-Debreu Securities

The model above delivers the key intuitions that explain our empirical findings: other things equal, countries with more similar (dissimilar) relative factor endowments invest more (less) in one another due to better (worse) insurance possibilities. However, many of the model's assumptions and implications are at odds with reality. First of all, most real-life assets are not Arrow-Debreu. Moreover, international consumption correlations are lower than output correlations, which suggests that actual international risk sharing is far from the complete asset market benchmark. (See Backus *et al.* [2].) Finally, countries tend to invest most of their wealth in their own domestic assets. (See French and Poterba [9].)

In Appendix C, we show that a similar model with a more realistic financial side also predicts a positive relationship between factor endowment similarity and international portfolio choice. Assume investors can buy ownership claims on countries' GDPs rather than Arrow-Debreu securities. Assume also that holding foreign assets is subject to frictions. This creates a home bias in each country's portfolio, and leads in turn, within the portfolio share that is invested in foreign assets, to a bias towards assets issued by countries with similar relative factor endowments. This is due to the fact that the latter provide a home-biased portfolio with better insurance for the same reasons we discussed above.

2.5 Sectoral Shocks

A detailed analysis of the implications of sectoral shocks is beyond the scope of this paper. However, for comparison purposes, we find it worthwhile sketching the investment patterns arising in our setup in the presence of sectoral shocks rather than country-specific shocks.¹² Modeling sectoral shocks is rather straightforward in the two-good, two-factor version of the model: consider production functions $y_{1j} = A_K K_j$ and $y_{2j} = A_L L_j$, where A_K and A_L are now sector-specific productivity levels. Define $A(s) = [A_K(s), A_L(s)]$ and consider states of nature $A(1) = [1 + a, 1]$ and $A(2) = [1, 1 + a]$ with probabilities

¹²In a completely different setup, Campa and Fernandes (2006) argue that country and industry shocks are of comparable size.

$\pi(1) = \pi(2) = 1/2$. The rest of assumptions of our benchmark model remain the same.

Notice that the incomes of countries with similar production structures are now perfectly correlated. Hence there would be no need for them to invest in one another. Regarding the investment flows between dissimilar countries, a number of cases arise that depend on the values of μ and ε :

1. $\mu = 0, \varepsilon \geq 1$: When all countries have got identical factor endowment ratios ($\mu = 0$), sectoral shocks do not lead to any portfolio investment, as the incomes of all countries are perfectly correlated. (Recall that with country-specific shocks there would be some portfolio investment in this case: $J - 1$ countries would take the same position in the country suffering the shock.)
2. $\mu \in (0, 1/2], \varepsilon = 1$: It is easy to show that with a Cobb-Douglas final good aggregator countries with different factor endowment ratios need not invest in one another for insurance purposes. This is because relative prices offer all the necessary insurance. (With country-specific shocks instead, countries with similar relative factor endowments would want to invest in one another, as we saw above.)
3. $\mu \in (0, 1/2], \varepsilon > 1$: This is arguably the most interesting case. For a positive μ , as ε rises relative prices become less responsive to shocks. This implies that countries with different factor endowment ratios would invest more in one another as ε grows. (With country-specific shocks instead, as ε grows, the investment positions between dissimilar countries catch up with those between similar countries: the investment positions between dissimilar countries rises, as relative price changes offer little insurance, whereas the investment positions between similar countries falls, as less insurance is needed.)

In general, the crisp predictions of the two-good, two-factor model fail to hold when there are more goods than factors due to the indeterminacy of production structures. In any case, in our empirical work we use a proxy for similarity in production structures so as to control, among other things, for the effects of sectoral shocks on portfolio choice.

3 Empirical Strategy

We estimate an equation that relates the amount invested by source country S in host country H to a proxy for relative factor-endowment similarity between countries S and H , and other controls, such as proxies for frictions in commodity and asset markets, as well as host- and source-country fixed effects. Consider the following expression:

$$B_{SH} = e^{\alpha_D D_{SH}} Z_{SH}^{\alpha_Z} u_{SH}, \quad (18)$$

where B_{SH} denotes country S 's portfolio investment in country H ; α denotes parameters; D_{SH} denotes a proxy for factor-endowment similarity between countries S and H ; Z_{SH} stands for a country-pair control; and u_{SH} denotes an error term assumed to be statistically independent of the variables on the right-hand side of the equation.¹³

Notice we are allowing for a non-constant elasticity of country S 's portfolio investment in country H , B_{SH} , with respect to the similarity proxy D_{SH} : equation (18) yields an elasticity $\alpha_D D_{SH}$, which is increasing in D_{SH} in the same way that the responsiveness β of the source-country's portfolio positions rises with the similarity of its factor endowment ratio to that of the host country. (See equation (14).)

3.1 Estimation

Apart from using the OLS and Tobit estimators to estimate equation (18), we also use the Poisson estimator. While equations like (18) are usually log-linearized and estimated by OLS, this practice may be inappropriate for a number of reasons. First, B_{SH} can be zero, in which case log-linearization is unfeasible. (This problem is often solved by adding one to all observations before taking logs.¹⁴) Second, as Santos-Silva and Tenreyro [29] have recently pointed out, under heteroskedasticity, the expected value of the log-linearized error will in general be correlated with the regressors, and OLS will therefore be inconsistent. This is because the non-linear transformation changes the properties of the error term, as the conditional expectation of $\ln u_{SH}$ depends on the shape of the conditional distribution of u_{SH} . Santos-Silva and Tenreyro [29] propose the following example as an illustration of this problem: assume u_{SH} is distributed lognormal, with $E(u_{SH} | D_{SH}, Z_{SH}) = 1$ and variance $\sigma_{SH}^2 = f(D_{SH}, Z_{SH})$.¹⁵ $\ln u_{SH}$ will thus be distributed normal, with $E(\ln u_{SH} | D_{SH}, Z_{SH}) = -\frac{1}{2} \ln(1 + \sigma_{SH}^2)$, which is a function of the regressors.

In the face of this problem, it is more appropriate to estimate equation (18) in its non-linear form. After assessing the properties of a number of alternative estimators, Santos-Silva and Tenreyro [29] propose the Poisson pseudo-maximum likelihood estimator (often used for count data) for this task. This estimator turns out to be consistent under relatively weak assumptions (mainly that the model is well specified), and also provides a natural way to deal with zero values, as no logarithmic transformation is necessary for its implementation.

¹³This is similar to the regression equation in Lane and Milesi-Ferretti [21].

¹⁴The Tobit estimator is also often used when the dependent variable takes zero and positive values. (Again, a one is added to all observations before taking logs.) However, in the presence of fixed effects, the Tobit estimator may be biased due to the incidental parameters problem.

¹⁵The characteristics of the data suggest u_{SH} will be heteroskedastic. Since B_{SH} is non-negative, when its conditional expectation approaches zero, the probability of B_{SH} being positive and its conditional variance must also tend to zero. When the conditional expectation of B_{SH} is large instead, it is possible to observe a greater dispersion, as B_{SH} can now deviate from its conditional expectation in either direction.

3.2 Accounting for Country Size

Other things equal, a larger country will have a stronger effect on world prices. Thus, countries should invest *more* in a larger country with similar relative endowments than in a smaller country; and countries should invest *less* in a larger country with dissimilar endowment ratios than in a smaller country. Country similarity should not have a positive effect on a country’s portfolio at all if the host country cannot affect world prices.

To capture this intuition, we classify host countries into two categories: ‘small’ (those with host GDP’s below the median of the sample) and ‘large’ (those with host GDP’s above the median of the sample). We then consider a separate coefficient on D_{SH} for each of these two categories, and test the null hypothesis that the two coefficients are equal. We expect the coefficient for large host countries to be larger.

As a robustness check, we interact D_{SH} with the host country’s log-GDP, $\ln(Y_H)$. The type of equation we estimate in this case has got the following form:

$$B_{SH} = e^{\alpha_D D_{SH}} e^{\alpha_Y \ln(Y_H)} e^{\alpha_I [D_{SH} \ln(Y_H)]} Z_{SH}^{\alpha_Z} u_{SH}. \quad (19)$$

Provided that D_{SH} takes positive values when countries are similar and negative values when countries are dissimilar,¹⁶ we expect this interaction coefficient to be positive. Let us consider the cases of similar and dissimilar country pairs separately to discuss this. Countries invest more in each other when they have similar factor-endowment ratios, *i.e.* $D_{SH} > 0$. The greater the size of the host country, the greater the investment for a given level of similarity. Alternatively, two countries with dissimilar factor-endowment ratios ($D_{SH} < 0$) want to invest less in one another because of the insurance mechanism relative prices provide. The greater the size of the host country, the more it influences world relative prices, and the more insurance it provides thereby to the source country. Therefore, less investment is required in a host country with dissimilar endowment ratios if it is a large country.

3.3 Variables and Data¹⁷

Our dependent variable B_{SH} is taken from the IMF’s Coordinated Portfolio Investment Survey (CPIS).¹⁸ For each participating country, the CPIS reports data on foreign asset holdings by residence of the issuer. These include both equity and debt, but the CPIS has made an effort to exclude foreign direct investment (FDI) from these data.¹⁹ Following the spirit of our model, we use foreign equity holdings as our dependent variable. Data have been released for end-1997 (with only 29 source countries), and then yearly from end-2001 (with

¹⁶The explanation on how D_{SH} is constructed can be found in section 3.3.

¹⁷See Appendix D for a detailed description of variables and sources.

¹⁸See Lane and Milesi-Ferretti [21] for a detailed description of the dataset, as well as a discussion of its potential shortcomings.

¹⁹The CPIS considers an investment as FDI (as opposed to portfolio investment) if the foreign investor owns 10 percent or more of the ordinary shares or voting power.

67 source countries) to end-2006. According to Lane and Milesi-Ferretti [21], for those countries that participated in the 1997, 2001 and 2002 surveys, there is considerable persistence in bilateral equity holdings. We focus exclusively on the 2002 edition. Table 1 reports some information for the countries in our sample.

Our measure of factor-endowment similarity between countries S and H is based on the following variable:

$$d_{SH} \equiv \left| \ln \left(\frac{K}{L} \right)_S - \ln \left(\frac{K}{L} \right)_H \right|. \quad (20)$$

The source for aggregate capital-labor ratios is Caselli and Feyrer [6].²⁰ Notice that d_{SH} decreases with the similarity of countries and is always positive. For the reasons discussed above, we need our proxy for factor endowment similarity (i) to rise with similarity, and (ii) to take positive values when countries S and H are ‘similar enough’ and negative values when they are ‘dissimilar enough’. For this purpose, we first compute $d'_{SH} = \max(d_{SH}) - d_{SH}$. Then, we finally rearrange our variable to $D_{SH} = d'_{SH} - \text{med}(d'_{SH})$, where $\text{med}(d'_{SH})$ is the sample median of d'_{SH} .²¹ We interpret $D_{SH} > 0$ as the country pair being *similar* in terms of factor-endowment ratios. Equivalently, $D_{SH} < 0$ implies the two countries have *dissimilar* ratios.²²

We proxy for commodity and asset trade frictions with distance, and dummies for country pairs in which countries participate in the same regional trade agreement, share a border, the same currency, a common language, a colonial relationship (past or present), and a common legal origin. The source for these data is Glick and Rose [10], but for the common legal origin dummy, which is taken from La Porta *et al.* [18].

Finally, we use a proxy for similarity in the production structures of countries. For any pair of countries j, j' , this variable is constructed as

$$E_{jj'} = 2 - \sum_i (s_{ij} - s_{ij'})^2, \quad (21)$$

where s_{ij} denotes country j 's export share of good i to the world.²³ $E_{jj'}$ is always positive and grows with the similarity of the production structures of countries. Data on manufacturing exports are obtained from the World Trade Flows Database (see Feenstra *et al.* [8]).

²⁰Capital is constructed with the perpetual inventory method from time series data on real investment with PWT 6.1 data using a depreciation rate of 0.06. Labor is defined as the number of workers also using PWT 6.1. It is obtained as $\text{RGDPCH} \cdot \text{POP} / \text{RGDPWOK}$, where RGDPCH is real GDP per capita computed with the chain method. See Caselli [5] and Caselli and Feyrer [6] for more details.

²¹Normalising D_{SH} by the mean rather than the median leads to very similar results.

²²Using a measure of country similarity based on factor endowments has the additional advantage that it is less likely to suffer from endogeneity problems than a measure of production specialization. Recall that the results by Kalemli-Ozcan *et al.* [13] and Koren [14] point out a causation channel from international asset market integration to production specialization.

²³We use exports by country-industry rather than production, because the former is available at fine levels of disaggregation for many more countries than the latter. The correlation between "similarity in exports" and "similarity in K/L ratio" is around 0.16.

4 Results

Tables 2-3 report our estimation results from three different econometric estimators (OLS, Poisson, and Tobit) and two ways of dealing with host-country size (first, the division of the sample into two groups of host countries based on GDP size; second, the interaction of the country similarity proxy D_{SH} with the host-country's $\ln(\text{GDP})$).²⁴

Table 2 reports results obtained without including any control variables but source- and host-country fixed effects; Table 3 reports results from regressions including a group of standard controls (related to distance and other trade barriers, cultural and institutional characteristics, etc.) and a proxy for similarity in production structures.²⁵

In each of Tables 2-3 we present eight regressions. Columns (1)-(4) present results for the host countries separated by a dummy variable based on size, while columns (5)-(8) rather present regressions using the interaction term. Column (1) corresponds to the Tobit estimation, column (2) to the OLS estimation with zeroes; finally, columns (3)-(4) corresponds to the Poisson estimation without and with zeroes, respectively. For the regressions based on the interaction term, the same sequential pattern applies.

In the remaining tables we perform a number of robustness checks to our main specification presented in Table 3. In Tables 4-5 we only present results for the Poisson estimator, since this is our preferred econometric specification.²⁶ Table 4 presents results for the whole sample, but including additional control variables that will be described in the next paragraph. Table 5 redoes the same regressions as in Table 4 by looking at relatively rich source and host countries. The World Bank classification for the year 2000 divides countries into four categories: (1) High Income; (2) Upper Middle Income; (3) Lower Middle Income; (4) Low Income. We restrict our attention to countries included in categories (1) and (2).²⁷

In each of Tables (4)-(5) we present twelve regressions, the first six using the dummy separation of host countries, and the last six using the interaction of the log of host GDP. Compared to the regressions in Table 3, columns (1)-(2) additionally include the log of bilateral trade (as an additional proxy for trade frictions)²⁸ and GDP growth correlations, which proxy for productivity shock correlations across countries, that may affect the portfolio positions of countries.

Columns (3)-(4) additionally include two financial variables that may influ-

²⁴All our tables present results with standard errors clustered at the source country level, *i.e.* investor country level.

²⁵To control for outliers, in Tables 3-8 we eliminate single observations that account for more than 30% of the total equity invested or received by a country. This reduces the sample by around 5%. We also tried (i) eliminating single observations accounting for more than 70% of the total equity invested or received by a country, and (ii) including all outliers. Results are comparable to the ones we report.

²⁶Tables for OLS and Tobit estimators provide similar results, and are available upon request.

²⁷That is, we remove Colombia, Peru, Indonesia, and Thailand from the sample.

²⁸The source for these data is once again Glick and Rose [10].

ence asset holdings in an incomplete financial market scenario. The two variables are the correlation in stock returns and the correlation between host-country stock market returns and source-country GDP growth, which takes into account the role of the host country's stock market in potentially hedging against the source country's output fluctuations. These two variables, based on data between 1980 and 1996, were constructed by Lane and Milesi-Ferretti [21], who are confident that the endogeneity of financial correlations to the size of bilateral financial holdings is not a concern, since most foreign equity investment took place since the mid-1990s.

Finally, columns (5)-(6) repeat the same procedure after including two additional variables that proxy for informational frictions: the difference in time zone across countries (to proxy for informational similarities) and the similarity in the log of GDP per capita (constructed in a manner similar to D_{SH}). For the regressions based on the interaction term, the same sequential pattern applies.

4.1 Benchmark Correlation

As mentioned above, in the results of Table 2 we omit any control variables. In columns (1)-(4) we divide the sample in two parts based on the host country's GDP level. We allow each subsample to have its own coefficient, and no interaction terms are included. We always test the null hypothesis of equal coefficients for the two subsamples. In columns (5)-(8), we interact the similarity in capital-labor ratios with $\ln(GDP)$.

In columns (1)-(4), we observe that the coefficient related to large host countries is always greater than the one for small countries, even though the difference is not always statistically significant. At this preliminary stage of the empirical analysis, we can already expect that most of the action will be concentrated in large host countries. In columns (5)-(8) we observe that for all three econometric specifications (Tobit, OLS, Poisson) our interaction term is positive. Except for column (5), the estimated coefficient is also statistically significant. However, since the coefficient on the similarity of capital-labor ratio is rather negative (and usually statistically significant), we cannot conclude that the total effect is positive and statistically significant, as our theory predicts, until we do not calculate the value of the combined coefficient, hereafter CC . This coefficient will depend on the host country's GDP size, and is determined in the following way:

$$CC = coef[D_{SH}] + \ln(GDP) * coef[D_{SH} * \ln(GDP)],$$

where $coef[D_{SH}]$ denotes the coefficient corresponding to endowment similarity, and $coef[D_{SH} * \ln(GDP)]$ denotes the coefficient corresponding to the interaction between factor-endowment similarity and host-country size. This combined coefficient becomes positive well before the mean and median of $\ln(GDP)$ in our sample.²⁹

²⁹The mean and median of $\ln(GDP)$ in our sample are 26.8 and 26.6, respectively.

4.2 Controls

In Table 3 we include controls related to international trade frictions. We also include the similarity in exports as a proxy for the similarity in production structures. In columns (1)-(4), where we divide the sample of host countries by their GDP into two groups, the coefficient for small host countries is never significant, while the coefficient for host large countries is always positive and statistically significant at the 1% level. Additionally, the null hypothesis of same coefficient values is always rejected at the 1% significance level. In columns (5)-(8), where we interact our factor-endowment similarity variable with the log of host-country GDP, the interaction term is always positive and statistically significant at the 1% level as our theory predicts.

For simplicity, let us address the economic significance by examining the OLS columns of Table 3. In order to assess the effect of country similarity on equity positions, we first focus on the separation of host countries into two groups. For large host countries, an increase in the index of factor-endowment similarity by 10% leads to an increase in equity positions towards the host country by 2.6% under a similarity index value of 0.25.³⁰ Similarly, when looking at the equations that interact the similarity index with the log of host country GDP, we find that an increase in the index of factor-endowment similarity by 10% leads to an increase in equity positions towards the host country by 1.7% when we are at the mean of host country GDP, *i.e.* $\ln(GDP) = 26.85$, and the similarity index takes the value of 0.25.³¹ When the size of the host country increases to $\ln(GDP) = 28$, a typical value for a large host country, then the increase in equity positions is of 2.7%, very much in accordance with the value obtained under the separation of host countries into two groups. Additionally, the combined coefficient, previously defined as *CC*, is positive for values of $\ln(GDP)$ above 24.8.³²

4.3 Robustness Checks

4.3.1 Full Sample: Additional Controls

In Table 4 we allow for a number of additional controls described previously. For the regressions with the dummy separation, columns (1)-(6), we always find that the coefficient for large countries is positive and statistically significant at the 1% level. On the other hand, the coefficient for the small host countries is never significant. Additionally, we test for equality of coefficients and always reject the null hypothesis of equal coefficients between subsamples.³³ For the

³⁰The equation for the non-constant elasticity is: $\frac{d(Eq_{ij})}{d(D_{SH})} \frac{D_{SH}}{Eq_{ij}} = \alpha_D D_{SH}$. Therefore, under $D_{SH} = 0.25$ and a coefficient $\alpha_D = 1.047$, we obtain an elasticity value of 0.26.

³¹The equation for the non-constant elasticity is: $\frac{d(Eq_{ij})}{d(D_{SH})} \frac{D_{SH}}{Eq_{ij}} = (\alpha_D + \alpha_I \ln(Y_H)) D_{SH}$. Therefore, under $D_{SH} = 0.25$, $\ln(Y_H) = 26.8$, and coefficients $\alpha_D = -8.169$, $\alpha_I = 0.33$, we obtain an elasticity value of 0.17.

³²See "GDP positive combined coefficient" at the bottom of the table.

³³See "H0: coef[KL_small]=coef[KL_large]" at the bottom of the table.

regressions with the interaction term with log of host GDP (columns (7)-(12)), the interaction term is always positive and statistically significant at the 1% level. And as in previous regressions, the combined coefficient becomes positive and statistically significant at the 5% level well before the mean and median of $\ln(GDP)$ in our sample.

Concerning the role played by the additional control variables, we find that the coefficient of the log of bilateral trade is positive and usually statistically significant at the 10% level. Two variables that are about to be significant at the 10% level are the GDP per capita correlations and the informational variable on time difference across countries.

4.3.2 High-income Countries (World Bank)

In Table 5 we restrict the sample to countries that belong to the categories High Income or Upper Middle Income, based on the World Bank classification for the year 2000. The main message remains unchanged: similarity in capital-labor ratios matters for equity holdings in the way proposed by our theoretical framework, and this effect becomes stronger as the size of the host country increases. Additionally, the values of the coefficients are similar to the ones with the full sample. For this reason, we can conclude that our results are not driven by developing countries.

4.3.3 The Role of Financial Development

As can be seen from Table 1, the stock market capitalization, a proxy for financial development, differs substantially across countries in our sample. It could be that our results are mainly driven by highly financially developed countries investing in similar countries, especially under the reasonable claim that capital-abundance and financial development are positively correlated.

To make sure that our results are not driven by a subsample of highly developed investor countries, in Table 6 we divide the sample of investor countries by the median of stock market capitalization averaged over the period 1985-2000. Columns (1), (3), (5), and (7) present results for the subsample of investor countries with financial development *above* the median of our sample, while the remaining columns show results for the ones *below* the median. Columns (1)-(2) control for the sample variables as in Table 3. In columns (3)-(4) we add the variable proxying for the similarity in the production structure, while in columns (5)-(6) we additional control for the log of bilateral trade. Finally, in the last two columns we also control for: correlation in GDP per capita growth, the two financial correlations previously used, and the two information controls (log of time difference and similarity in real GDP per capita).

Throughout all eight specifications based on the full sample, we observe that our theory holds independently of the investor's level of financial development. The coefficient on the dummy for large host countries is always positive and statistically significant at the 1% level, while the dummy for small host countries is never statistically significant. Interestingly, in terms of the significance of

control variables, the role played by stock market correlation seems to be much more important than in previous regressions.

5 Concluding Remarks

Recent explanations of the international portfolio positions of countries are based on commodity and asset trade frictions: a country invests more in countries with which goods and assets are traded more freely. This paper complements these theories by pointing out that international portfolio decisions are also influenced by the similarity of the capital-labor ratios of countries.

In particular, we introduce a model of international portfolio choice in which countries have varying degrees of similarity in their factor endowment ratios, and are subject to country-specific productivity shocks. The change in relative factor prices after a positive shock in a particular country provides insurance to countries that have dissimilar factor endowment ratios, but harms countries with similar ones. Therefore, countries with similar relative factor endowments have got a stronger incentive to invest in one another for insurance purposes than countries with dissimilar endowments. Since the effect of a shock on relative prices depends on the size of the country, in a generalization of our model we study how factor endowment similarity interacts with country size.

Our empirical work lends support to this hypothesis: the similarity in relative capital-labor ratios has got a positive effect on the source country's investment position in the host country. The magnitude of this effect depends on the host country's GDP size, as larger countries have a stronger impact on world prices.

Future work should try to elucidate whether and how other sources of comparative advantage also affect the international portfolio decisions of countries.

References

- [1] Acemoglu, D. and F. Zilibotti (1997): "Was Prometheus Unbound by Chance? Risk, Diversification, and Growth," *Journal of Political Economy*, 105, 709-751.
- [2] Backus, D., P. Kehoe and F. Kydland (1992): "International Real Business Cycles," *Journal of Political Economy*, 100, 745-775.
- [3] Beck, T., A. Demirgüç-Kunt, and R. Levine, (2000), "A New Database on Financial Development and Structure," *World Bank Economic Review* 14, 597-605.
- [4] Campa, J.M. and N. Fernandes (2006): "Sources of Gains from International Portfolio Diversification," *Journal of Empirical Finance*, 13, 417-443.
- [5] Caselli, F. (2005): "Accounting for Cross-Country Income Differences," *Handbook of Economic Growth*.
- [6] Caselli, F. and J. Feyrer (2007): "The Marginal Product of Capital," *Quarterly Journal of Economics*, 122, 535-568..
- [7] Cole, H.L. and M. Obstfeld (1991): "Commodity Trade and International Risk Sharing," *Journal of Monetary Economics*, 28, 3-24.
- [8] Feenstra, R.C., R.E. Lipsey, H. Deng, A.C. Ma, and H. Mo (2005): "World Trade Flows," *NBER WP 11040*.
- [9] French, K. and J. Poterba (1991): "Investor Diversification and International Equity Markets," *American Economic Review, Papers and Proceedings*, 81, 222-226.
- [10] Glick, R. and A.K. Rose (2001): "Does a Currency Union Affect Trade? The Time Series Evidence," manuscript.
- [11] Helpman, E. (1988): "Trade Patterns under Uncertainty with Country Specific Shocks," *Econometrica*, 56, 645-659..
- [12] Helpman, E. and A. Razin (1978): "Uncertainty and International Trade in the Presence of Stock Markets," *Review of Economic Studies*, 45, 239-250.
- [13] Kalemli-Ozcan, S., B.E. Sørensen, and O. Yosha (2003): "Risk Sharing and Industrial Specialization: Regional and International Evidence," *American Economic Review*, 93, 903-918.
- [14] Koren, M. (2005): "Financial Globalization, Portfolio Diversification, and the Pattern of International Trade," manuscript, Harvard University.
- [15] Kraay, A., N. Loayza, L. Servén and J. Ventura (2005): "Country Portfolios," *Journal of the European Economic Association*, 3 914-945.

- [16] Kraay, A. and J. Ventura (2000): "Current Accounts in Debtor and Creditor Countries," *Quarterly Journal of Economics*, 115, 1137-1166.
- [17] Kraay, A. and J. Ventura (2002): "Trade Integration and Risky Assets," *European Economic Review*, 46, 1023-1048.
- [18] La Porta, R., F. López de Silanes and A. Shleifer (2003): "What Works in Securities Laws?", *Journal of Finance*, 61, 1-32.
- [19] Lane, P. and G.M. Milesi-Ferretti (2001): "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Countries," *Journal of International Economics*, 55, 263-294.
- [20] Lane, P. and G.M. Milesi-Ferretti (2002): "Long-Term Capital Movements," *NBER Macroeconomics Annual 2001*, 16, 73-116.
- [21] Lane, P. and G.M. Milesi-Ferretti (2008): "International Investment Patterns," *Review of Economics and Statistics*, 90(3), 538-549
- [22] Lucas, R.E. (1982): "Interest Rates and Currency Prices in a Two-Country World," *Journal of Monetary Economics*, 10, 335-360.
- [23] Martin, P. and H. Rey (2000): "Financial Integration and Asset Returns," *European Economic Review*, 44, 1327-1350.
- [24] Martin, P. and H. Rey (2004): "Financial Super-markets: Size Matters for Asset Trade," *Journal of International Economics*, 64, 335-361.
- [25] Obstfeld, M. and K. Rogoff (1995): *Foundations of International Macroeconomics*, MIT Press.
- [26] Obstfeld, M. and K. Rogoff (2001): "The Six Major Puzzles in International Macroeconomics. Is There a Common Cause?" *NBER Macroeconomics Annual 2000*, 15, 339-389.
- [27] Portes, R. and H. Rey (2005): "The Determinants of Cross Border Equity Flows," *Journal of International Economics*, 65, 269-296.
- [28] Samuelson, P.A. (1954): "The Transfer Problem and Transport Costs," *Economic Journal*, 64, 264-289.
- [29] Santos-Silva, J.M.C. and S. Tenreyro (2005): "The Log of Gravity," *Review of Economics and Statistics*, 88, 641-658.
- [30] Svensson, L.E.O. (1988): "Trade in Risky Assets," *American Economic Review*, 78, 375-394.
- [31] Treffer, D. (1993): "International Factor Price Differences: Leontieff was Right!" *Journal of Political Economy*, 101, 961-987.
- [32] Ventura, J. (1997): "Growth and Interdependence," *Quarterly Journal of Economics*, 112, 57-84.

- [33] Wooldridge, J.M. (2002): *Econometric Analysis of Cross Section and Panel Data*, MIT Press.

6 Appendix A: Proofs

6.1 The Role of Endowment Similarity

Assume $\phi_j = 1$ for all $j \in J$.

6.1.1 Proof 1: $Y_k(l) > Y_k(k')$

Since $r(l) = w(k') > r(k') = w(l)$,

$$\begin{aligned} Y_k(l) &= \left(\frac{1}{2} + \mu\right) r(l) + \left(\frac{1}{2} - \mu\right) w(l) > \\ &> \left(\frac{1}{2} + \mu\right) r(k') + \left(\frac{1}{2} - \mu\right) w(k') = Y_k(k'). \end{aligned}$$

Tedious algebra yields

$$Y_k(l) - Y_k(k') = \frac{2a}{Y_W} \mu^2. \quad (22)$$

6.1.2 Proof 2: $\frac{1}{J} Y_W > Y_k(l)$

Since we have factor price equalization (à la Treffer [31]), we can find Y_W from the integrated equilibrium:

$$\begin{aligned} Y_W &= Y_W(l) = [y_{1W}(l)]^{\frac{1}{2}} [y_{2W}(l)]^{\frac{1}{2}} = \\ &= \left(\frac{J}{2} K_k + \frac{J}{2} K_l + aK_l\right)^{\frac{1}{2}} \left(\frac{J}{2} L_k + \frac{J}{2} L_l + aL_l\right)^{\frac{1}{2}}. \end{aligned}$$

Concerning $Y_k(l)$,

$$\begin{aligned} Y_k(l) &= r(l) K_k + w(l) L_k = \frac{1}{2} \left[\frac{y_{2W}(l)}{y_{1W}(l)}\right]^{\frac{1}{2}} K_k + \frac{1}{2} \left[\frac{y_{1W}(l)}{y_{2W}(l)}\right]^{\frac{1}{2}} L_k = \\ &= \frac{1}{2} \left[\left(\frac{\frac{J}{2} L_k + \frac{J}{2} L_l + aL_l}{\frac{J}{2} K_k + \frac{J}{2} K_l + aK_l}\right)^{\frac{1}{2}} K_k + \left(\frac{\frac{J}{2} K_k + \frac{J}{2} K_l + aK_l}{\frac{J}{2} L_k + \frac{J}{2} L_l + aL_l}\right)^{\frac{1}{2}} L_k \right]. \end{aligned}$$

Tedious algebra yields

$$Y_W - JY_k(l) = Y_W^{-1} (a^2 + Ja) L_k L_l = Y_W^{-1} (a^2 + Ja) \left(\frac{1}{4} - \mu^2\right) > 0. \quad (23)$$

6.1.3 Proof 3: $Y_k(k) > \frac{1}{J} Y_W$

Recall $\frac{1}{J} Y_W = \frac{1}{J} \sum_j Y_j(s) = \frac{1}{J} \sum_s Y_j(s)$. Since $\frac{1}{J} Y_W > Y_k(l) > Y_k(k')$, it follows that $Y_k(k) > \frac{1}{J} Y_W$.

6.1.4 Proof 4: $B_k(k')$, $B_l(k')$, $B_{k'}(k')$

From (1)-(4), (13), and (23),

$$B_k(l) = B_l(k') = Y_W^{-1} \left(\frac{a^2}{J} + a \right) \left(\frac{1}{4} - \mu^2 \right) > 0. \quad (24)$$

As for $B_k(k')$, from (13), (22), and (24),

$$B_k(k') = Y_W^{-1} \left[\left(\frac{a^2}{J} + a \right) \left(\frac{1}{4} - \mu^2 \right) + 2a\mu^2 \right] > 0. \quad (25)$$

Asset market clearing and equations (24) and (25) yield

$$B_{k'}(k') = -Y_W^{-1} \left[\left(\frac{a^2}{J} + a \right) \left(\frac{1}{4} - \mu^2 \right) (J-1) + 2a\mu^2 \left(\frac{J}{2} - 1 \right) \right] < 0.$$

6.2 The Role of Size

We allow for cross-country differences in size. We assume that the distributions of the scaling factor ϕ_j within J_k and J_l are symmetric.

6.2.1 Proof 5: $L_W(k') < K_W(k')$

$$\begin{aligned} K_W(k') &= \sum_{k \in J_k} \phi_k \left(\frac{1}{2} + \mu \right) + \sum_{l \in J_l} \phi_l \left(\frac{1}{2} - \mu \right) + \phi_{k'} a \left(\frac{1}{2} + \mu \right) = \\ &= \sum_{k \in J_k} \phi_k + \phi_{k'} a \left(\frac{1}{2} + \mu \right), \end{aligned} \quad (26)$$

$$\begin{aligned} L_W(k') &= \sum_{k \in J_k} \phi_k \left(\frac{1}{2} - \mu \right) + \sum_{l \in J_l} \phi_l \left(\frac{1}{2} + \mu \right) + \phi_{k'} a \left(\frac{1}{2} - \mu \right) \\ &= \sum_{k \in J_k} \phi_k + \phi_{k'} a \left(\frac{1}{2} - \mu \right) < K_W(k'). \end{aligned} \quad (27)$$

6.2.2 Proof 6: Sufficient Condition for $p(k'') [B_k(k'') - B_l(k'')] > p(k') [B_k(k') - B_l(k')]$

$$K_W(k'') - K_W(k') = (\phi_{k''} - \phi_{k'}) a \left(\frac{1}{2} + \mu \right) > 0, \quad (28)$$

$$L_W(k'') - L_W(k') = (\phi_{k''} - \phi_{k'}) a \left(\frac{1}{2} - \mu \right) > 0. \quad (29)$$

Notice $p(k'') [B_k(k'') - B_l(k'')] - p(k') [B_k(k') - B_l(k')] > 0$ if

$$\begin{aligned} &\left[\frac{1}{L_W(k'')} - \frac{1}{K_W(k'')} \right] - \left[\frac{1}{L_W(k')} - \frac{1}{K_W(k')} \right] = \\ &= \left[\frac{K_W(k'') - K_W(k')}{K_W(k'') K_W(k')} \right] - \left[\frac{L_W(k'') - L_W(k')}{L_W(k'') L_W(k')} \right] > 0, \end{aligned} \quad (30)$$

which is equivalent to

$$\frac{\frac{1}{2} + \mu}{\frac{1}{2} - \mu} > \frac{\left[\sum_{k \in J_k} \phi_k + \phi_{k''} a \left(\frac{1}{2} + \mu \right) \right] \left[\sum_{k \in J_k} \phi_k + \phi_{k'} a \left(\frac{1}{2} + \mu \right) \right]}{\left[\sum_{k \in J_k} \phi_k + \phi_{k''} a \left(\frac{1}{2} - \mu \right) \right] \left[\sum_{k \in J_k} \phi_k + \phi_{k'} a \left(\frac{1}{2} - \mu \right) \right]}. \quad (31)$$

Condition (17) is sufficient condition for this inequality to hold.

7 Appendix B: A Many-Good Model

This appendix discusses a many-good generalization of the model in section 2. Our purpose here is to show that the model's key feature driving international portfolio choice is relative factor endowment similarity. In the Heckscher-Ohlin model, production structures are undefined in the presence of more goods than factors. Therefore factor endowment similarity does not necessarily imply similar production structures. On the other hand, a country will still be interested in investing a larger share of its international portfolio in countries with similar factor endowments for insurance purposes.

We maintain most of the model's assumptions, but for the ones we mention here:

1. The final good C is now defined over a continuum of goods, which are aggregated in a Cobb-Douglas fashion:

$$C_j = \exp \left[\int_0^1 \ln C_j(z) dz \right], \quad (32)$$

where $C(z)$ denotes consumption of freely traded intermediate good z , $z \in [0, 1]$.

2. Each industry employs the two production factors, K and L , which are freely mobile between industries. Production functions are also of the Cobb-Douglas type:

$$y_j(z) = [A_j K_j(z)]^{\alpha(z)} [A_j L_j(z)]^{1-\alpha(z)},$$

where $y_j(z)$ denotes production of good z in country j ; and $\alpha(z) \in [0, 1]$. For simplicity, we assume $\alpha(z) = z$.³⁴

3. There is an upper limit $\bar{\mu} < 1/2$ to the differences in relative factor endowments we can allow for, as we focus (for simplicity) on the factor price equalization case.
4. We assume equal size for all countries: $\phi_j = 1$ for all $j \in J$.

³⁴Any symmetric distribution of $\alpha(z)$ such that $\alpha(z) = 1 - \alpha(1 - z)$ would yield similar results.

7.1 Goods Market Equilibrium

We again assume factor price equalization à la Treffer [31]. We will therefore find equilibrium prices by solving for the integrated equilibrium; *i.e.*, we assume both commodities and factors are freely mobile in the world, as if the latter were a single (closed) economy.

The integrated equilibrium conditions are the following:

- Pricing:

$$p(z) = b(z, r, w), \quad (33)$$

$$b(z, r, w) = \left[\frac{r}{\alpha(z)} \right]^{\alpha(z)} \left[\frac{w}{1 - \alpha(z)} \right]^{1 - \alpha(z)}, \quad (34)$$

$$P = \exp \left[\int_0^1 \ln p(z) dz \right], \quad (35)$$

where $b(z, r, w)$ denotes industry z 's cost function; r and w are, respectively, the prices of capital and labor in efficiency units; and P denotes the price of the final good, which we will use as numeraire: $P = 1$.

- Commodity market clearing:

$$C_W(z) = \frac{PC_W}{p(z)} = y_W(z), \quad (36)$$

$$C_W = Y_W = rK_W + wL_W,$$

where $K_W \equiv \sum_{j \in J} A_j K_j$ and $L_W \equiv \sum_{j \in J} A_j L_j$.

- Factor market clearing:

$$\int_0^1 \frac{\partial b(z, r, w)}{\partial r} y_W(z) dz = K_W, \quad (37)$$

$$\int_0^1 \frac{\partial b(z, r, w)}{\partial w} y_W(z) dz = L_W. \quad (38)$$

Putting conditions (33), (34), (36), (37), and (38) together, $w/r = K_W/L_W$, and $P = e^{-\frac{1}{2}r^{\frac{1}{2}}w^{\frac{1}{2}}}$. These last two equations and the choice of numeraire yield $r = e^{-\frac{1}{2}}(K_W/L_W)^{-\frac{1}{2}}$ and $w = e^{-\frac{1}{2}}(K_W/L_W)^{\frac{1}{2}}$. It is easy to show that the results we discussed in section 2.1 also hold here. Defining country j 's gross domestic product as $Y_j = r(A_j K_j) + w(A_j L_j)$, we obtain $Y_k(k) > \frac{1}{J}Y_W > Y_k(l) > Y_k(k')$. The model's symmetry implies $Y_{k'}(k') > \frac{1}{J}Y_W > Y_l(k') > Y_k(k')$.

7.2 Asset Market Equilibrium

The following results are the counterpart to the results discussed in section 2.3.1:

1. Assume $\mu > 0$. Consider state of nature k' , $k' \in J_k$: $B_k(k') > B_l(k') > 0 > B_{k'}(k')$. By symmetry, $B_k(k') > B_k(l) > 0 > B_k(k)$.
2. For $\mu = 0$, $B_k(k') = B_l(k')$.
3. $d\beta/d\mu > 0$.

8 Appendix C: International Portfolio Choice without Arrow-Debreu Securities

This appendix discusses a model without Arrow-Debreu securities that yields results comparable to those we obtained in section 2. We assume the same setup as in section 2 on the goods side (including our assumptions on productivity shocks and states of nature), but consider a completely different asset side.

1. Let us simplify by assuming $J = 4$, $\phi_j = 1$ for all $j \in J$, and complete specialization ($\mu = 1/2$).
2. We assume quadratic utility

$$U(C_j) = C_j - \frac{b}{2}C_j^2, \quad (39)$$

where $b > 0$.³⁵

3. Before uncertainty is realized countries can only exchange ownership claims on their GDPs.
4. International asset trade is costly: a fraction $\tau_{jj'} = \tau \in (0, 1)$ of the payoff that country j receives from its claims on country- j' GDP, $j' \neq j$, is wasted as a cost of keeping foreign assets in country j 's portfolio ($\tau_{jj} = 0$ for all j).³⁶

Let V_j be the market value of country j 's uncertain GDP $Y_j \equiv p_j y_j$. The problem's budget constraints can be written as follows:

$$V_j = \sum_{j'=1}^J x_{jj'} V_{j'}, \quad (40)$$

$$C_j = \sum_{j'=1}^J x_{jj'} (1 - \tau_{jj'}) Y_{j'}, \quad (41)$$

³⁵ b must be small enough so that $U'(C) > 0$.

³⁶This is the classical 'iceberg' assumption due to Samuelson [28], which has been used in international finance by Martin and Rey [23], [24].

where $x_{jj'}$ denotes country j 's share of ownership claims on country- j' income.³⁷ Asset market clearing requires $\sum_{j=1}^J x_{jj'} = 1$ for all $j' \in J$. Country j 's utility maximization problem can be expressed as:

$$\max_{\{x_{jj'}\}_{j'=1}^J} E \left[U \left[\sum_{j'=1}^J x_{jj'} (1 - \tau_{jj'}) Y_{j'} \right] \right], \quad (42)$$

subject to $V_j = \sum_{j'} x_{jj'} V_{j'}$. The first-order conditions with respect to $x_{jj'}$, $j' = 1, \dots, J$, yield

$$\frac{\lambda_j V_{j'}}{1 - \tau_{jj'}} = E[U'(C_j) Y_{j'}] = \text{cov}[U'(C_j), Y_{j'}] + E[U'(C_j)] E(Y_{j'}), \quad (43)$$

$j' \in J$, and where λ_j is the Lagrange multiplier associated to the constraint. Due to the model's symmetry, $\lambda_j = \lambda$, $E(Y_j) = E(Y)$, and $V_j = V$ for all j . The presence of international asset market frictions thus implies $\text{cov}[U'(C_j), Y_j] < \text{cov}[U'(C_j), Y_{j'}]$ for all $j' \neq j$. With quadratic utility, this is equivalent to $\text{cov}[C_j, Y_j] > \text{cov}[C_j, Y_{j'}]$. Thus, portfolios will be home-biased due to the presence of frictions.

We now show $x_{kk'} > x_{kl}$. Consider first $k, k' \in J_k$: since $\text{cov}[C_k, Y_k] > \text{cov}[C_k, Y_{k'}]$ and $\text{var}(Y_k) = \text{var}(Y_{k'})$,

$$[x_{kk} - x_{kk'}(1 - \tau)] \text{var}(Y_k) > [x_{kk} - x_{kk'}(1 - \tau)] \text{cov}(Y_k, Y_{k'}). \quad (44)$$

Since $\text{cov}(Y_k, Y_{k'}) < 0$,³⁸ $x_{kk} > x_{kk'}(1 - \tau)$. Consider now $k, k' \in J_k$ and $l, l' \in J_l$: since, from the first-order condition (43), $\text{cov}[C_k, Y_{k'}] = \text{cov}[C_k, Y_l]$,

$$x_{kk'}(1 - \tau) \text{var}(Y_{k'}) + x_{kk} \text{cov}(Y_k, Y_{k'}) = x_{kl}(1 - \tau) \text{var}(Y_l) + x_{kl'}(1 - \tau) \text{cov}(Y_l, Y_{l'}). \quad (45)$$

By symmetry, $\text{var}(Y_{k'}) = \text{var}(Y_l) > 0$, $\text{cov}(Y_j, Y_k) = \text{cov}(Y_l, Y_{l'}) < 0$, and $x_{kl} = x_{kl'}$. Solving for $x_{kl}(1 - \tau)$,

$$\begin{aligned} x_{kl}(1 - \tau) &= \frac{x_{kk'}(1 - \tau) \text{var}(Y_{k'}) + x_{kk} \text{cov}(Y_k, Y_{k'})}{\text{var}(Y_{k'}) + \text{cov}(Y_k, Y_{k'})} < \\ &< \frac{x_{kk'}(1 - \tau) [\text{var}(Y_{k'}) + \text{cov}(Y_k, Y_{k'})]}{\text{var}(Y_{k'}) + \text{cov}(Y_k, Y_{k'})} = x_{kk'}(1 - \tau), \end{aligned} \quad (46)$$

since $x_{kk} > x_{kk'}(1 - \tau)$ and $\text{cov}(Y_k, Y_{k'}) < 0$. Hence, $x_{kk'} > x_{kl}$: country k invests a larger share of its wealth in country k' than in country l .³⁹

This setup is correctly spelt out only for the case $x_{kk} > x_{kk'} > x_{kl} \geq 0$. How can we make sure that we have no shortselling in equilibrium? Notice that

³⁷Country j 's 'total consumption' of the final good (that is, inclusive of the resources wasted in keeping its international portfolio) is $\sum_{j'=1}^J x_{jj'} Y_{j'}$.

³⁸Under complete specialization, it is easy to prove that $\text{cov}(Y_k, Y_{k'}) < \text{cov}(Y_k, Y_l) = 0$.

³⁹According to our computer simulations, allowing for CRRA utility and a higher elasticity of substitution between goods, as well as for a less restrictive distribution of states of nature, yields similar results. These results are available upon request.

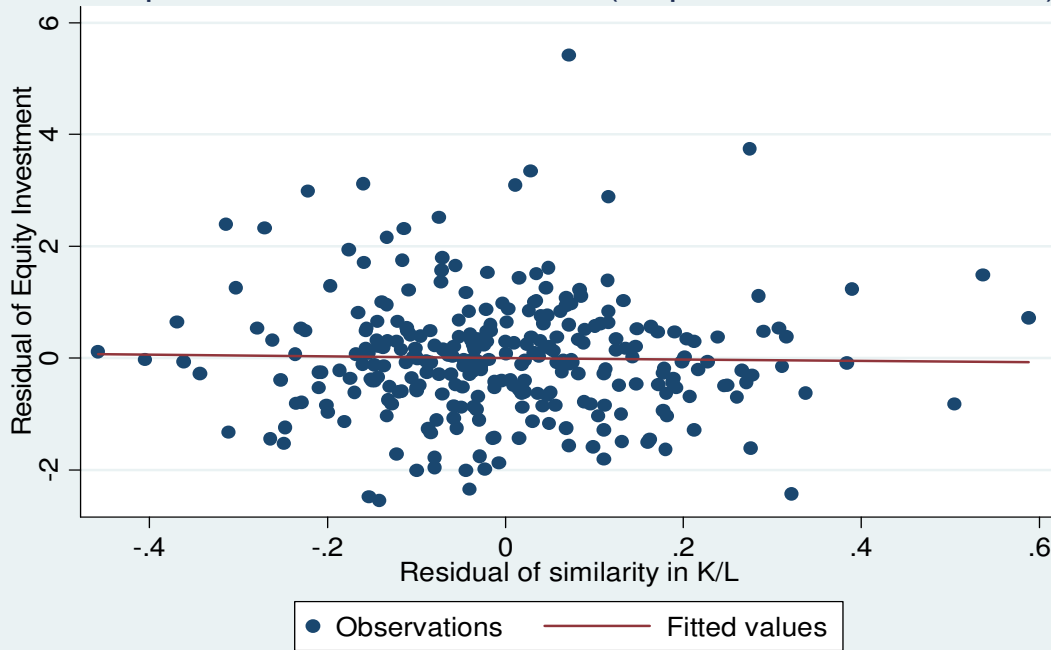
in the absence of asset trade frictions ($\tau = 0$), countries would be able to insure fully by choosing $x_{kk} = x_{kk'} = x_{kl} = 1/4$. We can show that x_{kl} is a continuous function of τ . Hence, by continuity, for a small positive τ , $x_{kl} > 0$. (In any case, we do not observe shortselling in the data.)

9 Appendix D: Sources and Definitions of Variables

1. Bilateral portfolio equity holdings (in millions of US dollars): Portfolio equity instruments issued by host country residents and held by source country residents. Source: 2002 Coordinated Portfolio Survey (IMF). Year: 2002.
2. GDP (in millions of year-2000 US dollars). Source: Penn-World Tables. Year: 2001.
3. Total population. Source: World Development Indicators. Year: 2001.
4. Log of bilateral trade. Source: Glick and Rose [10].
5. Distance: Logarithm of great circle distance in miles between the capital cities of source and host countries. Source: Glick and Rose [10].
6. Common border: Dummy variable taking the value of 1 if source and host countries share a border. Source: Glick and Rose [10].
7. Regional trade agreement (RTA): Dummy variable taking the value of 1 if source and host countries share the same regional trade agreement. Source: Glick and Rose [10].
8. Currency area: Dummy variable taking the value of 1 if source and host countries are in the same (strict) currency union. Source: Glick and Rose [10]. (Updated for the euro area by the authors.)
9. Colony/Colonizer: Dummy variable taking the value of 1 if source and host countries ever had a colonial relationship. Source: Glick and Rose [10].
10. Common language: Dummy variable taking the value of 1 if source and host countries share a common language. Source: Glick and Rose [10].
11. Common legal origin: Dummy variable taking the value of 1 if source and host countries have a legal system with a common origin (common law, French, German, or Scandinavian). Source: La Porta *et al.* [18].
12. Correlation in GDP growth rates: Correlation between the real GDP growth rate in the source and host country. Authors' own computations based on real GDP growth rates. Source: World Development Indicators. Period: 1981-2000.

13. Correlation of stock returns. Source: Lane and Milesi-Ferretti [21] Period 1980-96.
14. Correlation of growth-stock returns. Source: Lane and Milesi-Ferretti [21] Period 1980-96.
15. Capital-labor ratios. Source: Caselli [5] and Caselli and Feyrer [6]. Year: 2000.
16. Time difference. Authors' calculation. The variable is constructed as $\ln(0.001 + time_difference)$.
17. Exports by sector to the world at the 2-digit level. Source: Feenstra (NBER database). We only include countries that have at most 4 missing sectoral values.
18. Stock market capitalization (average 1985-2000). Source: Beck *et al.* [3].

Graph 1. Small host countries (slope=-0.13, t-stat=-0.35)



Graph 2. Large host countries (slope=1.5, t-stat=4.04)

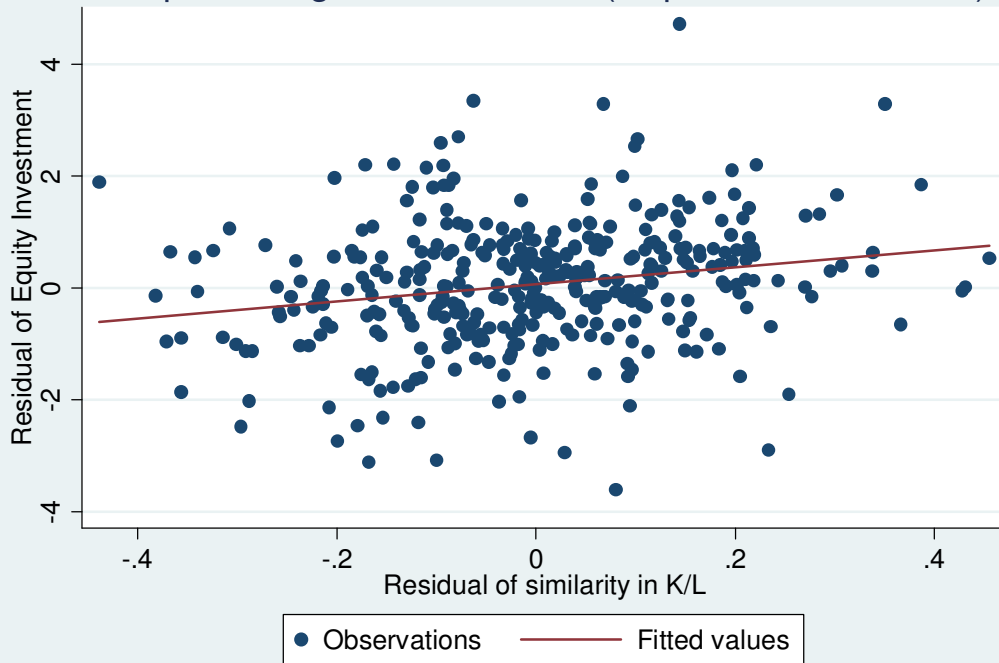


Table 1. Information on countries in the sample

Countries	Total source equity	Total host equity	KL ratio	Stock market	GDP
United States	1010832	700712	146391	0.97	9766702
United Kingdom	382012	532698	98998	1.25	1475473
Canada	184005	92856	137800	0.68	834418
Netherlands	179561	181611	134941	0.85	426979
Japan	169489	267749	145955	0.83	3061726
France	135612	217040	142196	0.45	1505280
Ireland	116098	84961	106142	-	101163
Italy	99302	82264	148889	0.25	1321779
Sweden	66628	41224	116631	0.75	225143
Australia	59182	67546	132703	0.63	511186
Belgium	48689	23300	156396	0.48	256399
Norway	43142	12885	177840	0.28	152434
Spain	35424	78611	120603	0.38	826115
South Africa	30911	14895	25692	1.43	360227
Finland	17491	63167	131405	0.67	118716
Austria	15726	3806	150438	0.13	220685
New Zealand	7545	4015	102645	0.43	80377
Argentina	6246	909	50699	0.18	402113
Portugal	4006	9354	87457	0.2	180681
Chile	2166	2715	45687	0.61	178883
Greece	1858	4329	94564	0.28	160250
Israel	1607	11797	115771	0.37	128604
Korea	1098	50235	108017	0.33	762600
Brazil	939	19778	39218	0.18	1269952
Malaysia	377	6272	58274	1.44	251322
Colombia	245	171	15271	0.98	243894
Indonesia	50	3717	14821	0.15	868471
Thailand	33	5465	38127	0.38	418524
Turkey	8	5605	29238	0.15	363847
Mexico	-	29874	49067	0.22	809757
Peru	-	721	23145	0.12	114061

"GDP" is the real GDP of 2001 in millions of US\$ 2000.

"Total source equity" and "Total host equity" are both measured in millions of US\$ 2002.

"K/L ratio" is directly taken from Caselli and Feyrer (2007).

"Stock market" is the average stock market capitalization between 1985-2000

Table 2. Full Sample. Columns (1)-(4): dummy separation. Columns (5)-(8): ln(GDP) interaction.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Tobit	OLS	Poisson	Poisson	Tobit	OLS	Poisson	Poisson
	Equity>=0	Equity>=0	Equity>0	Equity>=0	Equity>=0	Equity>=0	Equity>0	Equity>=0
Similarity in KL ratio (small host countries)	0.732	0.897	0.624	0.605				
	[0.234]***	[0.156]***	[0.312]**	[0.302]**				
Similarity in KL ratio (large host countries)	1.030	1.320	0.978	0.942				
	[0.187]***	[0.251]***	[0.340]***	[0.318]***				
Similarity in KL ratio					-2.003	-4.157	-5.840	-5.693
					[2.697]	[2.368]*	[3.266]*	[3.249]*
Similarity in KL ratio*ln(GDP)					0.108	0.196	0.239	0.233
					[0.099]	[0.091]**	[0.119]**	[0.120]*
Observations	687	687	560	687	687	687	560	687
H0: coef[KL_small]=coef[KL_large]:	0.26	0.05	0.29	0.32				
GDP positive combined coefficient					18.5	21.2	24.4	24.4
R-squared		0.86				0.86		
Pseudo R-squared	0.38		0.95	0.95	0.38		0.95	0.95

Note: Equity holdings of source/investor country i in host/recipient country j are measured in millions of US dollars. The dependent variable is $\ln(1+Equity)$ in the case of OLS and Tobit, while it is Equity in the Poisson regressions. Regressions include source and host country fixed effects. Standard errors are clustered at the source country level and are reported in parenthesis. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively. The Pseudo R-squared for Poisson is without clustering.

Table 3. Full Sample. Columns (1)-(4): dummy separation. Columns (5)-(8): ln(GDP) interaction.

	(1) Tobit Equity>=0	(2) OLS Equity>=0	(3) Poisson Equity>0	(4) Poisson Equity>=0	(5) Tobit Equity>=0	(6) OLS Equity>=0	(7) Poisson Equity>0	(8) Poisson Equity>=0
Log of distance	-0.736 [0.122]***	-0.602 [0.134]***	-0.161 [0.074]**	-0.163 [0.074]**	-0.731 [0.121]***	-0.589 [0.136]***	-0.159 [0.077]**	-0.159 [0.077]**
Common legal origin	0.459 [0.145]***	0.375 [0.151]**	-0.092 [0.178]	-0.092 [0.178]	0.455 [0.144]***	0.379 [0.151]**	-0.056 [0.181]	-0.055 [0.182]
Dummy for common border	0.271 [0.297]	0.148 [0.327]	0.430 [0.129]***	0.432 [0.131]***	0.303 [0.297]	0.198 [0.329]	0.469 [0.129]***	0.470 [0.131]***
Dummy for common language	0.396 [0.223]*	0.299 [0.242]	0.492 [0.175]***	0.498 [0.175]***	0.406 [0.222]*	0.290 [0.248]	0.494 [0.174]***	0.498 [0.174]***
Dummy for ever colony/colonizer	0.460 [0.293]	0.537 [0.342]	-0.180 [0.206]	-0.184 [0.205]	0.454 [0.293]	0.538 [0.355]	-0.234 [0.199]	-0.238 [0.198]
Dummy. Strict currency area	0.055 [0.270]	0.046 [0.315]	0.968 [0.221]***	0.975 [0.221]***	0.072 [0.270]	0.065 [0.318]	0.976 [0.224]***	0.982 [0.224]***
Dummy for regional trade agreement	0.080 [0.289]	0.217 [0.341]	0.196 [0.183]	0.194 [0.185]	0.094 [0.288]	0.233 [0.348]	0.211 [0.189]	0.209 [0.192]
Similarity in KL ratio (small host countries)	-0.131 [0.222]	0.284 [0.257]	-0.495 [0.449]	-0.495 [0.448]				
Similarity in KL ratio (large host countries)	0.595 [0.179]***	1.047 [0.311]***	0.770 [0.286]***	0.745 [0.269]***				
Similarity in exports (small host countries)	-0.220 [2.185]	-0.348 [2.008]	-0.866 [2.271]	-0.914 [2.250]				
Similarity in exports (large host countries)	-0.602 [2.244]	0.216 [2.365]	0.969 [2.253]	0.883 [2.226]				
Similarity in KL ratio					-7.605 [2.596]***	-8.169 [2.178]***	-7.816 [2.198]***	-7.602 [2.267]***
Similarity in KL ratio*ln(GDP)					0.293 [0.095]***	0.330 [0.084]***	0.299 [0.075]***	0.291 [0.078]***
Similarity in exports					10.137 [18.767]	4.637 [15.829]	-11.219 [7.867]	-11.176 [7.640]
Similarity in exports*ln(GDP)					-0.406 [0.695]	-0.195 [0.588]	0.374 [0.254]	0.370 [0.245]
Observations	650	650	523	650	650	650	523	650
H0: coef[KL_small]=coef[KL_large]:	0.00	0.00	0.00	0.00				
GDP positive combined coefficient					26.0	24.8	26.1	26.1
R-squared		0.88				0.88		
Pseudo R-squared	0.43		0.96	0.96	0.43		0.96	0.96

Note: Equity holdings of source/investor country i in host/recipient country j are measured in millions of US dollars. The dependent variable is $\ln(1+Equity)$ in the case of OLS and Tobit, while it is Equity in the Poisson regressions. Regressions include source and host country fixed effects. Standard errors are clustered at the source country level and are reported in parenthesis. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively. The Pseudo R-squared for Poisson is without clustering.

Table 4. Full Sample. Columns (1)-(6): dummy separation. Columns (7)-(12): ln(GDP) interaction.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0
Log of distance	0.006	0.011	0.026	0.027	0.008	0.009	-0.042	-0.034	-0.025	-0.021	-0.039	-0.035
	[0.110]	[0.111]	[0.109]	[0.109]	[0.106]	[0.106]	[0.119]	[0.119]	[0.118]	[0.118]	[0.113]	[0.113]
Common legal origin	-0.121	-0.125	-0.126	-0.129	-0.018	-0.021	-0.071	-0.075	-0.077	-0.079	0.025	0.023
	[0.156]	[0.157]	[0.158]	[0.159]	[0.147]	[0.146]	[0.157]	[0.158]	[0.160]	[0.161]	[0.149]	[0.149]
Dummy for common border	0.397	0.397	0.386	0.383	0.425	0.417	0.435	0.433	0.431	0.428	0.460	0.450
	[0.130]***	[0.132]***	[0.134]***	[0.136]***	[0.134]***	[0.137]***	[0.131]***	[0.133]***	[0.136]***	[0.138]***	[0.138]***	[0.141]***
Dummy for common language	0.502	0.505	0.479	0.483	0.441	0.446	0.492	0.494	0.475	0.478	0.437	0.438
	[0.178]***	[0.177]***	[0.179]***	[0.178]***	[0.165]***	[0.163]***	[0.178]***	[0.177]***	[0.181]***	[0.180]***	[0.165]***	[0.163]***
Dummy for ever colony/colonizer	-0.171	-0.175	-0.153	-0.157	-0.101	-0.111	-0.232	-0.236	-0.221	-0.225	-0.172	-0.181
	[0.207]	[0.206]	[0.210]	[0.209]	[0.206]	[0.204]	[0.201]	[0.200]	[0.205]	[0.204]	[0.203]	[0.201]
Dummy. Strict currency area	0.985	0.989	0.991	0.992	0.994	0.995	0.988	0.991	0.994	0.994	0.996	0.996
	[0.243]***	[0.243]***	[0.240]***	[0.240]***	[0.244]***	[0.244]***	[0.249]***	[0.249]***	[0.246]***	[0.246]***	[0.250]***	[0.249]***
Dummy for regional trade agreement	0.223	0.214	0.237	0.225	0.285	0.285	0.186	0.175	0.199	0.186	0.226	0.217
	[0.107]**	[0.105]**	[0.115]**	[0.113]**	[0.142]**	[0.133]**	[0.131]	[0.127]	[0.137]	[0.132]	[0.148]	[0.142]
Similarity in KL ratio (small host countries)	-0.538	-0.525	-0.561	-0.550	-0.465	-0.437						
	[0.442]	[0.437]	[0.431]	[0.426]	[0.409]	[0.399]						
Similarity in KL ratio (large host countries)	0.741	0.723	0.741	0.723	0.875	0.875						
	[0.283]***	[0.268]***	[0.281]***	[0.266]***	[0.322]***	[0.323]***						
Similarity in exports (small host countries)	-0.979	-1.079	-1.195	-1.311	-1.140	-1.272						
	[2.141]	[2.115]	[2.141]	[2.118]	[2.051]	[2.012]						
Similarity in exports (large host countries)	0.818	0.681	0.698	0.560	0.396	0.202						
	[2.122]	[2.081]	[2.105]	[2.068]	[1.948]	[1.907]						
Similarity in KL ratio							-7.737	-7.465	-7.704	-7.443	-7.356	-7.203
							[2.470]***	[2.493]***	[2.491]***	[2.513]***	[2.551]***	[2.572]***
Similarity in KL ratio*ln(GDP)							0.295	0.285	0.294	0.284	0.286	0.281
							[0.084]***	[0.086]***	[0.085]***	[0.087]***	[0.091]***	[0.093]***
Similarity in exports							-6.591	-6.434	-7.262	-7.268	-4.892	-3.391
							[9.114]	[8.876]	[8.589]	[8.367]	[9.828]	[9.623]
Similarity in exports*ln(GDP)							0.206	0.196	0.227	0.223	0.137	0.077
							[0.296]	[0.285]	[0.277]	[0.266]	[0.330]	[0.322]
Log of bilateral trade	0.181	0.192	0.188	0.198	0.207	0.212	0.137	0.150	0.143	0.154	0.170	0.180
	[0.121]	[0.121]	[0.118]	[0.119]*	[0.120]*	[0.120]*	[0.130]	[0.130]	[0.130]	[0.129]	[0.126]	[0.126]
GDP growth correlations	-0.256	-0.246	-0.315	-0.304	-0.385	-0.359	-0.217	-0.209	-0.250	-0.241	-0.317	-0.299
	[0.177]	[0.176]	[0.209]	[0.209]	[0.224]*	[0.228]	[0.193]	[0.192]	[0.229]	[0.228]	[0.242]	[0.244]
Correlation stock returns			0.379	0.359	0.389	0.408			0.257	0.239	0.268	0.292
			[0.302]	[0.304]	[0.354]	[0.347]			[0.328]	[0.330]	[0.361]	[0.358]
Correlation GDP growth - stock return			-0.093	-0.115	-0.102	-0.125			-0.025	-0.047	-0.029	-0.050
			[0.203]	[0.204]	[0.200]	[0.201]			[0.221]	[0.222]	[0.219]	[0.219]
Similarity in ln(GDP per capita)					-0.162	-0.286					-0.177	-0.323
					[0.472]	[0.456]					[0.581]	[0.557]
Time difference					0.037	0.036					0.035	0.035
					[0.024]	[0.024]					[0.024]	[0.024]
Observations	523	650	501	624	501	624	523	650	501	624	501	624
H0: coef[KL_small]=coef[KL_large]:	0.00	0.00	0.00	0.00	0.00	0.00						
GDP positive combined coefficient							26.2	26.2	26.2	26.2	25.7	25.6
Pseudo R-squared	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96

Note: Equity holdings of source/investor country i in host/recipient country j are measured in millions of US dollars. The dependent variable is $\ln(1+Equity)$ in the case of OLS and Tobit, while it is Equity in the Poisson regressions. Regressions include source and host country fixed effects. Standard errors are clustered at the source country level and are reported in parenthesis. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively. The Pseudo R-squared for Poisson is without clustering.

Table 5. World Bank sample of High Income and Upper Middle Income countries. Columns (1)-(6): dummy separation. Columns (7)-(12): ln(GDP) interaction.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0	Poisson Equity>0	Poisson Equity>=0
Log of distance	0.006	0.008	0.027	0.025	0.008	0.006	-0.042	-0.038	-0.024	-0.023	-0.038	-0.037
	[0.110]	[0.112]	[0.110]	[0.111]	[0.107]	[0.108]	[0.120]	[0.120]	[0.120]	[0.120]	[0.114]	[0.114]
Common legal origin	-0.122	-0.125	-0.127	-0.128	-0.015	-0.017	-0.072	-0.075	-0.078	-0.079	0.026	0.026
	[0.157]	[0.158]	[0.159]	[0.160]	[0.148]	[0.148]	[0.158]	[0.159]	[0.161]	[0.162]	[0.151]	[0.151]
Dummy for common border	0.401	0.396	0.390	0.383	0.428	0.417	0.442	0.436	0.439	0.431	0.466	0.455
	[0.132]***	[0.134]***	[0.137]***	[0.138]***	[0.137]***	[0.140]***	[0.133]***	[0.135]***	[0.138]***	[0.140]***	[0.140]***	[0.143]***
Dummy for common language	0.504	0.507	0.480	0.484	0.443	0.447	0.494	0.496	0.475	0.478	0.437	0.439
	[0.181]***	[0.180]***	[0.182]***	[0.181]***	[0.169]***	[0.167]***	[0.180]***	[0.179]***	[0.184]***	[0.183]***	[0.167]***	[0.166]***
Dummy for ever colony/colonizer	-0.168	-0.174	-0.149	-0.154	-0.098	-0.108	-0.226	-0.232	-0.213	-0.219	-0.166	-0.175
	[0.211]	[0.211]	[0.214]	[0.214]	[0.210]	[0.209]	[0.205]	[0.205]	[0.210]	[0.210]	[0.207]	[0.206]
Dummy, Strict currency area	0.987	0.992	0.992	0.995	0.995	0.997	0.988	0.993	0.995	0.996	0.996	0.998
	[0.244]***	[0.245]***	[0.241]***	[0.241]***	[0.245]***	[0.245]***	[0.250]***	[0.250]***	[0.247]***	[0.247]***	[0.251]***	[0.250]***
Dummy for regional trade agreement	0.234	0.224	0.249	0.237	0.303	0.298	0.205	0.195	0.220	0.208	0.249	0.240
	[0.110]**	[0.108]**	[0.118]**	[0.116]**	[0.145]**	[0.138]**	[0.133]	[0.130]	[0.139]	[0.135]	[0.150]*	[0.145]*
Similarity in KL ratio (small host countries)	-0.556	-0.521	-0.582	-0.547	-0.484	-0.438						
	[0.446]	[0.441]	[0.435]	[0.430]	[0.415]	[0.407]						
Similarity in KL ratio (large host countries)	0.724	0.731	0.721	0.730	0.862	0.880						
	[0.295]**	[0.298]**	[0.295]**	[0.299]**	[0.339]**	[0.349]**						
Similarity in exports (small host countries)	-0.982	-1.066	-1.204	-1.304	-1.139	-1.252						
	[2.153]	[2.125]	[2.150]	[2.126]	[2.057]	[2.023]						
Similarity in exports (large host countries)	0.819	0.710	0.696	0.585	0.389	0.241						
	[2.131]	[2.086]	[2.109]	[2.068]	[1.948]	[1.906]						
Similarity in KL ratio							-7.843	-7.560	-7.815	-7.541	-7.484	-7.293
							[2.510]***	[2.512]***	[2.535]***	[2.537]***	[2.585]***	[2.602]***
Similarity in KL ratio*ln(GDP)							0.298	0.289	0.297	0.288	0.290	0.284
							[0.086]***	[0.086]***	[0.087]***	[0.088]***	[0.093]***	[0.094]***
Similarity in exports							-7.118	-7.082	-7.855	-8.000	-5.108	-4.224
							[9.176]	[9.046]	[8.635]	[8.522]	[9.925]	[9.897]
Similarity in exports*ln(GDP)							0.225	0.220	0.248	0.249	0.144	0.108
							[0.299]	[0.292]	[0.279]	[0.273]	[0.334]	[0.332]
Log of bilateral trade	0.179	0.188	0.185	0.193	0.202	0.207	0.133	0.143	0.138	0.147	0.164	0.173
	[0.122]	[0.123]	[0.119]	[0.120]	[0.121]*	[0.122]*	[0.132]	[0.132]	[0.131]	[0.131]	[0.128]	[0.127]
GDP growth correlations	-0.266	-0.252	-0.328	-0.314	-0.399	-0.376	-0.224	-0.213	-0.259	-0.248	-0.329	-0.312
	[0.179]	[0.180]	[0.214]	[0.215]	[0.229]*	[0.233]	[0.196]	[0.197]	[0.235]	[0.236]	[0.248]	[0.251]
Correlation stock returns			0.386	0.370	0.407	0.414			0.274	0.258	0.293	0.306
			[0.316]	[0.316]	[0.365]	[0.360]			[0.344]	[0.344]	[0.374]	[0.373]
Correlation GDP growth - stock return			-0.099	-0.121	-0.111	-0.135			-0.028	-0.051	-0.035	-0.057
			[0.206]	[0.207]	[0.202]	[0.204]			[0.224]	[0.224]	[0.220]	[0.221]
Similarity in ln(GDP per capita)					-0.198	-0.274					-0.209	-0.308
					[0.480]	[0.462]					[0.591]	[0.574]
Time difference					0.037	0.036					0.036	0.035
					[0.024]	[0.024]					[0.024]	[0.024]
Observations	471	546	449	521	449	521	471	546	449	521	449	521
H0: coef[KL_small]=coef[KL_large]:	0.00	0.00	0.00	0.00	0.00	0.00						
GDP positive combined coefficient							26.3	26.2	26.3	26.2	25.8	25.7
Pseudo R-squared	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96

Note: Equity holdings of source/investor country i in host/recipient country j are measured in millions of US dollars. The dependent variable is $\ln(1+Equity)$ in the case of OLS and Tobit, while it is Equity in the Poisson regressions. Regressions include source and host country fixed effects. Standard errors are clustered at the source country level and are reported in parenthesis. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively. The Pseudo R-squared for Poisson is without clustering.

Table 6. Full sample. Separation of source countries based on financial development (FD)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Source countries:	High FD	Low FD	High FD	Low FD	High FD	Low FD	High FD	Low FD
	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson
	Equity>0	Equity>=0	Equity>0	Equity>=0	Equity>0	Equity>=0	Equity>0	Equity>=0
Similarity in KL ratio (small host countries)	0.489	0.345	-0.417	-0.266	-0.371	-0.483	-0.137	-0.989
	[0.452]	[0.875]	[0.417]	[1.074]	[0.396]	[1.220]	[0.309]	[0.993]
Similarity in KL ratio (large host countries)	1.024	1.497	0.843	1.477	0.820	1.263	0.821	1.534
	[0.171]***	[0.441]***	[0.313]***	[0.550]***	[0.323]**	[0.457]***	[0.274]***	[0.565]***
Log of distance			-0.082	-0.527	0.009	-0.125	0.069	-0.463
			[0.083]	[0.110]***	[0.118]	[0.356]	[0.135]	[0.266]*
Common legal origin			0.013	0.157	-0.017	-0.002	-0.040	0.234
			[0.129]	[0.228]	[0.109]	[0.200]	[0.129]	[0.166]
Dummy for common border			0.746	-0.093	0.667	-0.065	0.645	-0.135
			[0.257]***	[0.111]	[0.265]**	[0.237]	[0.264]**	[0.308]
Dummy for common language			0.375	0.732	0.349	0.689	0.339	0.979
			[0.149]**	[0.444]*	[0.140]**	[0.500]	[0.153]**	[0.544]*
Dummy for ever colony/colonizer			-0.265	0.379	-0.272	0.367	-0.225	0.411
			[0.173]	[0.143]***	[0.174]	[0.166]**	[0.180]	[0.196]**
Dummy. Strict currency area			0.909	0.851	0.890	0.992	0.983	0.472
			[0.355]**	[0.303]***	[0.359]**	[0.313]***	[0.358]***	[0.302]
Dummy for regional trade agreement			0.325	0.016	0.118	0.440	0.199	0.526
			[0.201]	[0.226]	[0.238]	[0.311]	[0.182]	[0.309]*
Log of bilateral trade					0.183	0.488	0.212	0.353
					[0.145]	[0.371]	[0.141]	[0.338]
GDP growth correlations					-0.029	-0.667	-0.064	-0.545
					[0.105]	[0.101]***	[0.195]	[0.405]
Correlation stock returns							0.221	-0.856
							[0.521]	[1.126]
Correlation GDP growth - stock return							0.244	-0.174
							[0.227]	[0.487]
Similarity in exports (small host countries)							-2.277	6.918
							[4.037]	[2.119]***
Similarity in exports (large host countries)							6.099	3.483
							[4.409]	[2.244]
Observations	294	202	294	202	294	202	286	189
H0: coef[KL_small]=coef[KL_large]:	0.33	0.36	0.02	0.20	0.03	0.20	0.03	0.04
Pseudo R-squared	0.93	0.94	0.97	0.97	0.97	0.97	0.97	0.97

Note: Equity holdings of source/investor country i in host/recipient country j are measured in millions of US dollars. The dependent variable is $\ln(1+Equity)$ in the case of OLS and Tobit, while it is Equity in the Poisson regressions. Regressions include source and host country fixed effects. Standard errors are clustered at the source country level and are reported in parenthesis. *, **, *** indicate statistical significance at the 10%, 5%, 1% level, respectively. The Pseudo R-squared for Poisson is without clustering.