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## INFORMATION DIFFUSION IN INTERNATIONAL MARKETS

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## Abstract\*

Specific information on trade and financial markets across international borders is costly to acquire. Sellers and buyers rely instead on information obtained from partner behavior in other countries. Three channels are identified through which information is disseminated in import and equity markets of 14 OECD countries. The first consists of information spillovers from commercial to financial markets and vice-versa. We find strong evidence in support of the first direction and some for the reverse, suggesting that traders use common information, frequently from the same sources, such as financial intermediaries. The second and third channels emphasize seller and buyer reputation in third markets. They are equally important in explaining bilateral import flows, but buyer reputation appears to be more relevant for equity flows. All three channels may help better explain contagion effects across markets and countries.

*JEL classification codes:* F10, F30, L15

*Keywords:* Trade, Equity flows, Information spillovers

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# 1 Introduction

Globalization has been a persistent phenomenon of the post-war period. The gross volume of cross-border capital flows has grown at an average of 25 percent per year, and trade in goods and services has also increased, albeit not as dramatically, but at least twice as fast as world GDP, over the past 20 years. The most common explanation lies in the dramatic declines in communication and transport costs.<sup>1</sup>

On the other hand, a growing literature has argued that this globalization process may not be as important as is commonly perceived. Trade and financial markets still experience an impressive “home bias” in the sense that consumers and investors continue to prefer to spend and hold a disproportionate share of their assets in local markets. McCallum (1995) finds that trade among Canadian provinces is 22 times larger than trade between Canadian provinces and states in the United States, in spite of the absence of significant trade barriers between these two countries.<sup>2</sup> In the same vein, Trefler (1995) finds that a large share of “missing trade”—the fact that one observes a much smaller volume of trade than predicted by a factor abundance model—can be explained by a bias in preferences towards “home” goods. Similarly, Tesar and Warner (1998) observed that more than 90 percent of American and Japanese equity wealth is held at home. For Obstfeld and Rogoff (2000), this “home bias” reflects the persistence of (moderate) trade costs as they point out the continuous success of the simple gravity approach in explaining trade and investment flows between countries.<sup>3</sup>

More generally, the relative importance of information costs on trade and financial flows has been emphasized in several recent studies.<sup>4</sup> Rangan and Lawrance (1999) suggest that firms, in pursuing cross-border economic opportunities, engage in a double process of identifying potential exchange partners, and of assessing their reliability and creditworthiness. Both search

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<sup>1</sup> For example, air-shipping prices have fallen by 55 percent since 1980 in the United States (World Bank, 2001). Similarly, maritime shipping prices have declined by 45 percent since 1985. The cost of a 3-minute telephone call between New York and London went down 99 percent between 1970 and 1997, and the cost of information processing by a computer per instruction per second has declined more than 99.99 percent since 1980 (World Bank, 1998).

<sup>2</sup> An extensive literature has followed to try to explain this high number, and although the latest estimates by Anderson and van Wincoop (2001) reduced this number to 6, the figure still exhibits an impressive amount of home bias.

<sup>3</sup> There are probably too many trade theories behind the gravity equation (Deardorff, 1998), but as suggested by Evenett and Keller (2001), these explain different types of trade patterns across countries.

<sup>4</sup> Grossman (1998) avers “that we need models where distance (and common policy, and common language, and common culture) play more of a role. I suspect this is a model with imperfect information, where familiarity declines rapidly with distance...”

and deliberation are information-intensive processes that are likely to be more important in international than domestic transactions. Rauch (1999) shows that proximity and common language explain more trade in differentiated products than in homogenous products because search costs are larger. Evans (2000) establishes that the home bias identified by McCallum (1995) for Canada-US trade is more important for differentiated than for homogeneous goods, emphasizing the role played by information asymmetries. In a similar vein, Rauch and Trindade (1999) explain the variations in China's bilateral trade by the role of Chinese ethnic networks, which reduce information costs. Portes and Rey (1999) find that the importance of distance as a determinant of bilateral trade and equity flows is reduced by more than half when information flows among countries are accounted for by bilateral phone calls and the number of foreign subsidiaries established in the recipient country. Lastly, Nicita and Olarreaga (2000) find that the role of information goes beyond bilateral partners, as importers may also refer to the performance of exporters in third markets to determine their worthiness.

The objective of this paper is to explore three potential channels through which cross-country information spillovers can influence bilateral trade and equity flows. Although the role of information has been emphasized in the recent literature, little attention has been given to the channels through which information is diffused across traders and markets. The first channel consists of information spillovers between cross-border flows of equity and goods. Since getting information about a specific country is costly, once the decision has been made to overcome these costs and acquire information, it may be rational to invest in different types of flows simultaneously. This can best be illustrated by considering the role of banks or financial intermediaries, who will acquire information, and then finance trade, equity, and FDI transactions as well as inform their clients about possibilities for investment and trade projects in the country. The concentration of financial (e.g., FDI) and commercial flows in a relatively small number of large multinationals also suggests information sharing among decision-makers within these companies. Foreign affiliates of multinationals account simultaneously for more than one fifth of world exports and for an important share of FDI worldwide; the 100 largest Transnational Companies accounted for about 12 percent of total foreign assets in 2000 (UNCTAD, 2001). Thus, the concentration of information in a few agents in international markets suggests that equity investors are able to capture basic information from existing

bilateral commercial flows, and vice-versa, leading to a strong link between these two types of flows.<sup>5</sup>

The second channel examines to what extent importers and equity investors base their purchasing decisions on the performance of the sellers in other countries. We call this the *seller-reputation* effect. Importers in the United States who are considering buying products from Italy may want to learn from the experience of Canadian or Japanese importers that buy Italian products (for example, do Italian exporters deliver on time?). Similarly, when Swiss investors consider investing in France they may be influenced by the experience of other foreign investors (e.g., German or Japanese) in France. In addition, Swiss investors and American importers will pay more attention to investors and importers who are “closer” to them in an information sense (i.e., those with whom they exchange a significant amount of information).

Finally, the third channel is the *buyer-reputation* effect. Exporters may search for information on the experience of other country exporters with an importer (for example, does the importer pay on time?). Similarly, before selling equity to a foreign investor the seller may seek information on the reliability of the foreign buyer by assessing his reputation in other countries. For international traders, access to the judiciary system may be very costly and the understanding of the legal system more difficult, suggesting that the buyer and seller reputation potentially plays a larger role for international than for national transactions.

We explore the potential role of these information channels as determinants of cross-border flows in a panel of 14 countries (and 182 bilateral relationships for each cross-border flow) over a period of 7 years. After correcting for different endogeneity biases, and observing a strong autocorrelation of the error term, we develop a simple, new methodology to estimate a gravity model with panel data in the presence of serial correlation in the error term. The results suggest, first, that bilateral imports are an important determinant of bilateral equity outflows, but the reverse is less true, suggesting that investors partially base their actions on observed trade flows, whereas importers do not seem to rely as much on information provided by investors abroad. This finding may also indicate that information that leads to decisions regarding purchases of goods may also lead to decisions regarding ownership of firms that produce those

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<sup>5</sup> More generally, the empirical interdependence between the current and capital accounts as well as the different elements of the capital accounts has been well demonstrated by several authors (see Claessens and Dooley, 1995, or Edwards, 1998).

goods. Second, there is strong evidence of *buyer-* and *seller-reputation* effects in international goods markets. Third, in equity markets there is strong evidence of *buyer-reputation* effects, whereas there is little evidence of *seller-reputation* effects.

Although some information channels seem more important than others, the information-content of cross-border flows appears to be an important determinant of bilateral imports and equity outflows. We believe that this finding provides some insights into recent episodes of contagion in financial and commercial markets across countries over the past few years (see Carmazza, Ricci, and Salgado, 2000 and Van Rijckeghem and Weder, 2001). Information flows not only from one country to another through seller and buyer reputation channels, but also across commercial and equity markets when investors are using the same sources of information. All these channels may represent avenues for contagion. These results are compatible with explanations where contagion is more likely when investors cannot distinguish between different types of shocks (say, quality and productivity shocks),<sup>6</sup> or in environments where there are fixed costs in gathering country-specific information (as in Calvo and Mendoza, 2000). It is clear that information diffusion across markets can create virtuous or vicious circles. In this paper we identify channels through which information flows across countries and markets.

The remainder of the paper is organized as follows. Section 2 develops a simple model to explain the role of the information content of rest-of-the world cross-border flows in determining bilateral trade flows. Section 3 presents the empirical methodology, and Section 4 presents the results. Section 5 concludes.

## 2 A Simple Model

The model developed here is a simple extension of the probability model proposed by Leamer and Stern (1970), where cross-border flows are viewed as being generated by a large number of independent transactions. World trade and equity flows are respectively defined as  $M = \sum_i m_i$  and  $E = \sum_i e_i$ , where  $m_i$  are total imports of country  $i$  and  $e_i$  are total equity outflows of country  $i$ . Shares of country  $i$  in total world trade and equity flows are then defined as  $s_i^m = m_i/M$  and  $s_i^e = e_i/E$ .

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<sup>6</sup> See Calvo (1999) for an example with a similar argument for bond flows.



The probability that buyers and sellers of products and equities across international borders agree on a particular transaction will depend on transaction costs among countries. Transaction costs are a function of geographic distance among countries, language, cultural differences and, more importantly, the extent to which information flows among countries. Information on potential buyers' and sellers' reliability will tend to reduce transaction costs. This information could be obtained from other countries. For example, transaction costs between buyers in country  $i$  and sellers in country  $j$  will depend on the extent that information on  $j$ 's seller performance with other countries is provided to buyers in country  $i$ , and vice versa.

Another source of reduction in transaction costs, between an importer in  $i$  and an exporter in  $j$ , is the information revealed by existing cross-border equity flows between  $i$  and  $j$ . Similarly, the existence of trade flows between  $i$  and  $j$  may reveal information for cross-border investors in  $i$  and  $j$ . These information flows could even be internal to the firm, as argued earlier.

Summarizing all the determinants of transaction costs described above, the transaction costs for flow  $f$  ( $f = m, e$ ) are given by  $C^f = c^f(d_{i,j}; \Omega_{i,j}; \Omega_i^{k \rightarrow j}; \Omega_j^{k \rightarrow i}; f_{i,j}^{\neq f})$ ; where  $d_{i,j}$  is the distance between countries  $i$  and  $j$ ;  $\Omega_{i,j}$  is the bilateral information flow between countries  $i$  and  $j$ ;  $\Omega_i^{k \rightarrow j}$  is the information that country  $i$  obtains from other countries ( $k$ ) on the performance of  $j$ ;  $\Omega_j^{k \rightarrow i}$  is the information that country  $j$  obtains from other countries ( $k$ ) on the performance of  $i$ ; and  $f_{i,j}^{\neq f}$  is the other flow (equity or trade) between  $i$  and  $j$ . The three last variables capture the three channels described in the introduction: seller reputation,  $\Omega_i^{k \rightarrow j}$ , buyer reputation,  $\Omega_j^{k \rightarrow i}$ , and information spillovers between equity and import flows,  $f_{i,j}^{\neq f}$ .

Assuming that the matching of buyers and sellers is independently drawn from the pool of potential cross-border flows in the world, and that the probability of their agreeing on a particular transaction,  $\pi$ , depends on the extent of transaction costs, then the probability that one will observe a flow  $f$  ( $f = m, e$ ) between countries  $i$  and  $j$  is given by:

$$p_{i,j}^f = s_i^f s_j^f \pi_{i,j}^f = s_i^f s_j^f c^f \left( d_{i,j}; \Omega_{i,j}; \Omega_i^{k \rightarrow j}; \Omega_j^{k \rightarrow i}; f_{i,j}^{\neq f} \right) \quad (1)$$

The expected value of country  $i$  purchasing equity or goods (imports) from country  $j$  is then given by:

$$\begin{aligned}
e_{i,j} &= E p_{i,j}^e = \frac{e_i e_j}{E} c^e \left( d_{i,j}; \Omega_{i,j}; \Omega_i^{k \rightarrow j}; \Omega_j^{k \rightarrow i}; m_{i,j} \right) \\
m_{i,j} &= M p_{i,j}^m = \frac{m_i m_j}{M} c^m \left( d_{i,j}; \Omega_{i,j}; \Omega_i^{k \rightarrow j}; \Omega_j^{k \rightarrow i}; e_{i,j} \right)
\end{aligned} \tag{2}$$

Assuming that transaction costs functions are log-linear and that total flows from a particular country depend log-linearly on the size (GDP) and level of development (GDP per capita, noted  $y/\ell$ ) of the country, the expressions in equation (2) can be rewritten as information-augmented gravity equations:

$$\begin{aligned}
\log(e_{i,j}) &= -\log(E) + \beta_1 \log(y_i) + \beta_2 \log(y_j) + \beta_3 \log(\ell_i) + \beta_4 \log(\ell_j) + \\
&\quad \beta_5 \log(d_{i,j}) + \beta_7 \log(\Omega_{i,j}) + \beta_8 \log(\Omega_i^{k \rightarrow j}) + \beta_9 \log(\Omega_j^{k \rightarrow i}) + \beta_{10} \log(m_{i,j}) \\
\log(m_{i,j}) &= -\log(M) + \lambda_1 \log(y_i) + \lambda_2 \log(y_j) + \lambda_3 \log(\ell_i) + \lambda_4 \log(\ell_j) + \lambda_5 \log(d_{i,j}) + \\
&\quad \lambda_7 \log(\Omega_{i,j}) + \lambda_8 \log(\Omega_i^{k \rightarrow j}) + \lambda_9 \log(\Omega_j^{k \rightarrow i}) + \lambda_{10} \log(e_{i,j})
\end{aligned} \tag{3}$$

We will base the empirical analysis on a stochastic version of the expressions in equation (3). All parameters are expected to be positive except for  $\beta_3, \beta_4, \lambda_3, \lambda_4$ , which capture the impact of GDP per capita (through population) on import and equity flows, and  $\beta_5$  and  $\lambda_5$ , which capture the impact of geographic distance on the transaction cost between two trading partners. Parameters with subscripts 7 to 10 capture the information content of cross-border flows. Common language, which is also a determinant of transaction costs, will be introduced as a dummy variable in both equations.

### 3 Empirical Strategy

We apply the model to a sample of 14 developed countries from 1990 to 1996.<sup>7</sup> Although this sample may appear limited at first glance, it is useful to recall that, in 1996, these 14 countries represented more than 86 percent of global equity capitalization, about 97 percent of equity

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<sup>7</sup> These are Australia, Canada, France, Germany, Hong Kong, Italy, Japan, Netherlands, Scandinavia (Sweden, Norway, Finland), Singapore, Spain, Switzerland, United Kingdom and United States.

flows, 74 percent of world GDP, and 65 percent of world trade.<sup>8</sup> The absence of developing countries is explained by the non-availability of data on bilateral equity flows.<sup>9</sup>

As in Portes and Rey (1999), data on bilateral equity flows was obtained from Cross-Border Capital. Bilateral equity outflows ( $e_{i,j}$ ) are measured as equity purchases of residents of country  $i$  in the equity markets of country  $j$ .<sup>10</sup> Bilateral imports ( $m_{i,j}$ ) only include trade in goods (from United Nations' Comtrade database) because figures on bilateral service trade are not as accurate. GDP ( $y$ ) and population ( $\ell$ ) data are from the World Development Indicators of the World Bank. Bilateral distance ( $d_{i,j}$ ) was calculated as the geographic distance between capitals.

To proxy for bilateral information flows ( $\Omega_{i,j}$ ) across countries, we followed Portes and Rey (1999) and used the volume of telephone call traffic from country  $i$  to country  $j$  provided by the International Telecommunication Union (ITU). We also used an alternative proxy defined as the bilateral trade in newspapers and periodicals<sup>11</sup> because data on bilateral phone calls by ITU has several missing values for our sample of countries. Moreover, by using the newspaper data, we are able to distinguish between imports and exports of newspapers and so identify the direction of the information flow. Such a distinction was not possible with the data on bilateral phone calls, given that it is difficult *a priori* to know in which direction the information flows in a telephone conversation.<sup>12</sup> These two proxies are, however, highly correlated, as shown in Figure 1 (the correlation coefficient is 0.77 and significant at the 1 percent level).<sup>13</sup>

Next, we measure the two information channels that have been emphasized in this paper: seller and buyer reputation, for both imports and equities, as follows (for  $f = e, m$ ):

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<sup>8</sup> Sources are Tesar (1998) for capitalization figures, World Development Indicators for trade and GDP figures, and IMF's International Financial Statistics for equity flows.

<sup>9</sup> We also attempted to introduce Foreign Direct Investment outflows in our model, but the results of the FDI equation were very poor, probably due to the quality of the data (the OECD International Foreign Direct Investment statistics only report "net" outflows). Also, the usual criteria (i.e., more than 10 percent equity investment to be classified as FDI) is not clear-cut, and both flows are frequently confused, especially in the cases of mergers or privatization (see Graham and Krugman, 1995, for a few examples).

<sup>10</sup> Unlike Portes and Rey (1999), we only include purchases and exclude sales to capture gross rather than "net" equity outflows.

<sup>11</sup> See Nicita and Olarreaga (2000).

<sup>12</sup> Note that the data has information on who called, but this may be completely orthogonal to the direction of the information flow.

<sup>13</sup> In the late 1990s a better proxy for bilateral information flows could be Internet traffic. However, information on bilateral Internet traffic is not available to our knowledge. Given that our sample ends in 1996, newspaper and phone-call traffic seem relatively good proxies.

$$\begin{aligned}
\Omega_j^{k \rightarrow i} &= \sum_k \frac{\Omega_{i,k}}{\Omega_i^T} m_{k,j} & \text{and} & & \Omega_i^{k \rightarrow j} &= \sum_k \frac{\Omega_{j,k}}{\Omega_j^T} m_{i,k} \\
\Omega_j^{k \rightarrow i} &= \sum_k \frac{\Omega_{i,k}}{\Omega_i^T} e_{k,j} & \text{and} & & \Omega_i^{k \rightarrow j} &= \sum_k \frac{\Omega_{j,k}}{\Omega_j^T} e_{i,k}
\end{aligned} \tag{4}$$

where  $\Omega_j^T$  is the total volume of international phone calls of country  $j$ . Alternatively, when we use exports of newspapers,  $\Omega_j^T$  is defined as the rest of the world's exports of newspapers to country  $j$ .

The first two equations capture the seller and buyer reputation channels for imports, while the last two do so for equities. It might be useful to recall the assumptions behind the construction of these information variables. The seller reputation channel captures the idea, for example, that a German importer assesses the reputation of a US exporting firm by accounting for the willingness of other buyers to purchase the US firm's exports. Furthermore, he incorporates the behavior of other investors into his own decision proportionally to the flow of information that he will receive from them. Specifically, in the case of country  $i$  imports from country  $j$ , the seller-reputation channel  $\Omega_i^{k \rightarrow j}$  is defined as the weighted-sum of all country  $k$  imports from country  $j$  weighted by the share of information exchanged between country  $i$  and each country  $k$  which has imported from country  $j$ .<sup>14</sup> The buyer-reputation channel  $\Omega_j^{k \rightarrow i}$  is defined in the same manner. In the case of imports, it is equal to the information-weighted sum of imports that country  $i$  buys from all  $k$  countries, weighted by the share of information exchanged between exporter  $j$  and all  $k$  countries which export to country  $i$ . The same definition of seller and buyer-reputation channels applies to equity outflows.

We faced a series of problems in estimating equations (3). A priori, one could use ordinary least squares (OLS), pooling the whole data set and introducing year dummies to capture the size of world trade and equity flows ( $M$  and  $E$ ) and all other missing variables that

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<sup>14</sup> When phone calls are used as the information variable, the information flow is defined as the sum of phone calls from country  $i$  to country  $k$  and from country  $k$  to country  $i$ . This flow is divided by the sum of total bilateral phone calls between country  $i$  and other countries to determine the information share. When newspaper exports are used as the information weights, they are defined as exports of newspapers from  $k$  to  $i$  divided by total imports of newspapers by country  $i$ .

are year-specific and invariant across countries. A first set of regressions along these lines is presented in the next section.

However, there are several simultaneity problems that need to be dealt with when estimating equations (3). The first problem is that equity flows and imports are by assumption endogenous to each other and therefore need to be estimated simultaneously in order to obtain unbiased estimates. We accounted for this problem by estimating both equations simultaneously and using as instruments market capitalization in each country, and import and export taxes.<sup>15</sup> The second problem is that our information variables described in equations (4) (the buyer- and seller-reputation variables) are constructed using trade and equity flows between countries, thus introducing simultaneity by construction. It is straightforward to see that these four variables are correlated with the error term. In order to correct for this we used the information variables as described in (4), only that they were instrumented by the information-weighted sum of all other exogenous variables in (3) (see Anselin, 2001).<sup>16</sup> The last simultaneity issue to tackle is that information flows may themselves be endogenous. Indeed, an increase in trade or cross-border equity flows may not only be caused by better information, but may also cause higher demand for information. We used telephone infrastructure (number of fixed lines) and number of newspapers in circulation in each country as instruments for bilateral phone calls and exports of newspapers to account for this issue in our system regressions.

An additional econometric issue we faced is the influence of cyclical factors (e.g., world recession or terms of trade changes) on some of our variables. Such an influence could significantly bias the estimated coefficients associated with our information variables if omitted. In order to control for this, we first introduced time dummies and OECD average growth rates in the pooled regression, as suggested by Portes and Rey (1999).<sup>17</sup> We found out that this method was not satisfactory because it did not control for serial autocorrelation inherent to import and equity flows (as shown by the extremely low Durbin-Watson statistics presented in the next section). Given these residual characteristics, we opted for an alternative approach that uses a

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<sup>15</sup> One could think that the information variables would be sufficient to identify the system of simultaneous equations, but as discussed below all information variables are potentially endogenous.

<sup>16</sup> That is, we construct information weighted sums of GDP, population, etc., to instrument seller and buyer reputation variables, using weights for each explanatory variable which are identical to those used in the construction of seller and buyer reputation variables. Both phone calls and newspaper exports used to construct weights are those already instrumented by existing phone lines or total newspaper sales, respectively.

generalized least squares technique to account for serial correlation. Modifying the typical approach that stacks data by country members, we stacked data by years so that the estimated residual covariance matrix captures the correlation of error terms across years. By doing so, we obtained a system composed of 14 equations: seven for equity purchases and seven for imports (one for each of the seven years in the sample). We then constrained the coefficients of each of the seven regressions corresponding to each type of flow to be the same for each year (except for yearly constants, which capture the effects of cyclical variables). More formally, we exploited the asymptotic in the cross-section domain to obtain estimates of serial dependence, and therefore correct for autocorrelation of the error term.

Finally, given the endogeneity between import and equity flows discussed above, the estimator we used for this constrained system of 14 equations is three stages least squares (3SLS), which allows us to estimate the 14 equations simultaneously while imposing necessary constraints on estimates.

## 4 Results

We present the estimated results for equation (3) using the standard OLS and the 3SLS approaches that were described in the preceding section. The results obtained with OLS (Table 1) are useful because they can be compared with previous empirical studies that have included some of our information variables. They basically indicate that our results are consistent with previous gravity-type estimates and that all our information variables matter on the magnitude of bilateral commercial and financial flows. Perhaps most interestingly, the estimated elasticities of distance decline significantly once the information variables are introduced. This suggests that an important share of what was previously captured by the distance coefficient is better proxied by information-related variables.<sup>18</sup> Also note that the number of observations varies in each equation because we do not have data on bilateral information flows for all observations (as discussed earlier, data on exports of newspapers are more complete than data on bilateral phone calls).

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<sup>17</sup> Following Portes and Rey (1999), we also included regional dummies for European countries, East Asian countries, and Western Hemisphere countries. As in many other gravity-type estimations, we also included a common language dummy. For simplicity, these are not included in the functional forms presented here.

<sup>18</sup> See Grossman (1998) and Portes and Rey (1999) for a discussion along these lines.

As explained earlier, these results are nonetheless biased by endogeneity issues and by the influence of residual autocorrelation (note the extremely low Durbin-Watson estimates suggesting positive autocorrelation of the error term).<sup>19</sup> For this reason, we focus our attention on interpreting the findings obtained by using 3SLS (Table 2) that uses the asymptotic in the cross-section domain to estimate the time dependence of the error term.

Given that a priori we did not have a particular preference for the use of phone calls or newspaper exports in constructing information variables, we estimated the system with these two information variables alternately. The most interesting result consists of the significant role played by information variables in bilateral flows of imports of goods and equity purchases, showing that buyer and seller reputation channels have an influence on top of standard gravity measures such as distance and standard bilateral information flows (such as bilateral phone calls), even after controlling for all the sources of bias that were present in the OLS specification.

Both seller and buyer reputation are significant in explaining bilateral import behavior at the one percent level when using newspapers, and at the five percent level when using phone calls. By contrast, buyer reputation seems to be the only significant information channel in explaining bilateral equity outflows. This channel may not only capture reputation effects, such as the fact that when firms place their equity they need to be careful in selecting their partners, but also that some markets may be more liquid than others. To the extent that there is no perfect arbitrage across markets, equity issuers from one country may learn from other equity issuers that a particular market or country may be particularly attractive in terms of liquidity to place equity. Also, the fact that the seller-reputation effect is insignificant in the case of equity flows does not imply that seller reputation is not important. Rather, it suggests that this information is not obtained through other buyers. One reason for this is that in the case of firms quoted in stock markets, most of the information needed is simply obtained by observing the firm's valuation in the stock market.

The specification that uses phone calls as the main information variable has the problem that the sign of phone calls is negative for imports equations (although it has the correct sign in equity equations). We also included the newspaper variable to see whether it had any additional explanatory power on top of that provided by phone calls, and it is only significant for imports

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<sup>19</sup> The Durbin-Watson estimates have been calculated using the Bhargava, Franzini and Narendranathan (1982) extension to panel data.

equations (and negative but not significant in the equity equations). By contrast, the specification that uses newspapers as the main information variable has the right sign for bilateral newspaper exports in both import and equity equations, whereas phone calls seem to have no additional explanatory power in either type of equation. The more parsimonious results observed in the system that uses newspapers as the main information variable can be explained by the fact that data on bilateral phone calls has several missing values for our sample of countries, as well as the fact that by using the newspaper proxies, we can distinguish between imports and exports of newspapers and so identify the direction of the information flow, something that cannot be done with the data on bilateral phone calls. Thus, we keep the system that uses the newspaper information variable as our preferred specification.

For our preferred specification, spillover effects are relevant from imports into equity, but not vice-versa. This is shown by the fact that bilateral imports are significant in bilateral equity purchases equations at the one percent level, whereas equity purchases are not significant in import equations. This provides evidence that the fact that countries trade between themselves opens up opportunities for other types of transactions/investments. Adjusted  $R^2$  measures range between 0.68 and 0.72 for imports and 0.54-0.70 for equity, depending on the year.

For completeness, we also explored estimation of the system using newspapers as the main information variable for imports and phone calls for equity, as well as a fourth specification, where we use phone calls as the relevant information variable for imports, and newspapers for equity. The results are presented in Table 2a. The specification using phone calls for equity and newspapers for imports merits attention, particularly because of the strong impact of the phone information variable on equity. Keeping in mind that newspaper exports and bilateral phone calls are only proxies for bilateral information flows, one may argue that the type of information that is diffused through bilateral phone calls has different properties than information diffused through newspapers. In particular, one would expect bilateral phone calls to be a better proxy for private information, whereas newspapers may be a better proxy for public information. If one believes that international equity flows are more private-information intensive,<sup>20</sup> then a specification that proxies the relevant information flows for equity using phone calls and for imports using newspaper exports may be the adequate one. Cross-spillover

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<sup>20</sup> One needs only to briefly visit a trading room to notice the importance of phone calls in the decision of equity investors.



effects are significant at the one percent level in both imports and equity equations. Buyer reputation remains robust to this alternative specification both for imports and equity equations, but not seller reputation in the case of imports that becomes insignificant. The same is true when the sources of information are reversed in the import and equity equations (see the last two columns in Table 2).

Our estimated equations contain a few additional variables—beyond our three channels—that may capture the influence of information on bilateral imports and equities. The role played by bilateral distance in imports varies across different specifications, but it is not significant in all specifications. Yet it makes sense that it remains significant given that it plays an important role in capturing transport costs. Distance also remains significant in most equity specifications, but its contribution to the explanation of equity flows is smaller than in the standard gravity model that excludes information variables. The use of a common language between any two countries also significantly enhances bilateral flows. This result is consistent with previous empirical findings (see Melitz, 2002 for recent evidence). Note, however, that the size of the coefficient in front of “common language” declines significantly when we introduce the information variables, as was the case with distance (see Table 1). Total bilateral trade of newspapers and/or phone calls also contributes to the explanation of both imports and equities flows, although the analysis above reveals that phone calls may be more important for equity flows.

Other results merit a brief explanation. Almost all the other estimated coefficients are statistically significant at the 99 percent level, with the exception of a few variables.<sup>21</sup> As expected, market capitalization and trade policies (import and export taxes) are robust determinants of equity and import flows respectively.

## **5 Concluding Remarks**

This paper confirms that information matters for investors and traders in international markets. Because collecting information is costly, most agents may follow what others are doing or tend to focus on what they know best, explaining the home bias observed in the recent literature on trade and international finance. Even though the role of information has been well established,

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<sup>21</sup> The population variables do not appear significant in the equity equation perhaps because our sample includes only highly developed countries (the population coefficient is supposed to capture the level of development, as in principle it controls for GDP per capita). GDP coefficients appear in equity equations with a negative sign. We attribute this to the fact that GDP and market capitalization may be collinear.

there have been surprisingly few attempts to identify the channels through which it is diffused across markets and agents.

We identified three basic channels. The first channel consists of information spillovers between imports and equity markets. Financial investors and importers seem to react to the same set of information, which is frequently conveyed to them by the same source: banks or financial intermediaries. Information on the profitability of conducting trade in goods with a partner may also reveal information about the profitability of other types of investment, such as equity. For example, an increase in imports by Switzerland from Canada is likely to positively influence cross-border purchases of Canadian equity by Swiss investors. The second and third channels emphasize seller and buyer reputation in international markets. We provide empirical evidence that these two last channels matter for bilateral import flows, while only buyer reputation plays a significant role in equity markets. Both seller and buyer reputation are strongly influenced by the level of information that investors or importers receive from international markets. The higher the level of information (as measured by telephone calls or newspapers), the greater will be the impact of reputation channels on bilateral flows.

The above results provide some insights about recent episodes of contagion in financial and commercial markets across countries. Let us take as a starting point a US firm that is believed to suffer from an abrupt decline in the quality of its products, leading German importers to cut their purchases. Importers in other countries interpret this decline in German imports as a source of bad news about the US firm—our seller reputation channel. The higher the flows of information received by other importers, the greater will be their reduction in imports. For example, Swiss importers would be more influenced than, say, Australian importers, because their information linkages with Germany are higher (language, newspapers, phone calls). Furthermore, this decline in bilateral imports between the US and Germany, if large enough, would send a negative message to German financial investors, who will in turn reduce their equity investments (our first channel). This interconnection between import and equity bilateral flows is enhanced by the role of banks and financial intermediaries, who are likely to provide not only information but also financing to most investors and importers in their international operations. As noted in the introduction, these results are compatible with explanations along the lines of Calvo and Mendoza (2000), who argue that contagion is more likely in environments where there are fixed costs in gathering country-specific information, particularly when the

utility gain of paying fixed information costs falls as the number of countries where investments can be made increases. For our specific example, it may be too costly to pay the cost of verifying whether the US firm suffered a breach in the quality of its products or not, particularly when there are many other partners to trade with.

Also, to the extent that there is more than one source of uncertainty, there is another avenue for contagion. If investors cannot distinguish between a quality shock, which is clearly related to reputation, and, say, a productivity shock, which does not reduce product quality but does reduce produced quantity, then productivity shocks may be interpreted as quality shocks and lead to lower imports from other countries, even when product quality remains unaffected.<sup>22</sup> These examples show that information channels across markets can create virtuous or vicious circles, explaining contagion effects that took place across several episodes in international markets over the past decade.

Finally, since buyer and seller reputation do influence the behavior of several investors and traders across markets, our approach raises the question of the role of government intervention in the diffusion of information. There might be a rationale for promotion agencies—export and investment—in diffusing information and marketing trade and investment opportunities. The success of a few agencies such as Ireland’s Industrial Development Agency and Singapore’s Economic Development Board seem to support this argument. Still, little is known about these agencies, suggesting that more evidence needs to be collected both in industrial and developing countries.

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<sup>22</sup> An example along these lines on informational problems for bond flows (the inability to distinguish between shocks to asset returns and liquidity constraints when bond prices fall) can be found in Calvo (1999). The effects of informational frictions combined with margin requirements, and their impact on asset price and trading overreaction are covered by Mendoza and Smith (2002).

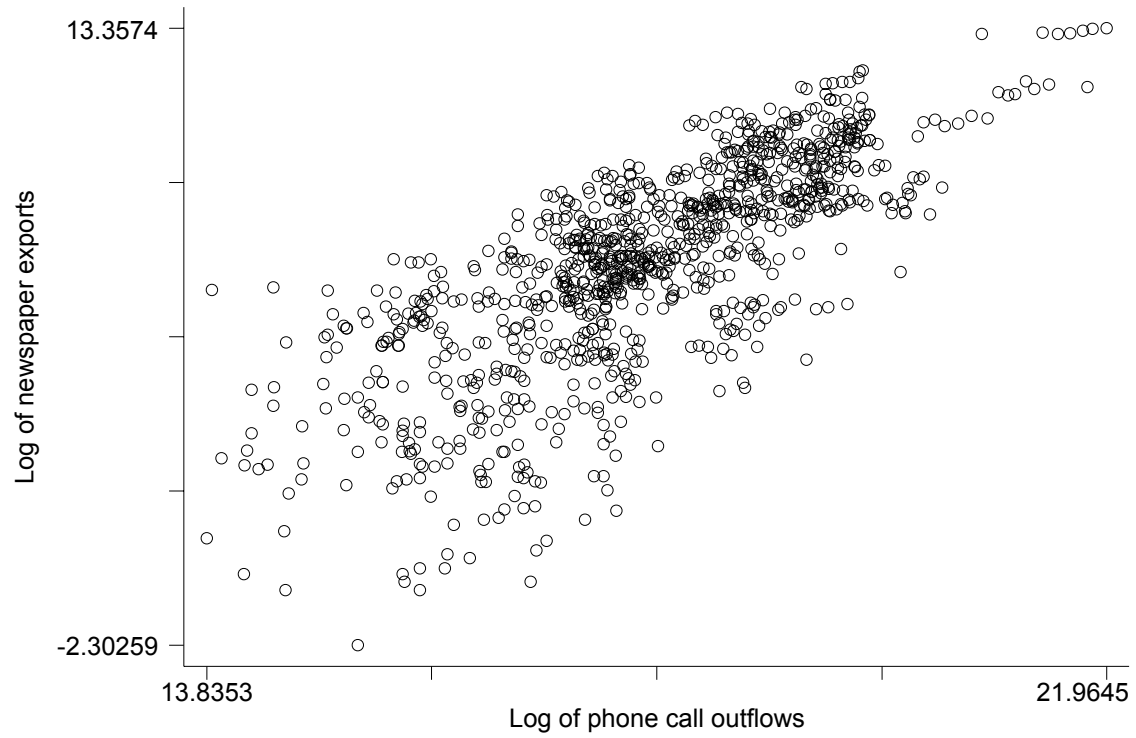
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**Figure 1. Bilateral Exports of Newspapers and Phone Call Outflows (1990-1996)**



**Table 1. Bilateral Imports and Equity Flows: The Role of Information (Pooled OLS) \***

GRAVITY VARIABLES	Imports ( $m_{i,j}$ )	Equities ( $e_{i,j}$ )	Imports ( $m_{i,j}$ )	Equities ( $e_{i,j}$ )	Imports ( $m_{i,j}$ )	Equities ( $e_{i,j}$ )
GDP reporter ( $y_i$ )	0.80 (0.09)***	2.97 (0.26)***	0.46 (0.09)***	0.47 (0.23)**	0.45 (0.08)***	0.97 (0.22)***
GDP partner ( $y_j$ )	1.62 (0.08)***	2.18 (0.24)***	1.26 (0.08)***	0.76 (0.27)***	1.00 (0.09)***	0.89 (0.25)***
Population reporter ( $\ell_i$ )	-0.32 (0.09)***	-2.25 (0.27)***	-0.29 (0.08)***	-0.63 (0.24)***	-0.09 (0.09)	-1.01 (0.22)***
Population partner ( $\ell_j$ )	-1.03 (0.08)***	-1.22 (0.25)***	-1.00 (0.08)***	-0.53 (0.26)**	-0.71 (0.08)***	-0.51 (0.24)**
Distance ( $d_{i,j}$ )	-0.31 (0.08)***	-0.76 (0.08)***	0.12 (0.03)***	-0.04 (0.08)	-0.06 (0.03)**	-0.16 (0.07)**
OECD growth	0.01 (0.04)	0.30 (0.15)**	0.02 (0.04)	0.30 (0.13)***	-0.02 (0.04)	0.30 (0.13)**
Europe dummy	0.96 (0.06)***	-0.83 (0.23)	0.97 (0.05)***	-1.23 (0.22)***	0.82 (0.06)***	-1.29 (0.20)***
East Asia dummy	1.24 (0.13)***	1.89 (0.23)***	0.89 (0.11)***	0.47 (0.24)*	0.84 (0.13)***	0.46 (0.21)**
W Hemisph. dummy	1.53 (0.12)***	-0.78 (0.26)***	1.42 (0.11)***	-1.51 (0.35)***	1.71 (0.14)***	-0.87 (0.32)***
Common Language Dummy	0.57 (0.07)***	2.20 (0.16)***	-0.25 (0.08)***	0.34 (0.18)*	0.11 (0.07)	0.52 (0.15)***
<b>INFORMATION VARIABLES</b>						
Phone calls ( $\Omega_{i,j}$ )			0.45 (0.03)***	0.56 (0.10)***		
Buyer-reputation $\left( \Omega_j^{k \rightarrow i} \right)$ using bilateral phone-calls			0.11 (0.04)***	0.30 (0.06)***		
Seller-Reputation $\left( \Omega_i^{k \rightarrow j} \right)$ using bilateral phone calls			0.06 (0.04)	0.78 (0.05)***		



**Table 1., continued**

Trade in newspapers ( $\Omega_{i,j}$ )					0.10 (0.01)***	0.19 (0.03)***
Buyer-reputation $\left(\Omega_j^{k \rightarrow i}\right)$ using newspaper exports					0.30 (0.04)***	0.38 (0.06)***
Seller-Reputation $\left(\Omega_i^{k \rightarrow j}\right)$ using newspaper exports					-0.06 (0.04)	0.77 (0.04)***
Imports ( $m_{i,j}$ )				0.63 (0.10)***		0.57 (0.08)***
Equity ( $e_{i,j}$ )			0.07 (0.01)***		0.09 (0.01)***	
<b>R<sup>2</sup>-adjusted</b>	0.76	0.46	0.83	0.62	0.82	0.64
<b># of observations</b>	1274	1274	1028	1028	1236	1236
<b>Durbin-Watson</b>	0.07	0.73	0.08	1.15	0.18	1.14

\* All regressions include time dummies for 1991 to 1996 (1990 is excluded as time dummies are correlated with OECD growth). Figures in parenthesis are White-consistent standard errors (\*\*\*) indicates significance at the 1 percent level; \*\* at the 5 percent level and \* at the 10 percent level). All variables are taken in logs except for OECD growth and the time and regional dummies. The Durbin-Watson is estimated using the Bhargava, Franzini and Narendranathan (1982) formula for panel data using the 182 bilateral relationships as the cross-section dimension.

**Table 2. Bilateral Imports and Equity Flows: The Role of Information  
(3SLS by year)\***

<b>GRAVITY VARIABLES</b>	<b>Imports (<math>m_{i,j}</math>)</b>	<b>Equities (<math>e_{i,j}</math>)</b>	<b>Imports (<math>m_{i,j}</math>)</b>	<b>Equities (<math>e_{i,j}</math>)</b>
<b>GDP reporter (<math>y_i</math>)</b>	0.36 (0.10)***	-1.20 (0.34)***	0.11 (0.10)	-7.30 (0.36)***
<b>GDP partner (<math>y_j</math>)</b>	0.73 (0.10)***	-2.18 (0.37)***	0.51 (0.09)***	-0.74 (0.40)*
<b>Population reporter (<math>\ell_i</math>)</b>	0.43 (0.15)***	0.18 (0.11)	-0.43 (0.09)***	-0.72 (0.60)
<b>Population partner (<math>\ell_j</math>)</b>	0.17 (0.14)***	0.16 (0.14)	-0.51 (0.09)***	-0.44 (0.55)
<b>Distance (<math>d_{i,j}</math>)</b>	-0.30 (0.04)***	0.18 (0.11)	-0.41 (0.04)***	-0.59 (0.13)***
<b>Europe dummy</b>	0.93 (0.13)***	-1.44 (0.31)***	1.03 (0.14)***	-0.83 (0.33)**
<b>East Asia dummy</b>	0.40 (0.22)*	-0.11 (0.45)	0.40 (0.24)*	0.14 (0.45)
<b>W Hemisph. dummy</b>	1.92 (0.36)***	-3.68 (0.74)***	1.90 (0.41)***	-1.30 (0.76)*
<b>Common Language Dummy</b>	0.52 (0.09)***	-0.83 (0.07)***	0.70 (0.09)***	0.66 (0.24)***
<b>Market capitalization reporter</b>		0.16 (0.14)		-0.05 (0.20)
<b>Market capitalization partner</b>		0.79 (0.12)***		0.94 (0.17)***
<b>Import taxes of the reporter</b>	-0.04 (0.01)***		-0.07 (0.01)***	
<b>Import taxes of the partner</b>	-0.05 (0.01)***		-0.05 (0.01)***	
<b>Export taxes of the reporter</b>	0.61 (0.68)		1.83 (0.83)**	
<b>Export taxes of the partner</b>	-1.77 (0.68)***		-2.39 (0.80)***	
<b>INFORMATION VARIABLES</b>				
<b>Phone calls (<math>\Omega_{i,j}</math>)</b>	-1.74 (0.33)***	8.43 (1.44)***	0.01 (0.02)	1.27 (1.39)
<b>Seller-reputation (<math>\Omega_i^{k \rightarrow j}</math>) using bilateral phone-calls</b>	0.11 (0.04)***	0.03 (0.08)		
<b>Buyer-Reputation (<math>\Omega_j^{k \rightarrow i}</math>) using bilateral phone calls</b>	0.11 (0.05)**	0.56 (0.08)***		
<b>Trade in newspapers (<math>\Omega_{i,j}</math>)</b>	0.43 (0.04)***	-0.30 (0.19)	0.78 (0.06)***	1.01 (0.28)***
<b>Seller-reputation (<math>\Omega_i^{k \rightarrow j}</math>) using newspaper exports</b>			0.26 (0.05)***	-0.18 (0.12)
<b>Buyer-Reputation (<math>\Omega_j^{k \rightarrow i}</math>) using newspaper exports</b>			0.25 (0.07)***	0.81 (0.09)***
<b>Imports (<math>m_{i,j}</math>)</b>		1.99 (0.15)***		0.07 (0.01)***
<b>Equity (<math>e_{i,j}</math>)</b>	0.15 (0.01)***		0.01 (0.01)	
<b>R<sup>2</sup>-adjusted</b>	0.73-0.77	0.41-0.55	0.68-0.72	0.54-0.70
<b># of observations</b>	2056	2056	2056	2056

\* Figures in parenthesis are standard errors (\*\*\*) indicates significance at the 1 percent level; \*\* at the 5 percent level and \* at the 10 percent level). The first two columns and the last two columns are estimated simultaneously.

**Table 2a. Bilateral Imports and Equity Flows: The Role of Information  
(3SLS by year)\***

<b>GRAVITY VARIABLES</b>	<b>Imports (<math>m_{i,j}</math>)</b>	<b>Equities (<math>e_{i,j}</math>)</b>	<b>Imports (<math>m_{i,j}</math>)</b>	<b>Equities (<math>e_{i,j}</math>)</b>
<b>GDP reporter (<math>y_i</math>)</b>	0.31 (0.09)***	-1.07 (0.34)***	0.47 (0.13)***	0.04 (0.29)
<b>GDP partner (<math>y_j</math>)</b>	0.87 (0.06)***	-1.77 (0.38)***	0.83 (0.12)***	-0.62 (0.31)**
<b>Population reporter (<math>\ell_i</math>)</b>	-0.14 (0.09)	-1.73 (0.54)***	0.37 (0.21)	-0.57 (0.27)**
<b>Population partner (<math>\ell_j</math>)</b>	-0.42 (0.07)***	-0.74 (0.52)	-0.01 (0.21)	0.11 (0.27)
<b>Distance (<math>d_{i,j}</math>)</b>	-0.33 (0.04)***	-0.17 (0.11)	-0.18 (0.04)***	-0.37 (0.10)***
<b>Europe dummy</b>	0.83 (0.13)***	-1.20 (0.32)***	0.89 (0.13)***	-0.95 (0.31)***
<b>East Asia dummy</b>	0.98 (0.23)***	-0.46 (0.45)	0.76 (0.22)***	-0.29 (0.45)
<b>W Hemisph. dummy</b>	1.60 (0.39)***	-2.77 (0.77)***	1.85 (0.37)***	-1.98 (0.77)***
<b>Common Language Dummy</b>	0.37 (0.10)***	0.02 (0.24)	0.47 (0.22)**	0.47 (0.22)**
<b>Market capitalization reporter</b>		0.46 (0.18)***		0.45 (0.15)***
<b>Market capitalization partner</b>		1.11 (0.15)***		0.88 (0.13)***
<b>Import taxes of the reporter</b>	-0.06 (0.01)***		-0.07 (0.02)***	
<b>Import taxes of the partner</b>	-0.02 (0.01)		-0.03 (0.02)*	
<b>Export taxes of the reporter</b>	-0.02 (0.65)		0.74 (1.05)	
<b>Export taxes of the partner</b>	0.09 (0.65)		-1.09 (1.05)	
<b>INFORMATION VARIABLES</b>				
<b>Phone calls (<math>\Omega_{i,j}</math>)</b>		4.24 (1.28)***	-1.02 (0.48)**	
<b>Seller-reputation (<math>\Omega_i^{k \rightarrow j}</math>) using bilateral phone-calls</b>		-0.09 (0.10)	0.12 (0.06)	
<b>Buyer-Reputation (<math>\Omega_j^{k \rightarrow i}</math>) using bilateral phone calls</b>		0.63 (0.10)***	0.13 (0.08)	
<b>Trade in newspapers (<math>\Omega_{i,j}</math>)</b>	0.22 (0.05)***			0.07 (0.18)
<b>Seller-reputation (<math>\Omega_j^{k \rightarrow i}</math>) using newspaper exports</b>	0.01 (0.01)			0.10 (0.09)
<b>Buyer-Reputation (<math>\Omega_j^{k \rightarrow i}</math>) using newspaper exports</b>	0.23 (0.07)***			0.71 (0.07)***
<b>Imports (<math>m_{i,j}</math>)</b>		1.47 (0.17)***		1.14 (0.16)***
<b>Equity (<math>e_{i,j}</math>)</b>	0.07 (0.01)***		0.18 (0.01)***	
<b>R<sup>2</sup>-adjusted</b>	0.79-0.80	0.50-0.64	0.68-0.78	0.57-0.69
<b># of observations</b>	2302	2302	2302	2302

\* Figures in parenthesis are standard errors (\*\*\*) indicates significance at the 1 percent level; \*\* at the 5 percent level and \* at the 10 percent level). The first two columns and the last two columns are estimated simultaneously.