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ABSTRACT

We apply a new approach to a new panel data set on bilateral gross cross-border equity flows between 14 countries, 1989-96. The remarkably good results have strong implications for theories of asset trade. We find that the geography of information heavily determines the pattern of international transactions.

Our model integrates elements of the finance literature on portfolio composition and the international macroeconomics and asset trade literature. Gross asset flows depend on market size in both source and destination country as well as trading costs, in which both information and the transaction technology play a role. The resulting augmented 'gravity' equation has equity market capitalisation representing market size and distance proxying some informational asymmetries, as well as a variable representing openness of each economy. But other variables explicitly represent information transmission (telephone call traffic and multinational bank branches), an information asymmetry between domestic and foreign investors (degree of insider trading), and the efficiency of transactions ('financial market sophistication').

This equation accounts for almost 70% of the variance of the transaction flows. Dummy variables (adjacency, language, currency or trade bloc, and a 'major financial centre' effect) do not improve the results, nor does a variable representing destination country stock market returns. The key role of informational asymmetries is confirmed. Our information transmission variables also substantially improve standard gravity equations for trade in goods.

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1. Introduction

There are very few well-established results on the determinants of trade in assets, especially securities. Such work has been impeded by data problems, and there is little theory behind it. The literature on portfolio investment focuses on portfolio choice and the determinants of returns.

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, 1989-96.

We provide new, clear-cut evidence on the determinants of these flows: we explain 70% of their variance with a parsimonious set of variables. Our results demonstrate that market size, openness, efficiency of transactions, and distance are the most important determinants of transaction flows. The very significant negative impact of distance on transactions is at first sight quite 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 many equities in distant countries whose business cycles have a low or negative correlation with their own country's cycle. If that were the case, distance could have potentially a positive effect on asset trade because of the diversification motive[1].

We show that distance is largely a proxy for information asymmetries: we use in particular telephone call traffic and multinational bank branches to account for information transmission, and an index of the degree of insider trading for information asymmetries between domestic and foreign investors. All these variables are highly significant[2]. In our

[1] 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. 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.

[2] It is also remarkable that our information transmission 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).

sample, the diversification motive is therefore completely dominated by the information effect. The geography of information appears central for the distribution of asset flows.

Our empirical results suggest that theoretical modelling of asset trade should embark on the same type of radical change that we have seen in the literature on goods trade: it should shift away partly from models based on factor endowments, comparative advantage and autarky prices[3] towards models including differentiated assets, transaction costs and information asymmetries.

The finance literature has emphasised information asymmetries much more than the asset trade literature, but it has largely focused on portfolio choice and asset pricing, rather than transaction volumes for trade in equities. Yet there are very interesting, important issues here.

First, understanding flows may tell us something about stocks, i.e. about the determinants of portfolio composition. On this issue, the effort to relate theory to the data has led to an impasse represented by the 'home bias puzzle' (Tesar and Werner, 1995; Lewis, 1998). We use 'home bias' in a very general sense, referring to the evidence that residents of a given country invest much less abroad than portfolio allocation models would appear to suggest as optimal diversification. There is continuing controversy over whether this home bias is due to transaction costs, including informational asymmetries. Our analysis and results throw some light on these questions.

Second, the equity portfolio flows that we study are a substantial component of the huge international capital flows that feature in 'globalisation'. These are at the centre of current macroeconomic policy concerns. A better understanding of their determinants may help us, for example, to interpret herding behaviour and contagion effects.

Third, financial market integration (e.g., in the euro area, as discussed in Portes-Rey 1998a, Martin-Rey 1999b) will have a wide range of consequences for asset trade. Improvements in our knowledge about a major dimension of this trade could help us to

[3] See Helpman and Razin (1978), Svensson (1988).

analyse how the various aspects of integration will affect international transactions in securities.

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 insights from the finance literature to a perspective based on international macroeconomics and trade. We sketch a simple model which leads to our basic estimating equation. In Section 3, we describe our data and discuss the evolution of the equity investment flows in a three-region aggregation. Section 4 examines the determinants of portfolio equity investment flows. A simple specification analogous to the gravity model for goods trade performs well for equity flows, but we can do much better by incorporating innovations suggested by the finance approach. Thus we develop the specification by using a new variable to represent market size and employing variables directly representing information flows and transaction efficiency. 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. Section 6 concludes.

2. The explanation of gross cross-border equity portfolio flows

There are two perspectives from which one can view the determinants of cross-border equity flows. The first comes out of the finance literature on portfolio composition, while the second arises from international macroeconomics and trade.

The finance viewpoint focuses on portfolio adjustment, information, and the relationship of flows to returns. It features the home bias puzzle and offers several insights but no clear conclusions, even regarding the appropriate theoretical framework for modelling flows.

The literature starts from theories and observations on portfolio stocks. Cooper and Kaplanis (1994) show that neither deviations from PPP nor the deadweight costs of foreign investing could be sufficient to explain the observed portfolio allocations. Tesar and Werner (1995) distinguish between 'fixed barriers' such as 'language, institutional and regulatory differences and the cost of obtaining information about foreign markets' (p. 479) and variable transaction costs. They argue that if the latter were important, we should observe foreign investors following 'buy-and-hold' strategies – but they observe that turnover on US residents' holdings of foreign equity is much higher than on their holdings of US equity. Since many of the 'fixed barriers' appear to be related to distance, they conclude that 'geographic proximity seems to be an important ingredient in the international portfolio allocation decision' (p. 485).

Gehrig (1993) and Kang and Stulz (1994) derive home bias from asymmetric information between domestic and foreign investors: the former are better informed about payoffs on their own market. Brennan and Cao (1997) move from stocks to flows, accepting this foreign-local asymmetry. They construct a model in which purchases of foreign equities are found to be an increasing function of the return on the foreign equity market index, if the foreign investors have a cumulative information disadvantage. 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.

This is an intuitively appealing story, but their empirical support for it is very weak. They find a preponderance of positive correlations between flows from the US to other countries and contemporaneous returns on the destination countries' equities, but (i) the significance levels are low; (ii) this result does not hold for foreign purchases of US equities; (iii) a positive correlation could be the result of an exogenous shift in US demand unrelated to new information; (iv) as they acknowledge, even when the coefficients were positive, they were not saying much – 'our model is able to explain only a small proportion of the variance of international equity portfolio flows' (p. 1876). 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[4]. This work further supports the hypothesis that foreign investors are less well informed than domestic investors.[5]

Froot *et al.* (1998) 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). They reject, however, the central Brennan-Cao contention that the covariance of returns and inflows is due to an informational disadvantage for international investors. They find a strong *regional* component in this relationship, and the remaining country-specific portion of flows is not significantly associated with returns.

Gehrig (1998) treats information in a specifically geographical context. He notes that 'pure equity…constitutes a security with high (maximal) informational complexity'. He then focuses on the role of financial centres in processing information and suggests that the intensity of that activity is related to the concentration of branches of multinational banks in such centres.[6] The role of bank branches as informational links has been suggested by Choi *et al.* (1986, 1996) and Jeger *et al.* (1992). Gehrig's model implies that 'in markets for information-sensitive assets, complex local information and straightforward public information could behave like complements, in which case incentives to form information networks are reinforced by technological improvements [that cut communication costs and thereby increase general public information].' (p.32) He concludes that 'face-to-face

[4] Tesar (1998) finds that an 'expected returns' variable performs well in explaining monthly data for US investors' net purchases of equities in 22 foreign countries.

[5] Kim and Wei (1999) study equity investors' trading behaviour before and during the Korean crisis of 1997-98. Their results on both positive feedback trading and herd behaviour support the view that non-resident investors are at an informational disadvantage. So do the results of Frankel and Schmukler (1996), who find that local residents 'led' non-residents in exit behaviour during the Mexican crisis of 1994-95.

[6] Brennan and Cao (1997) find the UK does not behave in accordance with their model and conjecture that 'the major US banking presence in London is what distinguishes the results for the UK…' (p. 1865).

communication within a financial centre and telecommunication are complements (p. 35).' He does not, however, relate this to transactions flows.

Hau (1999) explores informational asymmetries across the trader population. He finds that traders located outside Germany in non-German speaking financial centres but with similar market access show significantly lower proprietary trading profits. His results indicate "an important role for asymmetric information for the geographic distribution of market-making activity and possibly international portfolio management". He does not study trading volumes.

The very different viewpoint from the international economics literature starts from trade in goods. There are at least three ways to proceed. The first arises from the risk-sharing literature (summarised by Obstfeld and Rogoff, 1996), which implies that trade in equities will mirror trade in goods (equities of traded goods firms are traded in equilibrium but not those of firms in the non-traded sector)[7]. It has long been recognised, however, that the gravity model is a reliable and robust tool for explaining trade (e.g., Leamer and Levinsohn, 1995; Evenett and Keller, 1998). Thus the gravity model should explain equity trade *irrespective* of informational asymmetries on assets. Unfortunately, the theoretical result requires additively separable utility functions in traded and non-traded goods; moreover, we do in fact observe trade in equities of firms producing non-traded goods. So without refinements, this line of reasoning seems problematic.

An alternative argument for a gravity model of equity trade starts from the observed complementarity between trade and FDI flows. The latter are in turn related to portfolio equity flows (in part, simply in the data, where equity trade includes part of M&A). There is no theory here[8], but the argument is suggestive. Ghosh and Wolf (1998) make a case along these lines and also appeal to informational asymmetries that increase with distance. De Ménil (1999) finds that a gravity model accounts well for FDI flows among European countries.

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[7] The authors are grateful to Ken Rogoff for this point.
[8] Baldwin and Ottaviano (1999) propose a model in which FDI induces complementary trade flows.

A third route begins with Helpman's (1998) argument that product differentiation is the best rationale for the gravity model. By analogy, one could regard equities as highly differentiated products.

Martin and Rey (1999a) have analysed a model of asset trade from which a gravity equation emerges naturally. The two key elements that are required to generate such an equation are: 1) that assets are imperfect substitutes because they insure against different risks; 2) that cross-border asset trade entails some transaction or information costs. In their model, risk-averse agents develop different projects that correspond to different assets, which are traded on markets. Hence the number of assets is proportional to the number of agents in the country. Like Arrow-Debreu assets, each project/asset pays off in only one state of nature so that they are imperfect substitutes. The aggregate demand for country A assets from country B is then:

$T_{AB} = n_A n_B s_B^A p_A$

where n_A is the number of agents in country A and is therefore a measure of the number of different projects/assets developed and traded in this country. n_B is the number of agents of country B who demand assets of country A. s_B^A is the representative demand of an asset of A by an agent in B and p_A is the price of such an asset[9]. The demand of an asset of A by an agent of B (s_B^A) depends itself negatively on the transaction and information cost between A and B (τ_{AB}). For a given supply of the asset, higher transaction costs generate (through lower demand) a lower price of the asset. Higher aggregate demand from B (higher n_B) also implies (for a given supply of the asset) a higher asset price. Hence, the log of the asset flows from A to B can be written as:

$\text{Log } T_{AB} = \log(\text{constant}) + \log(n_A n_B) + \log(\tau_{AB})$.

Note that this equation is very similar to the standard gravity equations derived in the literature of international goods trade: the second term from the left is a product of a measure of the sizes of countries A and B, the third is the trading cost term (usually proxied by distance).

When going to the data, we interpret the trading cost both as an information cost and as an indicator of the efficiency of the transaction technology. We would expect information

[9] In their model, all assets of a given country have the same price because each state of nature is equiprobable and the dividend is identical across assets.

costs to be positively correlated with distance: the cost of travelling is higher for long distance, cultural differences may also be stronger, business links weaker. Hence we capture the informational dimension first by using distance, second by using explicit variables for information transmission (like telephone calls, number of bank branch subsidiaries) and variables measuring directly the degree of asymmetry between domestic and foreign investors (an index of insider trading). We find evidence that information sets have indeed a strong geographical component[10]. As far as the transaction technology is concerned, we have an index of sophistication of financial markets.

The model of Martin and Rey (1999a) suggests population or GDP as the size variable. GDP does perform acceptably in this role; population is normally used with it in the goods trade literature to represent 'openness'. In our preferred specification, however, we use a measure of size which is more directly related to financial markets: market capitalisation. Finally, we will experiment with various dummies (trading blocs, cultural blocs, main financial centres, country-specific dummies etc…) and cyclical variables (returns, growth rates, time dummies, etc…) to account for the time-series dimension of our data. But our preferred specification will turn out to be a very parsimonious one.

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

$$\text{Log}(T_{AB,t}) = \alpha_1 \log(\text{mcapA,t}) + \alpha_2 \log(\text{mcap}_{B,t}) + \alpha_3 \log(\text{distance}_{AB,t}) + \alpha_4 \text{ information variables} + \alpha_5 \text{ transaction technology variables} + \alpha_6 \text{ cyclical variables} + \epsilon_{AB,t}$$

[10] We document this (perhaps surprising) result further within Europe by analysing the geographical coverage of main European newspapers – see Section 4 – as suggested to us by Shan-Jin Wei.

3. Portfolio equity investment flows

Our equity transactions flow data come from Cross-Border Capital (London). There are eight years of the panel, 1989-96. 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 four 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 (country j) countries is identical. The cross-sectional dimension is the most important in our panel. These are transactions data: they record total activity (purchases and sales) by residents of country *i* (source) in the portfolio equity markets of country *j* (destination).

Western Hemisphere: United States, Canada (dummy variable: *wh*)
East Asia: Japan, Hong Kong, Singapore (dummy variable: *easia*)
EU Europe: UK, Germany, France, Netherlands, Spain, Italy, Scandinavia (dummy variable: *eu* for trade, *nonscan* for equity flows, because the Scandinavian countries were not subject to EU capital market integration measures before 1995)
Non-EU Europe: Switzerland
Australia

The share of these countries in global equity market capitalisation in 1996 was 86.6 per cent (Tesar, 1998). We also have data for trade flows of manufactures between the same countries. And we use several variables representing information flows and transactions costs:

telij = volume of telephone call traffic from country *i* to country *j* in each year (available annually, only for 1989-95)
banksij = number of branches in country *j* of banks headquartered in country *i* (available annually)
judeff = efficiency of the judicial system (from La Porta, *et al.*, 1997)
legal = effectiveness of the legal system in enforcing commercial contracts (*World Competitiveness Report,* 1997)
istr = absence of insider trading in stock markets (*World Competitiveness Report,* 1996)
soph = sophistication of financial markets (*World Competitiveness Report, 1996)*

Note that *judeff*, *legal*, *istr*, and *soph* are each available only for a single year in our sample and are therefore time-invariant in our regressions.

The equity investment and trade data exhibit a few striking features, which we discuss in more detail in a previous paper (Portes and Rey, 1998b):

- There is a sharp increase in international 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.

International trade flows increase more or less steadily but slowly for the period 1989-1996 between all the blocs, without exhibiting any particular idiosyncratic trend. But the pattern is very different for equity flows. Investment in equities from the US and EU15 into the other blocs increased much faster after 1991-92. Equity flows between EU15 and the US were almost three times bigger in 1996 than in 1992. This surge of cross-border equity flows may have resulted partly from the loosening of capital controls in the EU at the beginning of the 1990s. Portfolio equity investment of the Asian bloc remains quite stagnant over the period.

The EU15 invests heavily both in the US and in Asia (37% and 24% respectively of its total cross-border investments in equity). On the other hand, US investors provide 47% of the capital inflows due to EU15 equity sales, but Asian investors amount to only 7% of this total. Asian exports of manufactures to the US dwarf capital flows (in the form of equity purchases) from Asia to the US. For the US and EU15, however, equity flows tend to be bigger than trade flows.

Thus trade in goods and trade in equities differ both in geographical structure and in their evolution over time. Nevertheless, as we shall see, some factors may play similar roles in explaining both.

4. The determinants of portfolio equity investment flows

4.1. A baseline model

We now proceed to model equity flows empirically. We begin with a specification closely related to the estimating equation at the end of Section 2, which is similar to the gravity model for goods trade. The dependent variable *equityij* is the flow from country *i* (source investor) to country *j* (destination market). The estimates for the full panel are given in Table 1. Initially, we use GDP to represent market size. 'Openness' is represented here by population (we expect a negative coefficient). The overall OECD GDP growth rate represents cyclical conditions, and we include regional dummy variables (with a modified European Union dummy, *nonsc*, that omits the Scandinavian countries). All variables are in logs (except *growth* and the regional dummies), and the estimation procedure gives 'White-corrected' (heteroskedasticity-consistent) standard errors.

Both GDP variables and both country size variables enter with the expected signs and with generally well-determined coefficients. Distance is also appropriately negatively signed and is significant at the 5 per cent level. The cyclical variable and all three regional dummies are positively signed and estimated with reasonable precision. Overall, this straightforward, simple gravity regression is satisfactory and informative.

This is not merely useful, but also perhaps somewhat surprising. We would expect portfolio allocation to be influenced strongly by other variables that we have not included, like expectations of equity returns and the covariances of these returns. This is the first indication that the transactions flow data do not behave as one would expect portfolio stock data to behave.

The results in Table 1 have one peculiar feature: the 95% confidence intervals for the absolute values of the estimated coefficients on *gdpi* and *popi* overlap, and so (almost) do those for *gdpj* and *popj*. Since the coefficients are of opposite sign (and the variables are in logs), this suggests we could substitute per capita GDP for the separate GDP and population variables. But that would imply that the volume of cross-border equity transactions is independent of the size (either GDP or population) of source and destination countries, but rather varies only with per capita GDP and the other variables in the regression. This is not plausible, and we shall find it does not hold in the results below.

We do not initially introduce country-specific (or country-pair-specific) fixed effects, 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 (thus including regional bloc dummies and some of our information variables), because any such variable is spanned by the individual dummies representing the fixed effects.[11] Thus most of our estimation simply pools the time-series and cross-section data. We did, however, estimate a fixed-effects model without our time-invariant variables.

We ran this fixed-effects regression, with GDP, population, OECD GDP growth, and a returns variable. The results were very poor indeed. There was no need for a formal test to confirm that pooling was the correct approach.[12]

Although it is theoretically unjustified, for completeness we ran a random-effects estimation on our initial equation. We found that the coefficient estimates were very close indeed to those of Table 1, as well as the goodness-of-fit statistics. The panel estimation permitted us to distinguish between the relative roles of 'within' (time-series) and 'between' (cross-section) variation in 'explaining' equity flows, and the latter clearly dominated. We repeated this exercise for other specifications, with the same results.

We also do not use dummy variables representing geographical adjacency or common language (both used by Ghosh and Wolf, 1998). Adjacency is strongly collinear with the

[11] Nor is random effects panel estimation appropriate for our data, which are not drawn randomly from a larger population (on these points, see Baltagi, 1995).

[12] 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 subsamples. A standard Chow F-test of parameter stability fails because variances of the subsamples are not equal over years. And it is not possible to perform the Generalised 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).

regional bloc dummies in our sample; common language applies to only the US, Canada, the UK and Australia, and the Western Hemisphere dummy picks up US-Canada (as well as adjacency). We did nevertheless run regressions with language and adjacency dummies; there was no improvement, but it was satisfying that the coefficients on the market size, openness and distance variables were quite stable.

We then sought to allow both for a currency bloc effect and for what we call a 'major financial centre' effect. Frankel and Wei (1998) used a continuous variable for currency volatility within blocs. We proceeded differently, constructing a 'currency 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.). Inspection of the data and of residuals from the initial regression show that equity investment flows into and out of the US, UK and Japan are much higher than that initial regression would predict. This is hardly surprising. We represented this effect by constructing variables such as *usin*, which takes the value unity when the flow is purchase of US equities by any other country, zero otherwise, and *usout*, which takes the value unity for purchases by US investors in any other country, and zero otherwise.

Adding these two sets of variables to the initial specification eliminates the influence of the regional bloc dummy variables. We therefore dropped them and ran the equation which is shown in Table 2. The elasticity with respect to distance rises, to -0.71. The currency bloc variable enters positively and significantly, as do all the 'major financial centre' variables. The coefficient on the cyclical variable is virtually unchanged; those on the GDP and population variables move somewhat, but there is overlap between two-standard-error intervals around the initial set of results and these new coefficients. The overall goodness of fit of this equation rises dramatically too: from the initial $R^2 = 0.36$ (Table1) to $R^2 = 0.60$ (recall we have over 1400 degrees of freedom, with 182 cross-section observations for each of eight years). Inspection of the residuals shows that heteroskedasticity decreases as a consequence of introducing the financial centre dummies, and there is no apparent serial correlation.

We therefore use the model of Table 2 as our baseline for a move further away from the conventional gravity specification.

4.2. Market capitalisation as a measure of market size

Whereas GDP is doubtless the appropriate market size variable as a determinant of trade flows, equity market capitalisation is a more plausible determinant of investment flows.[10] We use beginning-of-period market capitalisation to avoid endogeneity[11].

Substituting market capitalisation for GDP noticeably improves the estimates. Not only does the overall goodness of fit improve going from Table 2 to Table 3, but also the dummy variables do much less of the work. Indeed, the currency bloc dummy variable disappears, and Table 3 therefore reports a regression that omits it. Moreover, one of the financial centre variables now appears with the 'wrong' sign. In fact, when we include explicit informational variables, as in the next sub-section, we discover that the coefficients on these financial centre dummies fall further in size and become very unstable (often taking negative signs) in individual annual cross-sections. We therefore drop them as well for the next stage. Note that the elasticity on distance here is higher even than in Table 2 (and substantially higher than is common in goods trade gravity equations).

4.3. Information flows and transactions costs

Broadly interpreted, trading costs may include both acquisition of information and the transactions technology. We have already proxied information with distance. Here we introduce three new explicit information variables. The first is *telij* (log of telephone call volume from country *i* to country *j* – we have observations only through 1995 for this variable). The second is a variable we constructed, *banksij*, that gives the number of branches in country *j* of banks headquartered in country *i*. The third is an index of 'the absence of insider trading in the stock market', *istrj* (this is relevant only for the

[10] Boyan Jovanovic suggested to us an alternative route to the use of destination market capitalisation to explain capital inflows, starting from the q-theory of investment.

[11] We also ran this equation and the extensions below instrumenting for the market capitalisation variables, with very little effect on their estimated coefficients. We used GDP and degree of sophistication of financial markets as instruments.

‘destination’ country) constructed from questionnaire data (*World Competitiveness Report*, 1996). We also include a variable representing the transactions technology, *soph*, an index of the ‘sophistication of financial markets’, again constructed from questionnaire data. The telephone call traffic and banks data are available annually; the insider trading and financial market sophistication variables are available only for one year in our sample.

We also at this stage introduce a new variable to represent ‘openness’. Population is not in principle a very satisfactory variable for this purpose, and now that we have taken GDP out of the estimating equation, we can without any complications use the ratio of total trade to GDP to measure a country’s overall openness to external transactions.

The results are reported in Table 4. They are not directly comparable with Table 3, because we have had to drop observations for 1996, and we substituted the new ‘openness’ variable. For comparison, however, running the regression of Table 3 for 1989-95 gives no significant change in any of the coefficients (in particular, the elasticity on distance, at –0.8298, and $R^2 = .6752$ are virtually identical). But the newly augmented equation is strikingly different.

The elasticity on source country market capitalisation falls somewhat, and that on destination country market capitalisation rises, but not significantly; the former is still considerably larger than the latter. The destination country ‘openness’ variable is now insignificant (and wrongly signed); this is equally true if we go back to using population rather than trade as a measure of openness in this specification. The coefficient on the cyclical variable rises, but not significantly.

Much more important is the fall by half in the size of the elasticity on distance – which was apparently representing quite a lot that is now seen to be the effects of the information and transactions technology variables. These are all remarkably successful: correctly signed and well determined. With no dummy variables, the equation still accounts for almost 70 per cent of the variance. It is particularly pleasing to find that the ‘ad hocery’ of dummy variables is superfluous.

This equation is quite robust. We ran it for annual cross-sections, where the R^2s ranged from 0.64 to 0.78, with a mean of 0.72 – exceptionally high for a cross-section regression with nine explanatory variables. We found here some evidence of substitutability between the distance variable and the telephone traffic and banks variables; the size and precision of the estimated coefficient on the former increase in the later years, while those of the latter fall, but both are consistently there with appropriate signs. Another indication of the substitute relationship between distance and telephone traffic came when we ran the equation of Table 4 for the full period 1989-96 without *telij*; despite the additional observations, there is very little difference in the estimated coefficients, except that the elasticity on distance (and on banks) is significantly larger. The changing roles of these variables might also be related to the overall surge in the volume of cross-border equity flows after 1992, noted in Section 3.

The interplay between distance and the telephone traffic and banks variables itself suggests that both represent information, but in somewhat different dimensions. For example, one interpretation might be that different classes of agents have different information sets. Telephone calls, for example, might represent the information gathering of the broad population and the cross-country networks associated with migration, cultural ties, past colonial relationships, etc; while 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). The argument is highly speculative, but the heterogeneity of information sets might leave room for several distinct 'information variables'.

We tried re-introducing the regional bloc effects. Two of the three are negative, and they do not change the estimated coefficients of other variables noticeably. The 'sophistication of financial markets' variable for the destination country is insignificant. We tried two different variables representing the effectiveness of the legal system. In our sample, however, the 'judicial efficiency' variable of La Porta *et al*. (1997) is negatively correlated with the 'effectiveness of the legal system in enforcing commercial contracts' index in the *World Competitiveness Report*. Perhaps it is not surprising, therefore, that when both are present, the former is insignificant and the latter takes a negative sign. When we include them individually, their coefficients are unstable and often wrongly signed in the annual cross-sections.

It has been argued that the most general form of a gravity model should include country dummy variables (for both source and destination) and time dummies (Matyas, 1997). Running the equation of Table 4 with all such dummies reduces the coefficients on market capitalisation, raises those on openness, and – most importantly – has little effect on those of distance, telephone call traffic, and banks.

Since our transactions data record the sum of purchases and sales of equities of country *j* by country *i*, we would expect that high volatility of the stock returns of countries *i* and *j* should increase asset flows, as investors have to readjust their portfolios more often. We find that the variance of the destination country stock index is indeed significant with the correct sign (positive); the variance of the source country stock index is not significant.

To compare our work with Brennan and Cao (1997), and others cited earlier, we also ran our regressions using gross purchases and gross sales of equities separately as dependant variables (instead of the sum of the two). It is further confirmation of our stress on the transactions dimension of our data that all our results so far are unaffected: estimated coefficients are well within the confidence intervals found in the aggregate equation, although not surprisingly they are in general somewhat less well determined. It might be thought appropriate, taking purchases and sales separately, to allow also for investors' expectations by including a variable measuring the percentage increase in the destination country's stock price index during the year (both contemporaneous and lagged). This variable appeared in the equation for purchases with a coefficient that was positive and marginally significant but of very small absolute value; it was not significant in the equation for sales.

We also tried net flows as the dependent variable on the market returns variable alone and in variants of our preferred specification; the only significant explanatory variables were market capitalisation, and they pick up less than 15% of the variance. The lack of success with the returns variable, in contrast to Brennan and Cao (1997), Brennan and Aranda (1999), and Froot *et al.* (1998), may simply be a consequence of using data of different frequency – the effect may show up in quarterly or daily data, but not in the annual data we use.

We also ran our preferred regressions on the European subsample of our panel. All our results were still valid, in particular regarding the roles of the distance and information variables. Even within Europe, therefore, the information sets of the various countries appear quite different. 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)[12]. We used FT Profile to search for keywords like France, French, etc… in the headlines of all these newspapers. Table 7 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[13].

5. Information and the gravity model for manufactures trade flows

For comparison with the equity flows, we also estimate gravity equations for trade flows (manufactures) over the same period. 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), population of both countries ('openness'), distance, the OECD GDP growth rate, and dummy variables for Western Hemisphere, European Union, and East Asia. Again, the specification is log-linear, and the estimation procedure gives 'White-corrected' (heteroskedasticity-consistent) standard errors.

[12] The choice of countries considered and periods has been dictated by data availability.
[13] These results are illustrative rather than claiming to be general.

The results for the full panel are shown in Table 5. We see that the market size (*gdpi, gdpj*) and openness (*popi, popj*) variables perform as expected, except for the population variable proxying openness of the destination country, which appears with the wrong sign, but a relatively small coefficient with only marginal significance. Trade varies positively with the cycle (*growth*), as expected, and also with the regional dummies (*wh, eu, easia*), although the EU dummy is insignificant. As for equity flows, the effects of EU membership may be picked up partly by the distance variable, since in our sample of countries, the EU members form a geographically contiguous bloc.

Note that the elasticity on the source country market size variable is substantially greater than one (and greater than that for the destination country). This is a common 'home market effect' in equations for trade in goods (large countries have high demand, more producers, produce to avoid transport costs, and export the surplus – see Feenstra, Markusen and Rose, 1998). Our estimates for equity flows exhibited a similar feature (the coefficient on *mcapi* always exceeds that on *mcapj*), but there was no particular rationale for this effect on the equity flows.

Frankel and Wei (1998) estimate a gravity model of trade, including both regional and currency bloc variables. They find strong evidence of the importance of trading blocs and weak effects for currency blocs. The coefficients they obtain for distance in their trade regressions are very close to our own. Indeed, Leamer and Levinsohn (1995) cite a 'consensus elasticity' of –0.6; our point estimate of –0.54 in Table 3 is one standard deviation away from this.

The picture changes dramatically, however, when we include explicit information variables alongside distance in the trade flow 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 Table 6. The information variables do indeed enter with sizeable, very well-determined coefficients; the proportion of the variance explained rises substantially; and, perhaps most interestingly, the coefficient on distance falls sharply.[14]

[14] Table 6 excludes 1996, because *telij* was not available to us for that year. For a direct comparison, we ran the regression of Table 5 for 1989-95 only. It was in all respects very close to that of Table 5: in particular, the elasticity with respect to distance was –0.56 (se = 0.05), with $R^2 = 0.71$.

The elasticity is now only –0.20! 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.[15,16]

[15] 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 (1996) presents 'evidence that supports the view that proximity and common language/colonial ties are more important for differentiated products than for products traded on organized exchanges in matching international buyers and sellers, and that search barriers to trade are higher for differentiated than for homogeneous products'.

[16] If in turn we use trade flows as one of the explanatory variables for equity flows, it enters significantly and positively. Not surprisingly, it reduces the coefficients on distance, telephone calls, and banks, but it does not drive out any of them. Thus trade flows may incorporate (or be influenced by) some of the information flows that appear to explain equity flows, but there may still be common influences on both that we have not yet succeeded in modelling explicitly.

6. Conclusion

We apply a new approach to a new panel data set on bilateral gross cross-border equity flows between 14 countries, 1989-96. The results are remarkably good and have strong implications for theories of asset trade.

We integrate elements from the finance literature on portfolio composition and the international macroeconomics and asset trade literature. Theory suggests that gross asset flows should depend on market size in both source and destination country as well as trading costs, in which both information and the transaction technology play a role. The resulting estimating equation, with equity market capitalisation representing market size and distance proxying some informational asymmetries, as well as a variable representing openness of each economy, is similar to the gravity model of goods trade. But we also include variables that explicitly represent information transmission (telephone call traffic and multinational bank branches), an information asymmetry between domestic and foreign investors (degree of insider trading in the stock market), and the efficiency of transactions (an index of financial market sophistication).

This equation accounts for almost 70% of the variance of the transaction flows, much more than in any previous work. Various dummy variables (adjacency, language, currency or trade bloc, and a ‘major financial centre’ effect) do not improve the results, nor does a variable representing destination country stock market returns. The key role of informational asymmetries appears to be confirmed. We also find that our information transmission variables substantially improve standard gravity equations for trade in goods: the importance of information asymmetries has been considerably underestimated in the empirical trade literature.

With almost 1500 observations on bilateral cross-border equity flows, we conjecture that these results are likely to be qualitatively robust. The various dummy variables we tried turned out to be unstable. But market size and cyclical conditions seem secure. The time-varying information variables are strong and robust. And the effect of distance on cross-country transaction flows remains strong, even in the presence of explicit information variables.

These results also seem to have considerable implications for the ‘home bias’ literature. Tesar and Werner (1995), studying securities transactions flows across five of the G7 countries (all in our sample), conclude that geographical proximity, trade linkages and language seemed to matter more than portfolio diversification motives. Lewis (1998) discusses another aspect of the home bias puzzle, ‘consumption home bias’. Related to this is the finding of Lane (1999) that ‘positive gross international investment positions are not associated with income smoothing at business-cycle frequencies’, which also leads him to remark that ‘international investment decisions are heavily influenced by factors other than risk/return and smoothing considerations’. Our empirical work is rather strong evidence that there is a very important geographical component in international asset flows. Countries have different information sets, which heavily influence their international transactions.

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Data Sources and definitions

Bilateral trade in manufactures: OECD Bilateral Trade Data Base

Trade between blocs: IMF, Direction of Trade Statistics

Bilateral equity investment flows: Cross Border Capital

Distance, adjacency, language: www.ksg.harvard.edu/people/sjwei/

GDP, population, GDP growth rates: *International Financial Statistics* (IMF) and OECD

Equity price indices: IMF, *International Financial Statistics;* www.yardeni.com

Telephone call traffic: *Direction of traffic – Trends in international Telephone Tariffs 1996*, International Telecommunications Union

Equity market capitalisation: Datastream

Bank branches: *Bankers Almanac*

Foreign equity investment has three main conduits: (1) The purchase of a substantial share of the equity of a company (normally taken to be 30%), 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. A distinction is made between the value of foreign equity trading (gross flows) and the value of new money flows (net flows) into foreign equities.

· 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 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% generally. The data are national balance of payments statistics, recording transactions between (for example) UK residents and overseas securities, or UK securities and overseas residents. That means a transfer of a UK equity held by a UK resident to a German resident, not the transfer of any foreign equity held by a UK resident to a German resident. Thus they do not include transactions between a German resident and US resident in a UK security. Likewise the German BoP statistics show the transfer of domestic equity held by a German resident to a US resident and not the transfer of any foreign equity held by a German resident to a US resident. Once the UK security is in the foreign domain and being transferred between foreign investors it will no longer show up in the BoP statistics.

(Source: Cross-Border Capital, direct communication from Angela Cozzini)

Table 1 – Bilateral equity flows 1989-96

equityij	coefficient	standard error	P > |t|
gdpi	2.219	0.202	0.000
gdpj	1.355	0.190	0.000
popi	-1.711	0.208	0.000
popj	-0.558	0.199	0.005
distij	-0.198	0.095	0.037
growth	0.429	0.074	0.000
wh	2.451	0.238	0.000
nonsc	0.653	0.262	0.013
easia	2.851	0.240	0.000

N = 1456
$R^2 = 0.3648$
$F(9, 1446) = 201.90$

All variables except growth and the dummy variables are measured in logs.
Standard errors are 'White-corrected' (heteroskedasticity-consistent).

Table 2 – Bilateral equity flows with currency bloc and 'major financial centre' effects 1989-96

equityij	coefficient	standard error	P > |t|
gdpi	2.316	0.186	0.000
gdpj	0.683	0.177	0.000
popi	-2.652	0.176	0.000
popj	-0.635	0.172	0.000
distij	-0.711	0.047	0.000
growth	0.405	0.060	0.000
currency	0.517	0.136	0.000
ukin	1.965	0.167	0.000
ukout	3.765	0.143	0.000
usin	3.930	0.193	0.000
usout	4.882	0.189	0.000
jin	2.725	0.240	0.000
jout	1.514	0.225	0.000

N = 1456
$R^2 = 0.6043$
F (13, 1442) = 259.40

All variables except growth and the dummy variables are measured in logs.
Standard errors are 'White-corrected' (heteroskedasticity-consistent).

Table 3 – Bilateral equity flows with market capitalisation and 'major financial centre' variables 1989-96

equityij	coefficient	standard error	P > |t|
mcapi	1.368	0.082	0.000
mcapj	0.647	0.074	0.000
popi	-0.778	0.052	0.000
popj	-0.152	0.053	0.004
distij	-0.845	0.039	0.000
growth	0.337	0.055	0.000
usout	1.982	0.264	0.000
usin	2.500	0.261	0.000
ukout	1.252	0.166	0.000
ukin	0.785	0.189	0.000
jout	-0.794	0.268	0.003
jin	1.461	0.268	0.000

N = 1456
$R^2 = 0.6762$
$F(12, 1443) = 347.34$

All variables except growth and the dummy variables are measured in logs.
Standard errors are 'White-corrected' (heteroskedasticity-consistent).

Table 4 – Bilateral equity flows 1989-95

equityij	coefficient	standard error	P > |t|
mcapi	1.020	0.048	0.000
mcapj	0.714	0.056	0.000
tgdpi	0.655	0.082	0.000
tgdpj	-0.052	0.076	0.491
distij	-0.440	0.049	0.000
telij	0.408	0.058	0.000
banksij	0.208	0.056	0.000
sophi	2.936	0.294	0.000
insidersj	1.940	0.332	0.000
growth	0.493	0.056	0.000

N = 1250
$R^2 = 0.6874$
F (10,1239) = 345.46

All variables except growth are measured in logs.
Standard errors are 'White-corrected' (heteroskedasticity-consistent).

Table 5 – Bilateral manufactures trade flows 1989-96

tradeij	coefficient	standard error	P > |t|
gdpi	1.039	0.076	0.000
gdpj	0.328	0.079	0.000
popi	-0.502	0.079	0.000
popj	0.159	0.084	0.058
distij	-0.544	0.047	0.000
growth	0.0520	0.027	0.055
wh	1.469	0.124	0.000
eu	0.028	0.113	0.800
easia	1.486	0.113	0.000

N = 1456
R^2 = 0.7111
F (9, 1446) = 549.94

All variables except growth and the dummy variables are measured in logs.
Standard errors are 'White-corrected' (heteroskedasticity-consistent).

Table 6 – Bilateral manufactures trade flows with information variables 1989-95

tradeij	coefficient	standard error	P > |t|
gdpi	0.995	0.076	0.000
gdpj	0.218	0.081	0.007
popi	-0.682	0.081	0.000
popj	0.132	0.090	0.141
distij	-0.195	0.055	0.000
telij	0.252	0.024	0.000
banksij	0.221	0.026	0.000
growth	0.108	0.027	0.000
wh	1.243	0.112	0.000
eu	0.486	0.116	0.000
easia	1.221	0.098	0.000

N = 1250
R^2 = 0.7713
F (11, 1238) = 565.5

All variables except growth and the dummy variables are measured in logs.
Standard errors are 'White-corrected' (heteroskedasticity-consistent).

Table 7 - National Information Sets

Geographical coverage of *Le Monde, The Guardian, Frankfurter Allgemeine Zeitung, La Stampa* (1996-1998)

Le Monde	UK	France	Germany	Nether.	Switz.	Spain	Italy	Scand.
%	17		27	8	7	15	17	9
The Guardian	UK	France	Germany	Nether.	Switz.	Spain	Italy	Scand.
%		46	15	6	5	9	13	6
Frankfurter	UK	France	Germany	Nether.	Switz.	Spain	Italy	Scand.
%	17	29		5	12	13	15	9
La Stampa	UK	France	Germany	Nether.	Switz.	Spain	Italy	Scand.
%	22	30	22	4	6	11		5

Geographical coverage of the *Financial Times, Les Echos* and *Il Sole 24 Ore* (1993-1998)

Fin. Times	UK	France	Germany	Nether.	Switz.	Spain	Italy	Scand.
%		30	25	7	6	9	12	11
Les Echos	UK	France	Germany	Nether.	Switz.	Spain	Italy	Scand.
%	29		29	5	6	10	13	7
Il Sole 24 Ore	UK	France	Germany	Nether.	Switz.	Spain	Italy	Scand.
%	22	31	27	3	6	7		4