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The determinants of cross-border equity flows

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Abstract

We explore a new panel data set on bilateral gross cross-border equity flows between 14 countries, 1989–1996. We show that a "gravity" model explains international transactions in financial assets at least as well as goods trade transactions. Gross transaction flows depend on market size in source and destination country as well as trading costs, in which both information and the transaction technology play a role. Distance proxies some information costs, and other variables explicitly represent information transmission, an information asymmetry between domestic and foreign investors, and the efficiency of transactions. The geography of information is the main determinant of the pattern of international transactions, while there is weak support in our data for the diversification motive, once we control for the informational friction. We broaden the scope of our results by presenting some evidence linking the results on equity transactions to equity holdings.

Keywords: Equity flows; Cross-border portfolio investment; Information asymmetries; Gravity model; Home bias

JEL classification: F36; F21; F12; G11

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1. Introduction

There are very few well-established results on the determinants of international trade in assets, especially securities. Such work has been impeded by data problems, and there is little theory behind it. We believe that this paper provides the first evidence of a systematic geographical pattern in the distribution of international portfolio equity transactions.

We now have a set of data on cross-border equity transaction flows. These are exceptional insofar as they give a panel of observations of cross-border purchases and sales of equities. They include all major equity markets (Europe, United States, Asia). They are annual bilateral (source and destination) gross portfolio equity flows, 1989–1996. The data set includes the US, but unlike any other data on asset flows we know of, it also has observations on bilateral country pairs excluding the US. Because of this special feature of the data, we can analyze the determinants of international trade in equities in a general set up, controlling for the special status of the US as the biggest world economy, as one of the main financial centers and as issuer of the main international currency.

We provide new, clear-cut evidence on the determinants of international transactions in equity: we find that a 'gravity model'[2] performs at least as well in explaining asset trade as goods trade. We derive the estimated equation from a simple micro-founded model of asset trade. We capture 70% of the variance of gross cross-border equity transactions with a parsimonious set of variables. We find that market size, efficiency of the transactions technology, and distance are the most important determinants of transaction flows. The very significant negative impact of distance on transactions is at first sight quite surprising and puzzling: unlike goods, assets are 'weightless', and distance cannot proxy transportation costs! Moreover, if investors seek to diversify their portfolios, they may want to buy equities in distant countries whose business cycles have a low or negative correlation with their own country's cycle.[3] If that were so, distance could have a positive effect on asset trade because of the diversification motive.[4] Where does the negative effect of distance come from? The most natural explanation is that informational frictions are positively correlated with distance. Geographical distance is a barrier to interaction among economic agents and, more broadly, to cultural exchange. Cultural affinities are a component of the network effects that influence international economic relations (Rauch, 2001). The hypothesis of informational frictions leads us to examine the effect not only of distance, but also of other variables that might more directly represent information flows.

To address this we use telephone call traffic, the degree of overlap in trading hours and multinational bank branches to account for information transmission, and an index of the

[2] A 'gravity model' has been the workhorse model for trade in goods since the 1960s. It explains trade flows between countries i and j by the two masses (GDPs) and distance. More elaborate versions include cultural affinities, trade bloc dummies, etc.

[3] Frankel and Rose (1998) show that trade between country pairs is positively related to the correlation of their business cycles; since trade decreases with distance, business cycle correlation does as well. Imbs (1999) provides direct evidence that correlations of business cycles decrease with distance.

[4] We investigate the diversification motive in Section 4. Note, however, that our data are for transactions, not asset holdings, so this argument is valid only if there is a positive relationship between flows and stocks. We do indeed find this to hold (see Section 6).

degree of insider trading to represent directly the information asymmetries between domestic and foreign investors. Telephone calls and bank branches, both of which are time-varying variables, are highly significant; the degree of overlap in trading hours also has some explanatory power in most specifications. Insider trading, for which we have data for only 5 years, has a negative but less well-determined effect on portfolio investment flows.[5] These results are robust to a wide range of specification tests and experiments with dummy variables. In our sample, the diversification motive is dominated by the information effect: we find weak support for a diversification motive in international asset transactions only once we control for informational frictions. Overall, the informational friction seems to be the main factor shaping the geographical distribution of international equity transactions.

Our results can therefore be seen as complementary to those of Coval and Moskowitz (1999) and of Portes et al. (2001). Coval and Moskowitz (1999) show a local bias in the holdings of mutual funds within the US. The authors underline the role of distance as an informational proxy to explain the investment decisions of those funds. They suggest that the same type of geographical bias they uncover in US holdings data may appear internationally and use a calibration method to quantify its effect. Portes et al. (2001) use a US-centered data set to focus on the differences between equity, corporate bond and government bond flows. They find that international transactions in government bonds are not influenced by distance. This is likely to be due to the nature of government bond payoffs, less subject to information asymmetries than corporate bonds or equities; and to the use of US government securities as the main central bank reserve asset, given the international currency status of the dollar. They find, however, that transactions in corporate bonds, whose payoffs are more similar to those on equity, are sensitive to informational frictions.

The evidence presented here shows that the geography of information is important for the distribution of international equity flows. International capital markets thus are not so frictionless as is often assumed in discussions of capital mobility and 'globalization'.[6] Our empirical results help to illuminate the character and impact of frictions in international capital markets: the market segmentation appears to be attributable mainly to informational asymmetries or 'familiarity' effects.[7] All this argues for the same type of radical change in theoretical modeling of asset trade that we have seen in the literature on goods trade. It should shift away from models based on factor endowments, comparative advantage and autarky prices (see Helpman and Razin, 1978; Svensson, 1988; Obstfeld and Rogoff, 1996, chapters 1–2 and 5) towards models including differentiated assets, transaction

[5] It is also remarkable that our information variables perform very well for a comparable panel of goods trade (Section 5). This suggests to us that the empirical goods trade literature overestimates the importance of transportation costs (proxied by distance) and considerably underestimates the importance of information asymmetries (also proxied by distance).

[6] This conclusion is consistent with some of the recent literature along the lines of Feldstein and Horioka (1980), as suggested by Gordon and Bovenberg (1996).

[7] Separating out 'familiarity' effects from pure informational symmetries remains a challenge for the empirical literature. Coval and Moskowitz (2001) show however that funds which invest more locally earn substantially higher returns, suggesting that for this class of investors, local investments reflect a true informational advantage.

costs, information asymmetries and possibly models based on some type of 'familiarity effect' (Heath and Tversky, 1991; Huberman, 2000). The finance literature has emphasized information asymmetries much more than the asset trade literature, but it has largely focused on portfolio choice and asset pricing, rather than transaction volumes. Yet there are very interesting, important issues here.

First, asset flows have increased greatly in the past two decades, and the equity portfolio flows that we study are a very substantial component of international capital flows. Studying transactions in those securities is interesting (and complementary to studying holdings and net flows), because transactions tell us something about the nature of the *frictions* economic agents encounter when trading assets and the degree of market segmentation. A better understanding of these frictions may help us to interpret herding behavior and contagion effects as well as the functioning of international capital markets in a broader sense. Indeed, it may help us understand when arbitrage across markets takes place and when it does not. Bekaert et al. (2002) show that for emerging markets, the dynamics of returns and net flows is altered depending on whether the countries are relatively open to foreign investment or not. We show here that gross equity flows across developed markets depend on the degree of information transmission.

Second, financial market integration (e.g., in the euro area, as discussed in Portes and Rey, 1998a; Martin and Rey, 2000) will substantially affect asset trade. Improvements in our knowledge about a major dimension of this trade help us to analyze how the various aspects of integration will affect international transactions in securities. Third, the gross transaction flows that we study are associated with the liquidity of the relevant equity markets. Fourth, there is a growing body of literature studying the links between flows and prices (see Lyons, 2001; Froot et al., 2001; Froot and Ramadorai, 2002; Stulz et al., forthcoming). Understanding the determinants of transactions may therefore be important to explain price effects.[8]

Finally, understanding flows may tell us something about stocks, i.e., about the determinants of portfolio composition. So far, the effort to relate theory to the data has led to an impasse represented by the 'home bias puzzle' (French and Poterba, 1991; Cooper and Kaplanis, 1994; Tesar and Werner, 1995; Lewis, 1999; Lane and Milesi-Ferreti, 2001). There is continuing controversy over whether this home bias is due to transaction costs, informational asymmetries and 'familiarity' effects or other frictions such as trading costs on the goods market (Obstfeld and Rogoff, 2001). Our analysis and results throw some light on these questions. Theories linking volumes of transactions and holdings are still not well-developed. We find in Section 6, however, with a different (US-centered) data set, that *empirically* the geographical distribution of holdings and transaction volumes share common characteristics.

Section 2 discusses the existing theoretical and empirical literature and draws some conclusions about how to model equity flows. We take a new direction that brings together insights from the finance literature and the perspective based on international macro-

[8] For a recent study of equilibrium flows, exchange rate movements and equity prices, see Hau and Rey (2002).

economics and trade. We sketch a simple model that leads to our basic estimating equation. In Section 3, we describe our data. Section 4 presents our main results: it examines the determinants of portfolio equity investment flows and points out the important role played by information flows. Section 5 shows that our informational variables enter significantly in a standard 'gravity' equation for goods trade, with a consequent reduction of the effect of distance; and we demonstrate that portfolio equity trade is not just a complement to goods trade. Section 6 presents evidence linking equity holdings and transactions. Section 7 concludes.

2. Gross cross-border equity portfolio flows

2.1. What do we know?

There is a substantial literature on home bias in asset holdings, but there are very few papers empirically analyzing the determinants of international *transactions* in assets and their link with informational asymmetries.

Tesar and Werner (1995) show that transaction costs are an unlikely explanation for home bias, since one observes turnover at least as high on foreign asset holdings as on domestic ones.[9] Brennan and Cao (1997) construct a model in which purchases of foreign equities are an increasing function of the return on the foreign equity market index. A public signal moves investors to revise their priors and hence change their portfolios; the less well informed foreign investors revise the means of their distributions more than do the better informed locals, so price moves simultaneously in the same direction as foreign purchases. The story is appealing, but the empirical evidence is limited: 'our model is able to explain only a small proportion of the variance of international equity portfolio flows' (p. 1876).[10] Froot et al. (2001) also find a contemporaneous correlation between flows and returns, as well as effects that they interpret as arising from private information (on emerging but not developed country markets).[11]

A very different viewpoint from the international economics literature starts from trade in goods. An argument for a 'gravity' model of equity trade is the empirically observed complementarity between trade and FDI flows. The latter in turn may be related to

[9] For a more recent study on this issue, see Warnock (2002).

[10] Brennan and Aranda (1999), however, obtain stronger results on the returns variable in a study of international flows of debt and equity capital during the Asian crisis. Tesar (1999) finds that an 'expected returns' variable performs well in explaining monthly data for US investors' net purchases of equities in 22 foreign countries. Bohn and Tesar (1996) had also found a similar result and suggest that foreign investors are at an informational disadvantage.

[11] Kim and Wei (1999) study equity investors' trading behavior before and during the Korean crisis of 1997–1998. Their results on both positive feedback trading and herd behavior are consistent with an informational asymmetry between non-resident and domestic investors. So are the results of Frankel and Schmukler (1996), who find that local residents 'led' non-residents in exit behavior during the Mexican crisis of 1994–1995. Timmermann and Blake (1999), using a sample of 247 UK pension funds (1991–1997), find that 'explanations based on relatively poorly informed foreign investors appear to be important in explaining the short-run dynamics of portfolio adjustments'.

portfolio equity flows.[12] There is no theory here, but the argument is suggestive. Ghosh and Wolf (1999), studying asset holdings, make a case along these lines and also appeal to informational asymmetries that increase with distance; they find some empirical support for the hypothesis. de Ménil (1999) finds that a 'gravity' model accounts well for FDI flows among European countries.[13]

2.2. Information asymmetries in the literature

The information that is required to evaluate financial assets such as corporate bonds and equities is not straightforward and not equally available to all market participants. What is the relevant information? It includes knowledge of accounting practices, corporate culture, political events, and the structure of asset markets and their institutions.

There is substantial evidence that the information available to market participants differs among them. Coval and Moskowitz (2001) show that US mutual funds which bias their investments towards companies whose headquarters are located nearby earn substantial abnormal returns. Grinblatt and Keloharju (2001) show that distance is a significant determinant of stockholdings and trades within Finland. Hau (2001) shows that foreign traders make significantly less profit than German traders when they transact on the German stock market. He also finds weak evidence that German-speaking traders (in Germany and Switzerland) perform better than their non-German-speaking colleagues. Pagano et al. (1999) and Ahearne et al. (2001) underline the importance of the informational barriers constituted by different national accounting standards and practices. Bekaert (1995) discusses the importance of 'indirect barriers to investment' for equity flows into emerging markets. These indirect barriers include poor information about those markets and frictions such as inefficient settlement systems, poor accounting standards and poor investor protection. Financial information itself is evidently important: on market liquidity, the identities of other market participants, or the covariances of asset returns. Privately observed order flow may reveal information about liquidity and price pressure (see Lyons, 2001).

The finance literature has offered numerous explanations for the home bias puzzle, including information asymmetries. From a theoretical perspective, Gehrig (1993) and Kang and Stulz (1997) derive home bias from asymmetric information between domestic and foreign investors. From an empirical perspective, French and Poterba (1991) invoke information asymmetry or some type of "familiarity" effect; Tesar and Werner (1995) focus on "language, institutional and regulatory differences and the cost of obtaining information about foreign markets" (p. 479) and suggest that "geographic proximity seems to be an important ingredient in the international portfolio allocation decision" (p. 485). Coval and Moskowitz (1999) suggest that 'economic distance', as measured by 'air fares or phone rates data for example' (p. 22) may be the right concept to explain investment biases. Huberman (2001) studies the characteristics of shareholders of Regional Bell Operating Companies and finds "compelling evidence that people invest in the familiar while often ignoring the principles of portfolio theory". Gordon and Bovenberg (1996) also focus on

[12] See Section 5 for a deeper discussion of the links between goods trade and equity trade. Dvorak (2000) presents a model with information asymmetries able to generate large gross capital flows and small net flows.

[13] See also Buch (2001) for related evidence concerning bank loans.

asymmetries of information between foreign and domestic investors but develop their model at a macro level, so it yields a relationship across countries between current account deficits and domestic real interest rates. Net flows are related to a returns variable; here, the empirical results give reasonably strong but very indirect support for the informational asymmetry hypothesis.[14]

2.3. An empirical model of asset trade

We base our empirical specification on a general equilibrium model with fully optimizing agents and endogenous market capitalization. This comes from Martin and Rey (in press), who propose a theory of asset trade from which a 'gravity' equation emerges naturally.[15] The three key elements that are required to generate such an equation are: (1) that assets are imperfect substitutes because they insure against different risks;[16] (2) that cross-border asset trade entails some transaction and/or information costs; (3) that the supply of assets is endogenous. In their framework, risk-averse agents develop an optimal number of Arrow–Debreu projects that correspond to different assets, which are traded on stock exchange markets. Hence, market capitalization in each country is an endogenous variable in the model. Higher aggregate demand from foreign countries implies a higher asset price, which in turn increases the incentives of agents to start new risky projects and list more financial assets. With a bit of rewriting, the log of transactions in equities T_{ij} (sum of purchases and sales) from country i to country j becomes:

$$\log T_{ij} = k_1 \log\left(M_i M_j\right) + k_2 \log\left(\tau_{ij}\right) + k_3 \tag{1}$$

where M_i and M_j are measures of the economic masses of country i and country j (here equity market capitalizations), τ_{ij} represents the trading cost between countries i and j and $k_1>0$, $k_2<0$ and k_3 are constants to be estimated.

This equation is very intuitive and is similar to the standard 'gravity' equations derived in the literature of international trade in differentiated goods. When going to the data, we interpret the trading cost as a function of both information cost and the efficiency of the transaction technology. We would expect information costs to be positively correlated with distance: the cost of traveling is higher for longer distances, cultural differences are likely to be stronger, business links weaker. Hence, we capture the informational dimension first by using distance, second by using explicit variables for information transmission (telephone calls, number of bank branch subsidiaries, degree of overlap in trading hours) and a variable measuring directly the degree of asymmetry between domestic and foreign investors (an index of insider trading). As far as the transaction technology is concerned, we have an

[14] Razin et al. (1998) accept the Bovenberg–Gordon model for foreign portfolio equity investment and the justification in terms of informational asymmetry between foreign and domestic investors.

[15] See also Martin and Rey (2000) for an application of the model to the issue of regional financial integration and location of financial centers. The model briefly sketched here is a simple static model. Transactions in and holdings of foreign assets coincide. We are fully aware of this limitation. But building dynamic theoretical models able to replicate the transaction volumes observed in financial asset data is still one of the major challenges of the finance literature and is certainly beyond the scope of this paper.

[16] This view is strongly supported by the empirical results of Shleifer (1986) and Wurgler and Zhuravskaya (2000), for example, who find that the elasticity of demand for stocks without close substitutes is relatively small.

index of sophistication of financial markets, some direct measures of transaction costs and indices of financial market development such as private credit over GDP.

To summarize, the basic estimating equation arising out of this analysis takes the following form:

$$\begin{aligned}\log\left(T_{ij,t}\right) = {} & \alpha_1 \log\left(mktcap_{i,t}\right) + \alpha_2 \log\left(mktcap_{j,t}\right) + \alpha_3 \log\left(distance_{ij}\right) \\ & + \alpha_4 \text{ information variables} + \alpha_5 \text{ transaction technology variables} \\ & + \text{time dummies} + \text{constant} + \varepsilon_{ij,t} \end{aligned} \tag{2}$$

The theory suggests that $\alpha_1=\alpha_2=1$, $\alpha_3<0$ and $\alpha_4>0$, $\alpha_5>0$ so that the equation can be estimated in a normalized form:

$$\begin{aligned}&\log\left(T_{ij,t}/\left(mktcap_{i,t} \times mktcap_{j,t}\right)\right) \\ &\quad = \beta_1 \log\left(distance_{ij}\right) + \beta_2 \text{ information variables} \\ &\qquad + \beta_3 \text{ transaction technology variables} + \text{time dummies} + \text{constant} + v_{ij,t} \end{aligned} \tag{3}$$

with $\beta_1<0$, $\beta_2>0$ and $\beta_3>0$.

Subsequently, we will add to the above specification variables representing the covariances between returns of country equity markets (we also experiment with covariance of consumption with stock market return and correlations between returns and between GDP growth rates). We also allow for a 'return-chasing' motive with a variable measuring the return on equity investment in the destination country. We check for robustness by detrending and experimenting with various normalizations, dummies and other control variables common in the goods trade literature (trading blocs, language, exchange rate volatility, main financial center dummies, country-specific dummies). We add time dummies to control for aggregate shocks such as a world business cycle, movements in the world rate of interest, or global capital market shocks. We will see that the simple specification presented above captures most of the variance in the data. We also check for robustness by splitting the sample and using various estimation techniques. All the results and robustness checks are presented in Section 4 and the accompanying tables.

3. Data

The equity transactions flow data we use in Section 4 come from Cross-Border Capital (London).[17] There are 8 years of the panel, 1989–1996. These are annual data, whereas Brennan–Cao use quarterly data, while Froot et al. have daily data. The former, however, are restricted to US bilateral transactions with 4 developed and 16 emerging market countries. The latter use a subset of aggregate (not bilateral) flows into and out of 46 countries. Our data are *bilateral flows*, so the set of 14 source (country i) and destination

[17] Summary statistics from this data base (which was initiated by Michael Howell and Angela Cozzini a decade ago at Baring Securities) appear in Lewis (1999) and Tesar and Werner (1995). More detailed information on these data can be found in Appendix A. For the US, the Cross Border Capital data are virtually the same as the US Treasury TIC data, at http://www.ustreas.gov/tic/index.htm.

(country j) countries is identical, and we have a total of 1456 observations ($8\times13\times14$). The cross-sectional dimension is the most important in our panel. These are transactions data: they record purchases (purchas_{ij}) and sales (sal_{ij}) by residents of country i (source) in the portfolio equity markets of country j (destination). The transaction variable we use in most of our specifications is the sum of purchases and sales, equity_{ij}. The countries are: North America: United States, Canada (dummy variable, NorthAm); East Asia: Japan, Hong Kong, Singapore (dummy variable, EastAsia); EU Europe: UK, Germany, France, Netherlands, Spain, Italy, Scandinavia (dummy variable, EU); Non-EU Europe: Switzerland; Australia.

Summary statistics for the transaction flow data are given in Table 1. Portfolio equity investment grew rapidly (though not monotonically) over our period. The mean

Table 1
Summary statistics

(a) Source country total purchases, sales, gross flows, net flows, 1989–1996 (US$ billions)

	Purchases mean	Sales mean	Transaction flows			Net flows means
			mean	min	max	
US	21.235	17.995	39.230	2.180	419.006	3.240
Japan	3.473	3.212	6.681	0	71.603	0.265
UK	19.001	18.260	37.258	0	319.84	0.743
Germany	2.541	2.305	4.846	0	27.515	0.236
France	2.223	2.140	4.363	0	21.833	0.083
Switzerland	6.142	5.962	12.101	0	84.536	0.183
Netherlands	2.023	1.754	3.776	0	33.502	0.268
Spain	0.159	0.137	0.296	0	2.937	0.022
Italy	0.974	0.925	1.895	0	22.329	0.050
Scandinavia	0.684	0.534	1.214	0	14.000	0.153
Canada	3.146	2.866	6.010	0	103.081	0.282
Australia	0.560	0.512	1.071	0	7.917	0.049
Hong Kong	1.884	1.730	3.614	0	26.040	0.155
Singapore	1.324	1.078	2.401	0	23.972	0.247

Gross flows $\text{mean}_i = \frac{1}{T}\sum_t \sum_j \text{equity}_{ij,t}$ (similarly for purchases and sales); $\text{min}_i = \min_{ij,t} \text{equity}_{ij,t}$; $\text{max}_i = \max_{ij,t} \text{equity}_{ij,t}$

i and j are country indices, t a time index. The total number of years T is 8.

(b)

Non-US transactions in percentage of total transactions	42%	
Intra-European transactions in percentage of total transactions	24%	
Distance (km)	mean	7039
	min	235
	max	17,700
Telephone volume (millions of minutes)	mean	99
	min	0.7
	max	3462
Market capitalization (US$ millions)	mean	752
	min	28
	max	6680

of the net flows is positive for all countries in the sample, consistent with a trend erosion of home bias. In these annual data, the net flows are typically very small by comparison with gross purchases and sales—perhaps of the same order of magnitude as the measurement error in the data. This picture would change with higher frequency data. Indeed, if there were only one stock to purchase in each country, or if the representative foreigner transacted only in a single index fund, then as the period length decreased, there would be a rising number of observations with only one of purchases or sales positive, with the other zero. At any instant, the investor would be only buying or only selling, not both simultaneously. Thus, we would expect the ratio of gross to net flows to increase with the length of the period.

The share of our 14 countries in global equity market capitalization in 1996 was 86.6%. The US is the main global investor, but there are many transactions (42% of the total, in value), which do not involve the US either as the source or the recipient country. The US is therefore far from being a 'hub' for all world financial transactions, and there is substantial asset trade among the other countries which is not intermediated through New York. Intra-European trade accounts alone for 24% of the transactions.

We denote the market capitalization of country i (at the beginning of the year) by mktcap_i. We use several variables representing information flows and transactions costs, as well as equity market returns, and their covariances. We put in parentheses after the variable the expected sign in the regression.

dist_{ij} (−) = distance between country i and country j. We used distance between capital cities (see Appendix A). We experimented with distance between financial centers and got similar results.

teleph_{ij} (+) = volume of telephone call traffic in minutes from country i to country j in each year (available annually), normalized to give telephnor_{ij} (see below).

bank_{ij} (+) = number of branches in country j of banks headquartered in country i (Bankers Almanac, available annually), normalized to give banknor_{ij} (see below).

overlap_{ij} (+) = number of trading hours overlap between the main financial centers of countries i and j.

insiders_j (−) = degree of insider trading in the stock market of the destination country (World Competitiveness Report, 1996, 1998, 2000).

soph_i (+) = sophistication of financial markets of the source country (World Competitiveness Report, 1996, 1998, 2000).

covar_{ij} (−) = covariances of stock market returns; we use two definitions. The first takes yearly observations calculated using monthly data on returns in country i and j during that year. The second uses the covariance between monthly returns over the entire period (1989–1996) and is therefore time-invariant.

Note that insiders_j is available only for 1992–1996, and soph_i is available only for 1993–1996. For the previous years, we take the 1992 and the 1993 values, respectively.

We also have a data set for trade flows of manufactures (OECD data) between the same countries (trade_{ij}) that is strictly comparable to our equity flow data. We analyze these data in Section 5. In Section 6, we use the two benchmark surveys of US holdings of foreign securities conducted by the Treasury Department (1995), (1998) to link equity transactions to equity holdings for the US.

4. The determinants of portfolio equity investment flows

4.1. The basic specification and estimates

We begin with a specification that is a 'stripped' form of the estimating equation (Eq. (2)) at the end of Section 2. All equations include a constant term and time dummies to control for aggregate shocks, whose estimates are not reported. The dependent variable $equity_{ij}$ is the gross purchases plus sales of portfolio equity by residents of country i (source investor) in the markets of country j (destination market). The estimates for the full panel are given in the first column of Table 2. We use beginning-of-period market capitalization ($mktcap_i$, $mktcap_j$) to represent financial size. All variables are in logs throughout, so all the corresponding coefficients are elasticities. There is no evidence of non-linearities in the data. The estimation procedure (here and below) gives 'White-corrected' (heteroskedasticity-consistent) standard errors, which are shown in parentheses

Table 2
Bilateral equity flows 1989–1996 (1–3); normalised flows (4–8); full set of country dummies (7); control for goods trade (8)

	(1) $equity_{ij}$	(2) $equity_{ij}$	(3) $equity_{ij}$[a]	(4) $equitynor_{ij}$	(5) $equitynor_{ij}$	(6) $equitynor_{ij}$[a]	(7) $equitynor_{ij}$[b]	(8) $equitynor_{ij}$
$mktcap_i$	0.987	0.993	1.006	–		–	–	–
	(0.037)	(0.030)	(0.058)					
$mktcap_j$	1.055	1.061	1.077	–	–	–	–	–
	(0.035)	(0.032)	(0.058)					
$soph_i$	0.456	0.610	0.627	0.609	0.434	0.451	0.169	0.441
	(0.038)	(0.034)	(0.055)	(0.034)	(0.039)	(0.066)	(0.124)	(0.038)
$soph_j$	0.094	0.248	0.265	0.258	0.080	0.119	−0.202	0.065
	(0.037)	(0.030)	(0.055)	(0.029)	(0.042)	(0.077)	(0.127)	(0.041)
$dist_{ij}$	–	−0.881	−0.890	−0.881	−0.673	−0.684	−0.646	−0.529
		(0.031)	(0.063)	(0.031)	(0.040)	(0.077)	(0.056)	(0.042)
$telephnor_{ij}$	–	–	–	–	0.174	0.171	0.078	0.155
					(0.027)	(0.045)	(0.032)	(0.027)
$banknor_{ij}$	–	–	–	–	0.148	0.136	0.236	0.174
					(0.034)	(0.068)	(0.057)	(0.034)
$insiders_j$	–	–	–	–	−0.001	0.045	−0.209	0.026
					(0.044)	(0.083)	(0.105)	(0.044)
$trade_{ij}$	–	–	–	–	–	–	–	0.224
								(0.031)
N	1456	1456	182	1456	1456	182	1455	1456
$F(K, N\text{-}K\text{-}1)$	206.71	352.58	189.74[c]	62.97	99.17	53.59[d]	66.19[e]	99.00
R^2	0.555	0.693	0.844[f]	0.322	0.445	0.648[f]	0.562	0.463

All our estimates include time dummies. In this table as well as all the tables that follow, these time dummies are not reported.

[a] 'Between' regression on group means.

[b] There is a full set of dummy variables for both source and recipient countries.

[c] $F(5,176)$.

[d] $F(6,175)$.

[e] $F(39,1415)$.

[f] 'Between'.

below the coefficient estimates. Both financial size variables and sophistication of financial markets variables ($soph_i$ and $soph_j$) enter with the expected signs and with very well-determined coefficients.

In column (2) we add distance. Distance is appropriately negatively signed and precisely estimated, and the R^2 of the regression jumps from 0.555 to 0.693: with five independent variables, this straightforward, simple 'gravity' regression captures almost 70% of the variance in our 1456 observations. It compares very favorably in terms of precision of estimates and explanatory power with the gravity regressions run in the goods trade literature, which have been hailed as one of the strongest and most robust stylized facts in international economics. We confirm our results in column (3), where we present a regression on group means ('between' estimator). The coefficients are similar to those in the pooled estimates, and the R^2 for this cross-section regression is remarkable: we explain 84% of the variance.

We note that the elasticities on each market capitalization are close to unity in all of our specifications (indeed they are never statistically different from one) as suggested by the theory. Therefore, from now on we use the normalized equation (Eq. (3)) at the end of Section 2 since it has better econometric properties. We call the normalized transaction flow equitynor$_{ij}$: it is the log of the gross bilateral cross-border equity flow divided by the product of the equity market capitalizations of each country. In column (4) of Table 2 we rerun our basic regression using equitynor$_{ij}$ as the dependent variable and confirm once more our earlier results: the coefficient on distance is significantly negative and very precisely estimated.

Distance, we conjecture, is in good part a proxy (inversely) for information. The first direct measure of information we introduce is telephone call traffic—we believe we are the first to introduce this variable. We normalize it for country economic size (i.e., the volume of telephone calls from country i to country j is divided by the square root of the product of their real GDPs): telephnor$_{ij}$. This global telephone call traffic variable is a proxy for overall information flow—not for the amount of time traders talk with each other. We argued earlier that this overall information flow affects transaction volumes. Because this variable measures total telephone call traffic between the two countries, it is not significantly endogenous to financial market activity. When added to the regression, it is significant and correctly signed, and it reduces the coefficient on distance (column (4)). When added on its own without distance it also performs very well (unreported).

We have two further informational variables: the number of branches in country j of banks headquartered in country i (banks$_{ij}$), which we also normalized (banknor$_{ij}$); and an index of the perceived extent of insider trading in the destination country's financial markets, insiders$_j$ (constructed from questionnaire data by the World Competitiveness Report, 1996, 1998, 2000).[18] The role of bank branches as informational links has been suggested by Choi et al. (1986, 1996) and Jeger et al. (1992).[19] As far as we know,

[18] This index is fairly closely related in our sample to the (quite separate) 'corruption' index developed by Transparency International (www.transparency.de); the rank correlation across the 14 countries is 0.47, rejecting independence at the 8% level.

[19] Gehrig (1998) focuses on the role of financial centers in processing information and suggests that the intensity of that activity is related to the concentration of branches of multinational banks in such centers.

however, we are the first to use such a variable as an informational proxy in empirical work. Including these as regressors, we have columns (5) and (6) of Table 2. Whether with distance or with telephone calls, the other information variables and the transactions cost variable appear with correctly signed, well-determined coefficients. The insider trading variable is the only one that is somewhat unstable. However, we later found that it works well for intra-European transactions (Table 3).

Why could foreign investors not overcome the informational problems by hiring local portfolio managers or buying research reports? The simplest answer is to ask them: the reply to the first suggestion—in effect—is that there are significant agency problems. The second is simply not serious—if one needs more than is produced by the head office, research by other market participants has little credibility. Insofar as it is possible to get reliable information from local representatives, our bank branches variable may capture this. Telephone call traffic indeed appears to be representing *some* of the information transmission that is inversely related to distance. When both are included, the coefficient of each is significantly less than what we obtain in estimates with either alone. The other coefficients are not overly sensitive to whether we use distance, telephone calls, or both.

One might be concerned about multicollinearity between distance and telephone calls—indeed, a causal relation between them—but the (robust) standard errors on their coefficient estimates are low, these estimates are very stable across specifications, and the correlation between the two variables is also not disturbingly high (−0.32). The fact that our information variables are jointly significant suggests that each of them picks up different aspects of informational asymmetries across countries. For example, one

Table 3

	Excluding US	Excluding US and UK	Flows within Europe			Without intra-European flows
	(1) equitynor$_{ij}$	(2) equitynor$_{ij}$	(3) equitynor$_{ij}$	(4) equitynor$_{ij}$	(5) equitynor$_{ij}$[a]	(6) equitynor$_{ij}$
soph$_i$	0.521	0.519	0.566	0.495	0.510	0.445
	(0.040)	(0.043)	(0.061)	(0.070)	(0.125)	(0.561)
soph$_j$	0.0733	0.123	0.007	−0.302	−0.291	0.190
	(0.046)	(0.050)	(0.055)	(0.100)	(0.213)	(0.056)
dist$_{ij}$	−0.721	−0.856	−0.756	−0.727	−0.719	−0.632
	(0.047)	(0.056)	(0.126)	(0.139)	(0.269)	(0.087)
telephnor$_{ij}$	0.156	0.141	–	0.084	0.081	0.182
	(0.030)	(0.032)		(0.057)	(0.087)	(0.033)
banknor$_{ij}$	0.151	0.118	–	0.020	0.025	0.192
	(0.047)	(0.055)		(0.073)	(0.165)	(0.039)
insiders$_j$	0.021	0.026	–	−0.398	−0.374	0.027
	(0.048)	(0.0511)		(0.117)	(0.251)	(0.195)
N	1248	1056	448	448	56	1008
$F(K,N-K-1)$	95.26	79.74	31.04	26.03	12.82[b]	57.86
R^2	0.457	0.450	0.408	0.429	0.611[c]	0.404

[a] 'Between' regression on group means.
[b] $F(6,49)$.
[c] 'Between'.

interpretation might be that different classes of agents have different information sets. Thus telephone calls might represent the information gathering of the broad population and the cross-country networks associated with migration, cultural ties, past colonial relationships, etc. Traders might be more influenced by their information about fundamentals, which are more closely correlated, the closer is a pair of countries geographically (which appears to be an empirical regularity, partly mediated through trade flows). Foreign bank branches might transmit information about specific companies directly to investment managers in the home country. The argument is conjectural, but the heterogeneity of information sets might leave room for several distinct 'information variables', all of which contribute towards explaining the variance in the data.

In order to avoid potential endogeneity problems with the bank variable, we use its beginning-of-period value (in any case, we believe that bank branches are not set up primarily to deal with portfolio equity trade, but for a wide range of reasons). We use beginning-of-period market capitalizations for the same reasons. We also instrumented the market capitalization variable (with population and transaction costs): the results on our information variables were robust.

With a total, then, of six explanatory variables, we capture 45% of the variance of bilateral cross-border equity flows (and 65% of the cross-sectional variance) for fourteen countries over 8 years (Table 2, columns (5) and (6)). This is the basic specification that we shall subject to various robustness tests below.

We do not introduce country-pair fixed effects (but we do perform robustness checks with country fixed effects in Table 2, column (7)), because we have a strong prior that the distance variable should be a major determinant of the flows. By construction, the distance variable (which is constant over all observations for a given country pair) will pick up some of the fixed effects. Conversely, with fixed-effects panel data estimation, we cannot use any time-invariant variable, because any such variable is spanned by the individual dummies representing the fixed effects. Moreover, the interesting variation in our panel is virtually all cross-sectional; a 'between' estimator on the time-series means for the country pairs demonstrates this clearly (see Table 2, columns (3) and (6)). The fixed effects estimator transforms the observed variables by subtracting out the appropriate time-series means. That clearly rules it out in our context. Thus, most of our estimation simply pools the time-series and cross-section data or uses the between estimator.[20]

Random effects panel estimation is not theoretically appropriate for our data, which are not drawn randomly from a larger population (see Baltagi, 1995). We can, however, get some information from a random effects estimation. These estimates show that the main component of the variance which our specification is capturing is indeed that in cross-

[20] It is, however, appropriate to ask whether the data are 'poolable'. Unfortunately, it is not possible to test poolability across years formally for a number of technical reasons. A Wald test for equality of parameters over years fails because of the Behrens–Fisher problem, that is, a failure to satisfy the assumption of independent annual sub-samples. A standard Chow F-test of parameter stability fails because variances of the sub-samples are not equal over years. And it is not possible to perform the generalized Chow test because a consistent estimate of the country- and time-specific variance components with which to weight the data can only be obtained from the within-groups (fixed effects) estimator—an estimator which is not able to estimate the effect of time-invariant variables like distance. Inspection and comparison of the results by years does, however, suggest considerable stability of the key coefficients (except insofar as we report otherwise—see below).

section (the 'between' R^2 is high, while that for 'within'—the time-series dimension—is very low).[21] It is also reassuring that the coefficients and their standard errors in these GLS estimates are fairly similar to the previous estimates.

4.2. Further robustness checks

Studies of goods trade often use a range of dummy variables that might plausibly be related to economic exchange between two countries. We therefore tried introducing such variables into the basic specifications of Table 2. First we ran our regressions with a full set of time and country dummies. We had dummies for all countries both as a source and a recipient country (*usin* and *usout* for example). The results are reported in Table 2, column (7). Our previous results are robust to this exercise. Then we experimented with geographical adjacency and common language. In our sample, adjacency is strongly collinear with the regional bloc dummies and brings no improvement. The common language dummy, which applies to the US, Canada, the UK and Australia in our sample, is significant with the expected sign for some specifications. But the coefficients on the initial explanatory variables were very stable in all specifications. We then sought to allow for a regional bloc effect, for (alternatively) a currency bloc effect, and for what we call a 'major financial center' effect. First, we used dummy variables for the three regions: North America, the EU, and East Asia. For the non-normalized and the normalized flows, two of the three regional dummy variables entered with positive signs in the basic specification; the other was not significant. But the coefficients on our main explanatory variables were unaffected.[22] We then considered the possibility that international equity flows may be driven by international trade flows so that the distance variable picks up the effect of trade linkages rather than information. We therefore included bilateral trade flows $trade_{ij}$ as a control variable in column (8) of Table 2: distance remains strongly significant. We discuss in detail the links between equity flows and goods trade flows in Section 5 of the paper.

Frankel and Wei (1998) used a continuous variable for currency volatility within blocs. We used their method and also constructed an 'exchange-rate stability' dummy variable for each bilateral relationship in our sample (e.g., this variable is unity for US–Hong Kong, unity for intra-ERM (EMS Exchange Rate Mechanism) currencies, zero for all Australian, Canadian, Singaporean, Swiss, and Japanese bilateral relations, etc.). When introduced into our basic specification, this variable took on a (insignificant) negative coefficient. The continuous volatility measures did not perform well either. Again, exchange rate stability does not seem to have a positive influence on cross-border equity transactions (this does not imply that currency union would have no such effect).

New York, London and Tokyo are the world's major financial centers, and even after allowing for their market sizes and sophistication, we might expect them to enter disproportionately in the data (see Mason and Warnock, 2001). We sought to represent any such effect by constructing (for the US, UK, and Japan) variables like *usin*, which takes the value unity when the flow is transactions in US equities by residents of any other

[21] See columns (1) and (2) of Table A of the unpublished appendix at www.princeton.edu/~hrey for the GLS results.

[22] See the unpublished appendix, Table A, column 5.

country, zero otherwise; and *usout*, which takes the value unity for transactions by US investors in any other country, and zero otherwise. Some of these dummy variables were significant but they did not affect the other coefficient estimates. We also reran our main regression taking first the US, and then both the US and the UK out of the sample. Our results were unaffected (see Table 3 columns (1) and (2)).

We tried two different variables representing the effectiveness of the legal system. We used both the 'judicial efficiency' variable of La Porta et al. (1997) and the 'effectiveness of the legal system in enforcing commercial contracts' index in the World Competitiveness Report (1996, 1998, 2000). Neither was consistently significant. Most of the countries in our sample rank so highly on this criterion that there is relatively little variation in either of these indices.

Our transactions technology variable, the index of 'sophistication of financial markets', is constructed from survey data. An alternative is to take direct estimates of transactions costs in equity markets. These are provided by McSherry and Elkins (see Appendix A). We find these do in fact perform almost as well as our 'sophistication' variables—they enter with the appropriate negative signs and well-determined coefficients. The estimates for other coefficients are not significantly affected. But the overall goodness of fit of the regression is somewhat lower than with the sophistication variables, so we retained the latter. We also experimented with the number of trading hours overlap, overla_{ij} since it is more difficult to place trades with countries which are in a very different time zone. We found a significant and positive effect of that variable, but our results still held (see Table 5, column (1)). Another interesting proxy for financial development is the ratio of private credit over GDP, which we call privcred_i. This variable also enters positively and significantly in some specifications but it is somewhat unstable. Again our results were unaffected when we included it, and the sophistication variable is preferred by the data.[23]

It is reasonable to ask whether our results are dominated by any particular year(s) or countries and whether the relationship between the transaction flows and our explanatory variables behaves in a consistent way over time. We therefore ran our basic specification as a cross-section for each year of the sample. The coefficients appear fairly stable; in particular, all of our main variables behave very well. Distance is always negatively signed, while telephone calls and financial market sophistication always exercise a positive influence on transaction flows. But the performance of the bank branches and insider trading variables is unsatisfactory. Still, they are consistently strong in Table 2 and in most of our other robustness exercises.[24]

We also estimated our basic specification for each country individually, treated as the source country of the transaction flows (so, for example, the US regression has as dependent variable gross transactions by US residents in each of the destination countries for each of the years of the sample, giving 104 observations for the regression). Again, the estimates (not reported) show country-by-country behavior consistent with the overall

[23] See columns (3) and (4) of Table A of the unpublished appendix at http://www.princeton.edu/~hrey for these results.

[24] We note also that when we ran maximum-likelihood estimation (along with the random effects estimation reported below), likelihood-ratio tests showed consistently that bank branches and insider trading should not be dropped from the specification. The year by year results are available in the unpublished Appendix in Table B.

regression and relatively little difference across countries. Non-parametric estimation (kernel) did not suggest any non-linearity in the data.

The regional integration in Europe, with the European Union and EFTA, has certainly affected the operation of capital markets. We might ask whether our results stand up if we take flows within Europe alone. The estimates are reported in Table 3 (columns (3) and (4)). Note that we have less than one-third of our full set of observations. Nevertheless, the basic specification works for all our information variables. Insider trading is correctly signed and significant. In fact, inspection of the data shows there is much more variation across Europe in the perceived extent of insider trading (with Spain, Italy and France at the 'bad' end of the spectrum) than there is among the non-European countries in our sample. The elasticity on distance is very close to the one we found for the whole sample. All the coefficients are somewhat less precisely estimated, as we would expect given the much lower number of observations. The coefficient of $soph_j$ is wrongly signed but not significant. In Table 6, column (5), we control for intra-European trade flows: distance still strongly enters the equation. This suggests that the type of information needed to trade equities within Europe cannot be summarized by trade linkages.

If we in turn exclude intra-European flows from the full sample (leaving the set of observations complementary to those covered in the left panel), we obtain the excellent results reported in Table 3 (column (5)). We have 1008 observations and our key variables are all precisely estimated and of the expected sign and magnitude. Only insider trading is wrongly signed (and it is insignificant).

We found the intra-European results very striking. Even in an arguably very integrated economic area (but before currency unification), the evidence points toward significant informational segmentation. To document this effect further, we studied the geographical coverage of some of the main European newspapers. We compared *Le Monde*, *The Guardian*, *La Stampa* and the *Frankfurter Allgemeine Zeitung* (main 'general interest' newspapers); and we looked separately at the *Financial Times*, *Les Echos* and *Il Sole 24 Ore* (main financial newspapers).[25] We used FT Profile to search for keywords like France, French, etc... in the headlines of all these newspapers. Table 4 shows for each newspaper the fraction of its headlines devoted to a given country. The results are suggestive: there is a much broader coverage of Spain and Italy by French newspapers compared to that of the British and to a lesser extent the German press. On the other hand, Switzerland is followed much more closely by Germany than by the UK (or France). France and Germany are likely to be more informed about each other than about the UK. Italian newspapers tend to write more about France than about Germany and the UK (in that order), and they do not say much about the Netherlands.[26] We note that the correlation between the number of articles written in country i about country j and the distance between the countries is indeed negative: -0.23 for the general interest newspapers and -0.33 for the financial newspapers.

[25] The choice of countries considered and periods has been dictated by data availability.

[26] These results are illustrative rather than claiming to be general.

Table 4
National information sets

Geographical coverage of *Le Monde*, *The Guardian*, *Frankfurter Allgemeine Zeitung*, *La Stampa* (1996–1998)								
Le Monde	UK	France	Germany	Netherlands	Switzerland	Spain	Italy	Scandinavia
(%)	17		27	8	7	15	17	9
The Guardian	UK	France	Germany	Netherlands	Switzerland	Spain	Italy	Scandinavia
(%)		46	15	6	5	9	13	6
Frankfurter	UK	France	Germany	Netherlands	Switzerland	Spain	Italy	Scandinavia
(%)	17	29		5	12	13	15	9
La Stampa	UK	France	Germany	Netherlands	Switzerland	Spain	Italy	Scandinavia
(%)	22	30	22	4	6	11		5

Geographical coverage of the *Financial Times*, *Les Echos* and *Il Sole 24 Ore* (1993–1998)								
Financial Times	UK	France	Germany	Netherlands	Switzerland	Spain	Italy	Scandinavia
(%)		30	25	7	6	9	12	11
Les Echos	UK	France	Germany	Netherlands	Switzerland	Spain	Italy	Scandinavia
(%)	29		29	5	6	10	13	7
Il Sole 24 Ore	UK	France	Germany	Netherlands	Switzerland	Spain	Italy	Scandinavia
(%)	22	31	27	3	6	7		4

4.3. Portfolio diversification

When we control for diversification motives, the results are quite interesting. We proxy risk diversification opportunities by incorporating various correlation variables in our basic specifications. Since we are now investigating the motive for acquiring foreign equities, the dependent variable is normalized net equity purchases ($purnor_{ij}$). We define net purchases as the purchases of country j's equities by citizens of country i minus the sales of country j's equities by citizens of country i. It is therefore a net flow of securities from country j to country i (this is a similar definition as Clark and Berko, 1997, for example). First we run our benchmark regression and show that our information variables explain purchases very well albeit with a lower R^2 than when we use total transactions as the dependent variable, as expected (see column (2) of Table 5).[27] Second we introduce the risk diversification variables. We use covariances of the stock market indices ($covar_{ij}$) calculated as the covariance between the monthly returns in each year. We also use the covariance between the monthly returns on the stock market indices of countries i and j over the entire period 1989–1996); or the covariances between the GDP growth rates of countries i and j, calculated at various time horizons; and covariances between the consumption growth rate and stock market return. In columns (3), (4) and (5) of Table 5, we present estimates with the covariance variable. If transactions occur because of a diversification motive, as in the model sketched in Section 2.3, we would expect that the covariance variables enter with a negative sign: the greater the comovements between financial assets of two countries, the lower the benefit of diversification. It could well be, however, that the diversification motive is overwhelmed by the friction. This is all the more true insofar as empirically the correlations of different countries' assets tend to be negatively correlated with distance: the further apart two

[27] See also Table C of the unpublished appendix at http://www.princeton.edu/~hrey.

Table 5
Estimates with trading hour overlap (1); benchmark regression with purchases; impact of risk diversification on purchases (3–6)

	(1) equitynor$_{ij}$	(2) purnor$_{ij}$	(3) purnor$_{ij}$	(4) purnor$_{ij}$ (other definition of covar$_{ij}$)	(5) purnor$_{ij}$	(6) purnor$_{ij}$
soph$_i$	0.464	0.504	0.505	0.524	0.507	0.532
	(0.042)	(0.058)	(0.058)	(0.061)	(0.058)	(0.058)
soph$_j$	0.107	−0.015	−0.016	−0.002	−0.015	0.050
	(0.044)	(0.069)	(0.813)	(0.071)	(0.069)	(0.044)
dist$_{ij}$	−0.532	−0.699	−0.715	−0.709	−0.745	–
	(0.080)	(0.051)	(0.051)	(0.053)	(0.053)	
telephnor$_{ij}$	0.165	0.206	0.217	0.222	0.217	–
	(0.028)	(0.036)	(0.036)	(0.036)	(0.036)	
banknor$_{ij}$	0.136	0.129	0.121	0.121	0.120	–
	(0.034)	(0.039)	(0.038)	(0.039)	(0.038)	
insider$_j$	−0.011	0.085	0.092	0.100	0.093	–
	(0.044)	(0.074)	(0.074)	(0.075)	(0.074)	
overla$_{ij}$	0.057	–	–	–	–	–
	(0.033)					
covar$_{ij}$	–	–	0.325	−0.303	–	0.346
			(0.112)	(0.185)		(0.136)
covar$_{ij}$/dist$_{ij}$	–	–		–	2.915	–
					(0.948)	
N	1448	1456	1456	1456	1456	1456
$F(K, N-K-1)$	98.19	71.84	69.72	67.05	69.42	19.09
R^2	0.451	0.335	0.338	0.336	0.339	0.123

countries are, the less correlated their business cycles are. If the diversification motive were powerful, French people, say, should invest a lot in Australian equities (controlling for size and transaction costs), since the French and Australian stock markets are not highly correlated. But if French people know very little about Australia, they may not want to invest there much anyway.

In fact, this is exactly what the data tell us: the covariance variable enters with a *positive* sign in our baseline regression when we do not control for the information friction (see column (6) of Table 5). We are just picking up here the fact that people prefer to invest in markets "close" to them—there is a positive correlation between geographical closeness and comovements of business cycles. But if we control for distance and the explicit information variables, as in columns (3) and (4), then the covariance variable enters with the expected negative coefficient in our regressions. In column (3) the covariance used is the first of those described above, which is time-varying over the sample. In column (4), we used the time-invariant measure. If we interact the comovement variable with distance (we divide covar$_{ij}$ by the log of distance), it then takes on a negative sign (see column (5)), which confirms our interpretation. These results however are somewhat unstable across specifications. On balance, we conclude that there is weak evidence for a diversification motive for asset trade in our annual data, but only when we control for the informational friction. We view these results as less robust than our results on the informational friction itself.

5. Information, goods trade, and asset trade

We now look at a panel of goods trade data that strictly matches our panel for equity trade. There is a sharp increase in international portfolio equity flows after 1992 for the US and EU15 but not for Asia; international equity transactions are very asymmetric across blocs; trade in goods and in equities shows different patterns both over time and on a cross-sectional basis (Portes and Rey, 1998b). Nevertheless, some factors may play similar roles in explaining both.

We estimate gravity equations for trade flows (manufactures) over the same period covered by our portfolio equity flows. The specification is standard (see, e.g., Hamilton and Winters, 1992). We use as dependent variable the average of exports reported by country i to country j and imports reported by country j from country i (this is not an average of i's imports and exports to j, but rather averages the *same* flow as recorded by the source and destination country, in order to deal with the well-known 'mirror statistics' discrepancies). Explanatory variables are GDP for both source and destination country (market size), per capita GDP ($gdppc_i$), distance, time dummies and dummy variables for North America, European Union, and East Asia. Again, the specification is log-linear, and the estimation procedure gives 'White-corrected' (heteroskedasticity-consistent) standard errors.

The results for the full panel are shown in column (1) of Table 6. We see that the market size (gdp_i, gdp_j) variables perform as expected. Trade is affected by the regional groupings, although the EU dummy is insignificant. The elasticity of trade with respect to distance is regarded as one of the most securely established empirical results in the

Table 6
Bilateral manufactures trade and equities trade, 1989–1996

$trade_{Ij}$	(1)	(2)	$equity_{ij}$	(3)	(4)	(5) within Europe
$gdp_I \times gdp_j$	0.512	0.580	$mktcap_i \times mktcap_j$	1.057	0.862	0.711
	(0.013)	(0.013)		(0.022)	(0.036)	(0.010)
$gdppc_i \times gdppc_j$	0.147	0.180	$trade_{ij}$	–	0.364	0.485
	(0.064)	(0.059)			(0.048)	(0.102)
$dist_{ij}$	−0.547	−0.279	$dist_{ij}$	−0.666	−0.455	−0.451
	(0.048)	(0.052)		(0.040)	(0.046)	(0.163)
$telephnor_{ij}$	–	0.123	$telephnor_{ij}$	0.179	0.131	0.038
		(0.010)		(0.027)	(0.027)	(0.055)
$banknor_{ij}$	–	0.141	$banknor_{ij}$	0.162	0.157	0.101
		(0.019)		(0.035)	(0.034)	(0.074)
NorthAm	1.461	1.398	$soph_i$	0.417	0.486	0.669
	(0.114)	(0.104)		(0.040)	(0.041)	(0.083)
EU	0.020	0.472	$soph_j$	0.055	0.116	−0.074
	(0.117)	(0.119)		(0.044)	(0.043)	(0.112)
EastAsia	1.484	1.440	$insider_j$	0.019	−0.003	0.303
	(0.131)	(0.127)		(0.045)	(0.044)	(0.122)
N	1456	1456	N	1456	1456	448
$F(K, N-K-1)$	495.82	539.14	$F(K, N-K-11)$	315.95	299.76	57.85
R^2	0.702	0.747	R^2	0.707	0.720	0.692

All the regressions include a full set of time dummies. We use the product of market capitalizations on the right-hand side of the equity equation to offer the closest parallel with the standard trade in goods specification.

literature. Leamer and Levinsohn (1995) cite a 'consensus elasticity' of −0.6; our point estimate of −0.55 in column (1) is one standard deviation away from this.

The picture changes dramatically, however, when we include explicit information variables alongside distance in the trade flows equation. Among the variables we used to explain equity flows, both telephone call traffic and bank branches are a priori plausible candidates to represent direct information flows between trading partners. Including them gives the results reported in column (2) of Table 6. The information variables do indeed enter with sizeable, very well-determined coefficients; and they improve the regression considerably. The EU dummy becomes significant, the proportion of the variance explained rises substantially, and most importantly, the coefficient on distance falls sharply. The elasticity is now only −0.28! Thus here too, in the workhorse gravity model of goods trade, distance appears to be proxying for information flows. The trade literature does not in fact justify convincingly the role of distance in the gravity equation, except by general reference to transport costs. It seems that information flows may be at least as important. These results suggest obvious directions for developing and refining the gravity model.[28]

Obstfeld and Rogoff (2001) propose an interesting and simple theoretical model in which asset trade is the mirror image of goods trade. Their theory can therefore potentially explain why the distribution of asset flows obeys a 'gravity' model like the distribution of trade flows, even without any transaction costs or information costs on asset markets. To investigate this possibility, we run a regression of equity flows on trade flows, distance and other information variables. We find that trade flows do enter significantly in the equation but that distance and the other information variables remain strongly significant (see columns (4) and (5) of Table 6, where we perform the regression both on normalized and non-normalized data). This suggests that the Obstfeld and Rogoff (2001) model may capture part but not all the determinants of asset flows.

More broadly, in principle, the benefits of diversification may be correlated with the intensity of trade between countries (and thus with geographical distance). That might have generated an omitted variables bias in our regressions. Our results here, however, also dismiss this possibility. They make it clear that asset trade cannot be thought of as a pure complement to goods trade, since distance enters very significantly in our asset trade regression despite the inclusion of the trade in goods term.

6. Relation between transaction flows and asset holdings

So far we have focused on the determinants of financial asset transactions. These determinants can a priori be different from the determinants of asset holdings. The literature is still missing theories linking transactions and holdings. In this part, we uncover an empirical link between the two in a distinct and more limited data set.

[28] There has been some movement in this direction. For example, Anderson and Marcouiller (1999) find that 'corruption and imperfect contract enforcement dramatically reduce trade'. Rauch and Trindade (1999) find that where ethnic Chinese communities in trading partner countries are large, they transmit information that helps to match buyers and sellers (Rauch, 1999 also deals with the effects of networks on trade flows).

Comprehensive data on foreign asset holdings are very scarce. In particular, there is no data set that would allow us to match our transactions data with holdings data. Recently, the US Treasury Department conducted two benchmark surveys (in 1994 and 1997) covering the US holdings of long-term securities of some 40 countries. We study the links between these data and the transaction data. We have a total of 80 observations (40 countries, 2 years). In this US-centered data set, we find a very strong positive correlation between the transactions data and the asset holding data. We report below our estimates using a between estimator:

$$\log(\text{US transactions}) = \underset{(0.053)}{1.05}\log(\text{US holdings}) + \underset{(0.127)}{6.66}; \quad R^2 = 0.87$$

The elasticity of US residents' transactions in foreign corporate equities with respect to US holdings in those equities is close to one. Not surprisingly, then, a between-regression of US holdings of foreign equities on foreign market capitalization and distance gives very good results and produces for distance an elasticity which is very similar to the ones we found in Section 4 for the transaction data:

$$\log(\text{US holdings}) = \underset{(0.082)}{0.47}\log(mktcap) + \underset{(0.098)}{0.24}\,soph_i - \underset{(0.262)}{0.71}\log(distance) + \underset{(2.50)}{2.05};$$

$$R^2 = 0.63$$

This suggests that the same informational friction shapes the pattern of international asset transactions and holdings. We note that regressing our turnover ratio variable on distance does not give anything: this tells us that our information variables impact holdings and transactions in a proportionate way. We are unable, however, to check the robustness of these results as thoroughly as we could for our previous results on transactions data (Section 4), because of the small number of observations in the holdings data and the special status of the US. We therefore consider these results as illustrative and as a first step towards gathering a set of stylized facts that unified theories of trading and asset holdings will have to match.

7. Conclusion

We analyze a new panel data set on bilateral gross cross-border equity flows between 14 countries, 1989–1996. To our knowledge, this paper is the first to uncover a specific geographical pattern of international asset transactions. We derived the estimated equation from a simple micro-founded model of asset trade. The results show that a 'gravity' model explains transactions in financial assets at least as well as trade in goods (Section 4). Our specification accounts for almost 70% of the variance of the transaction flows with a parsimonious set of variables. The results are robust to various sets of dummy variables (adjacency, language, currency or trade bloc, effectiveness of the legal system, a 'major financial center' effect, full set of country dummies), which, in general, do not improve the results. The basic specification is valid for individual years and country-by-country, as well as for intra-European transactions alone and when we exclude intra-European transactions or when we exclude the US (and other financial

centers). The results are robust to detrending and various estimation techniques (including non-linear estimates). With almost 1500 observations on bilateral cross-border equity flows, we conjecture that these results are likely to be qualitatively robust. To investigate further our hypothesis that distance enters in the equation as a proxy for information asymmetries we used other variables which plausibly represent international information flows (telephone traffic, number of bank branches, index of insider trading) and showed that these variables were also significant (Section 4).

We found weak evidence of a diversification motive in asset trade at yearly frequency. The covariance variable enters with the sign predicted by the theory (−) only after we control for the information friction. Indeed these information frictions seem to be the dominant force shaping the international distribution of asset flows, once one controls for size and transaction technology (Section 4). Our results accord well with those of Portes et al. (2001). Using another data set (more limited, since it is purely US-centered), they find that information variables are more important determinants of transactions in assets with higher information content (portfolio equities, corporate bonds) and are not significant explanatory variables for assets with low information content (treasury bonds).

In Section 5, we showed that our information variables improve substantially regressions for trade in goods, suggesting that the emphasis the trade literature puts on transportation costs may be exaggerated. We then showed that our information variables enter strongly in our equity flow regressions even when we control for trade in goods. This suggests that theories in which trade in assets is purely a mirror image of trade in goods or theories in which diversification benefits are highly correlated with trade in goods do not capture all the informational dimensions of asset trade.

Finally, we investigated with the available data the links between transactions and asset holdings in Section 6. There we found that the elasticity of US residents' transactions in foreign corporate equities with respect to US holdings in those equities is very close to one. We also find that market capitalization, market sophistication, and distance give a good explanation for holdings. We are not as confident in those results as in the former ones, however, because of the limited number of observations (only 80) and the nature of the data (US-centered).

We view our empirical work as strong evidence that there is a very important geographical component in international asset flows. International capital markets are not frictionless: they are segmented by informational asymmetries or familiarity effects. These results may have implications for the 'home bias' literature. Countries have different information sets, which heavily influence their international transactions. We capture different facets of these information sets with our information variables. More work linking transactions and holdings appears necessary both theoretically and empirically. In particular, a major challenge is to go beyond the simple static model we presented in Section 2 to explain in the same framework the transactions that we observed in our data and the geographical distribution of flows and holdings. Whether theoretical dynamic models based on asymmetric information and heterogeneous beliefs are more appropriate or whether the theory should also emphasize issues like 'familiarity' and behavioral explanations (Heath and Tversky, 1991; Huberman, 2001) remains an open issue.

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Appendix A. Data sources and definitions

A.1. Data set for Sections 4 and 5

Bilateral trade in manufactures: OECD Bilateral Trade Data Base

Distance, adjacency, language: http://www.nber.org/~wei/. Distance is the physical distance between capital cities (except for the US where Chicago is used). We also used distance between financial centers (New York for the US).

Latitude and longitude: http://geography.about.com/cs/latitudelongitude/index.htm. We used latitude and longitude differences between financial centers.

GDP, price index, population: *International Financial Statistics* (IMF) and OECD

Equity price indices and equity market capitalization: Datastream, MSCI

Telephone call traffic (total volume of calls in minutes): *Direction of traffic—Trends in International Telephone Tariffs 1996*, International Telecommunications Union

Bank branches: *Bankers Almanac*, various issues.

Transaction costs on financial markets: http://www.elkins-mcsherry.com/.

We used the sum of commissions, fees and market impact as well as commissions and fees alone.

Index of insider trading, index of sophistication of financial markets: World Competitiveness Report, 1996, 1998, 2000.

Each year, IMD conducts a survey to quantify issues related to competitiveness. The survey data is collected as follows. The IMD distributes questionnaires to top and middle managers (over 3500 executives) in 47 countries. For the 2000 survey, 3263 executives returned the questionnaires. Executives answer questions only about the country where they operate (hence the results reflect in-depth knowledge about each economy).

Note: for insiders and soph variables, we have data only for 1992–1996 and 1993–1996, respectively. Missing values are replaced by nearest figures. For example, for insiders, pre-1992 values are those observed for 1992.

Gross bilateral portfolio equity flows: Cross Border Capital, London 1998.

Foreign equity investment has three main conduits: (1) the purchase of a substantial share of the equity of a company, or the outright purchase of physical assets, such as plant, equipment, land or buildings. These transactions are deemed to be direct investments. They are differentiated from indirect, or portfolio, transactions. (2) The purchase or sale of an equity security on a stock exchange local to the issuing company for the benefit of a non-resident investor. In this instance, a UK fund manager's purchase of IBM stock in New York would be defined as a cross-border transaction. (3) The purchase or sale of a foreign equity on a stock exchange local to the investor. A UK fund manager's sale of IBM stock via SEAQ International in London would be recorded as a cross-exchange transaction.

Gross equity flows are the sum of all purchases and all sales of foreign equity.

Net equity investment is the difference between the purchases and the sales of foreign equity.

The data used in this paper are gross cross-border portfolio equity flows (cross-exchange transactions are small in the data). They are principally derived from three sources: national balance of payments statistics; official national stock exchange transactions; published evidence of international asset switches by major fund management groups. While these data sources complement one another and allow for cross-checks, there are limitations.

The threshold percentage distinguishing portfolio from direct varies from country to country but is around 20–30% in the data set. The data record transactions between domestic and foreign residents. It is the residence of the transactor that is recorded, rather than that of the final holder; thus if a British financial institution transacts with the US on behalf of a Hong Kong resident (say), the transaction is recorded as a US–UK flow. Moreover, once a UK security (say) is in the foreign domain and is being transferred between foreign investors, it no longer shows up in the UK balance of payments data (source: Cross-Border Capital, direct communication from Angela Cozzini).

Covariances of stock market returns: calculated taking the covariance over each year in the sample using monthly data on returns (covar_{ij}). This measure is therefore time-varying. We also took the covariance between monthly returns over the entire period 1989–1996 (so the variable is time-invariant for each country pair). Finally we also computed the covariances of monthly returns for the five years preceding date t; the covariances of the stock market return and consumption growth; and the covariances of real GDP growth rates. All covariances are computed in a common currency (Datastream).

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