Where is the Market? Evidence from Cross-Listings

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Abstract

We investigate the distribution of trading volume across different venues after a company lists abroad. In most cases, after an initial blip, foreign trading declines rapidly to extremely low levels. However, there is considerable cross-sectional variation in the persistence and magnitude of foreign trading. The ratio between foreign and domestic trading volume is higher for smaller, more export and high-tech oriented companies. It is also higher for companies that cross-list on markets with lower trading costs and better insider trading protection. Domestic trading increases around the cross-listing, and afterwards is negatively correlated with past foreign trading activity. This accords with the "flow-back hypothesis" that declining foreign trading is associated with the gravitational pull of the home market.

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1. Introduction

Several companies list their shares not only in their domestic exchange but also on foreign stock exchanges – a fact for which a variety of reasons have been offered and explored (see Karolyi, 1998, and Pagano, Röell and Zechner 2002, among others). A motive often advanced for this decision is that a foreign listing facilitates trading by foreign investors and therefore tends to attract them into the ranks of the company's shareholders. If this is true, then cross-listings should be followed by reasonably large and persistent trading activity on the foreign market.

This argument contrasts with the tendency towards agglomeration that according to several models is a quintessential feature of trading activity, owing to the positive externalities present in the trading process (Admati and Pfleiderer, 1988, Chowdry and Nanda, 1991, and Pagano, 1989). This tendency can be counterbalanced only by presence of frictions – whether arising from trading costs, from informational barriers or from regulatory obstacles – that shelter less active trading venues from the gravitational pull of the larger one. Whether such frictions exist, so that an active foreign market can be sustained after a cross-listing, is an empirical question, and is precisely the question that motivates this study.

Our first contribution is to document the typical pattern of trading activity after a cross-listing. The general pattern of foreign trading volume is qualitatively similar across companies: a blip immediately after the cross-listing, followed by a trend decline, which in most cases leads rapidly to virtual disappearance of foreign trading activity. This phenomenon, known as "flow-back" among practitioners and documented by Karolyi (2003) for the case of DaimlerChrysler AG, appears to be quite universal in our sample, which comprises all the European companies whose shares were cross-listed in the U.S. or in Europe during 1986-1997. This suggests that for most companies the tendency to the agglomeration of trading indeed prevails, so that fostering an active foreign market cannot be the main purpose of a cross-listing, unless the managers who take this decision make systematic mistakes.

However, we also find there is considerable cross-sectional variation in the persistence and magnitude of foreign trading. While for most companies the domestic market re-asserts its dominance within a year and often even faster, for a small but non-negligible group of companies the decline of foreign trading tends to be very slow, and several years after the cross-listing we still observe an active foreign market.

This cross-sectional diversity motivates the second step in our analysis: understanding which company and market characteristics are associated with the different patterns in long-run distribution of trading and in adjustment towards equilibrium. To guide the analysis, we review the possible reasons why foreign investors may wish to trade shares of cross-listed companies. Since trading can arise either from non-informational motives (such as risk diversification) or from the informational advantage relative to other traders, different firm characteristics can affect foreign trading activity depending on which trading motives are most relevant for foreign investors. For instance, companies with a large presence in foreign output markets should be more heavily traded abroad than other companies, since foreign investors should find it easier to collect timely and accurate information about their prospects. The same prediction holds if in the foreign market investors are given better protection against insider trading than those operating in the domestic exchange.

We also consider the role of trading frictions, such as differences in trading costs and in market design, which – as mentioned above – should help the foreign market to resist the gravitational pull of the domestic market. Our data make this possible, since our companies list on at least one of ten exchanges, which differ both in their trading costs and in the design of their trading mechanism.

In line with our priors, we find that the ratio between foreign and domestic trading volume is higher for more export-oriented companies, and for companies that cross-list into markets with lower trading costs and better insider trading protection. However, not all our priors turn out to be correct. Foreign trading activity tends to be comparatively high for small, high-growth and high-tech companies, which we would have expected to be less appealing for foreign investors, being typically more sensitive to inside information. A possible rationalization of this puzzle is that informational asymmetries between domestic and foreign investors are actually lower for small, high-growth and high-tech firms. This may be the case if these firms cross-list precisely in markets where local investors are more skilled at evaluating them, as could be the case – say – for a German biotech company cross-listing on Nasdaq. This is consistent with the finding by Pagano, Röell and Zechner (2002) that the likelihood of cross-listing in the United States is significantly higher for high-growth and high-tech companies.

Our third finding concerns the dynamics of domestic trading around and after the cross-listing. In principle, the foreign market may divert trading activity away from the domestic market, leave it unaffected or increase it. Indeed, in a six-months time window around the cross-listing, domestic trading seems to be abnormally large, probably a short-run reflection of the additional attention received by the company in connection with the cross-listing.

However, when one expands the data window to study the dynamic relationship between the two markets, it turns out that higher foreign turnover tends to be followed by lower domestic turnover, other things being equal. So the bulge in foreign trading immediately after the listing temporarily reduces subsequent trading volume. But the process operates in reverse as soon as foreign trading starts subsiding: the declining foreign volume observed after the cross-listing is followed by an increasing domestic volume, which is precisely the practitioner's definition of "flow-back". In conclusion, not only are the data consistent with the theoretical prediction of trading agglomeration, but they point to the presence of strong inertia in trading. The market where trading tends to agglomerate tends to remain the domestic one, where the company initially listed its shares.

The plan of the paper is as follows. In Section 2, we outline the hypotheses suggested by the literature about the geographic distribution of trading volume across alternative trading venues, and use them to draw testable predictions about how company and market characteristics should correlate with foreign trading volume. In Section 3, we describe our data. In Section 4, we document the pattern of foreign trading volume (scaled by its domestic counterpart) after cross-listing, and analyze how this variable correlates with company characteristics and with features of the exchanges where companies cross-list. In Section 5, we try to gauge whether the foreign market diverts trading activity away from the domestic market. Finally, Section 6 summarizes the results of the paper, and discusses their implications for the competition between stock exchanges and for the motivations of the cross-listing decision.

2. Hypotheses

In this section we outline the hypotheses suggested by the literature about the geographic distribution of trading volume across alternative trading venues for the same security. Two sets of issues arise. First, what is the long-run equilibrium distribution of trading volume across markets, and how does it depend on issuer and market characteristics? Second, what is the short-run adjustment in the distribution of trading volume after a new marketplace opens, such as after a cross-listing?

2.1 Determinants of the Level of Foreign Trading

When a security is traded simultaneously on two exchanges, positive trading externalities favor the concentration of trading on a single market, unless some friction prevents this outcome. Positive trading externalities arise from the fact that participation by other investors reduces the adverse price effect of one's orders, both in models with imperfectly competitive, risk-averse investors and in models with asymmetric information.

Pagano (1989) makes this point in a setting where risk-averse traders perceive their demand for the stock as affecting adversely the market price. A higher number of market participants implies a lower price sensitivity to a trader's net demand, thus increasing the market's liquidity. If a stock can be traded on two distinct auction markets with identical transaction costs, only two types of equilibria are possible: either all traders concentrate in the same market, or a knife-edge equilibrium occurs where traders separate between the two markets and are just indifferent between them. With differential trading costs, instead, a two-market equilibrium is possible where one market features a higher number of traders (and therefore lower price order-flow sensitivity), greater cross-sectional diversity in the traders' endowments, but higher transaction costs. Coexistence between markets can also obtain if one of the two markets is an auction market and the other is a search market.

The tendency toward agglomeration in a single market emerges also in models with asymmetric information, as shown by Chowdry and Nanda (1991) in a setting similar to that proposed by Admati and Pfleiderer (1990). In their model, privately informed traders, discretionary and non-discretionary liquidity traders place orders with risk-neutral market makers. They show that in equilibrium all traders with discretion over their trades' location will place their orders in the market with the largest number of non-discretionary traders. The less liquid market remains active only to the extent that some non-discretionary liquidity traders are trapped there. These traders' lack of discretion over their trading venue reflects can be thought as a reflection of their differential trading costs: for instance, they face prohibitively large trading costs abroad but not at home. Therefore, also in this case, complete agglomeration is blocked only by differential trading costs.

Similarly, Glosten (1994) demonstrates the prevalence of one market over potential competing trading venues if markets operate with pure limit-order books. He argues that rival markets would earn negative expected profits when competing against such a market. However, competing markets can coexist if the two markets have different microstructures. Parlour and Seppi (2001) make this point in the context of a model with a pure limit-order book and a hybrid market with a specialist and a limit order book. Traders can split their orders across the two markets. In this situation liquidity providers in the two markets have heterogeneous costs, and equilibria can arise where active traders place their orders in both markets (while in other equilibria the hybrid market dominates).

These results suggest that when a company cross-lists its shares in a competing exchange, trade should tend to concentrate on one of the two markets, unless this outcome is prevented either by the presence of differential transaction costs or by some difference in the design of

the two markets, or simply by a time zone difference that makes the active hours of the two markets not fully overlapping.

This still leaves several important questions open. First, if after a cross-listing trade tends to concentrate in one of the available markets, in which one will it concentrate? Second, if instead competing markets can coexist, which economic factors determine the split of trading activity across them?

Table 1 summarizes the variables that could affect the volume of trading in foreign markets after cross-listing, and indicates which empirical proxies can be used to measure them.

Table 1 Determinants of Foreign Trading Volume

Explanatory variables	Empirical measure	Predicted effect on foreign trading volume
Uninformed foreign trading	Beta with respect to foreign market	-
	Fraction of foreign share ownership	+
	Capital raised on foreign market	+
	Presence of institutional investors	+/-
Informed foreign trading	Fraction of foreign sales	+
	Company size (sales, total assets)	+
	Company growth rate	-
	Variability of stock return	-
	Analyst following	+
	High-tech sector	+/-
	Home vs. foreign anti-insider-trading protection	-
Trading frictions	Different trading costs	+
	Different market microstructure	+

2.1.1 Geographic Distribution of Uninformed Trading

One determinant of the geographic distribution of trading activity is the location of liquidity traders, or more generally of uninformed market participants, to the extent that they are "captive" of a specific trading venue, either because of differential trading costs or because of total lack of access to foreign markets.

Since the home investor base will in most cases include a large number of non-discretionary uninformed traders, after a cross-listing the domestic market should maintain its dominance in trading, unless the company makes a special effort to develop a foreign investor base. This may happen if the stock's risk characteristics make it very appealing for portfolio diversification by foreign investors. This should typically the case for stocks with **low beta** with respect to the foreign market: other things being equal, these stocks should be in high demand by foreign investors after a cross-listing, implying that their trading volume should also be higher than for other cross-listed stocks.

In some cases, a company may already have a large foreign shareholder base before the cross-listing, or develop it at the time of the cross-listing by advertising among foreign investors and analysts. It may also enhance such foreign shareholder base by issuing new shares on the foreign market at the cross-listing date or soon after it. One would expect such stocks to feature a larger foreign trading volume than that of others. Empirically, therefore, the distribution of trading volume should be related to the **fraction of foreign ownership** around the cross-listing date and to the amount of **capital raised abroad** at or soon after the cross-listing.

A large **presence of institutional investors** in a company's shareholder base may also affect the distribution of trading across exchanges, although in principle its effect can go either way. On the one hand, institutional investors typically have discretion over the trading venue where they execute their orders, and should be very sensitive to small differences in transaction costs. In this sense, they should be a force for agglomeration in a single exchange. This should reinforce any initial comparative advantage that the domestic market may possess. On the other hand, empirically a large number of institutional investors may be a proxy for a very international shareholder base, and therefore may be associated with heavier trading on foreign markets.

2.1.2 Geographic Distribution of Informed Trading

Information is another likely driver of the distribution of trade. If traders with privileged access to information use it locally, the place where such information is generated should contribute to determine the location of trading activity. For example, if most privileged information trickles down from the company's headquarters, one could expect informed trading to concentrate in the market closest to the headquarters. Grinblatt and Keloharju (1999) show that Finnish investors' portfolios are biased in favor of the stocks of geographically close companies, and Coval and Moskowitz (1999) identify a similar bias in the portfolio choices of U.S domestic portfolio funds. By the same token, if accounting information is initially published in the company's home-country language, informed trading should be initiated by domestic traders. There is considerable evidence that language barriers confer an informational advantage in equity markets. Hau (2001) documents that in the German electronic market Xetra, traders in non-German speaking locations make less profits than other traders, and underperform even compared to domestic traders in the same locations. Similarly, Grinblatt and Keloharju (1999) identify a language bias in the portfolio choices of the Swedish-language minority in Finland.

In principle, the informational advantages conferred by proximity and knowledge of the issuer's language need not affect the location of trading volume. Domestic traders could place their orders on a foreign rather than on the domestic market for the company's stock. However, in most cases it will be cheaper and quicker for them to trade domestically. The speed of execution is a crucial advantage of the home market whenever the value of information is very short-lived. For instance, Hau (2001) documents that proximity to corporate headquarters confers an informational advantage only for high-frequency trading.

Therefore, the presence of home-based headquarters and the language barrier confer a natural advantage to the domestic market also in retaining informed trading. The only exceptions might be instances where a considerable portion of value-relevant information is produced abroad. This can occur when the company exports or produces abroad a large fraction of its output, or that its major suppliers or competitors are located abroad. For instance, Kang and Stulz (1997) document that foreign investment in Japanese stocks is concentrated in large, export-oriented firms that are presumably more familiar to foreign investors. Therefore, empirically companies should be more likely to develop an active foreign market for their shares if they have a large **fraction of foreign sales** or they compete in a worldwide product market. The effect of this potential informational advantage on foreign trading volume will be compounded by a time zone difference between the two markets.

To the extent that most information is produced in the home country, the informational disadvantage of foreign investors depends on the sensitivity of the market price to private information. This will be highest for small companies, which are more informationally opaque and – being also younger -- have a shorter track record. As a result, foreign demand should be positively related to **company size**, as measured by sales or total assets, again in line with the findings by Kang and Stulz (1997).

The sensitivity to private information will also be high for high-growth companies, whose value lies mostly in growth opportunities rather than in the existing asset base. Therefore, other things being equal, foreign trading activity after a cross-listing should be negatively related to the **growth rate** of the company. Another measure of the importance of information is the **variability of the return** on the company's stock: this characteristic should also be negatively correlated with foreign trading. Finally, the research published by analysts can increase the public information available to all investors, and therefore should reduce the informational disadvantage of foreign investors. The **number of analysts following the stock** should therefore be positively related to foreign trading volume. For this variable, one faces a potential endogeneity problem, insofar as analyst following could be stimulated by a cross-listing. This problem can be faced by relying on (or instrumenting by) analyst following before the cross-listing.

In principle, also high-tech companies could be classified as more affected by private information (e.g., about patent development, new products and processes, etc.). However, the high-tech sector is also generally more exposed to worldwide competition, which may encourage foreign trading, as discussed above. Therefore, it is not a priori clear whether, on balance, **high-tech** companies should be expected to develop a more active foreign market for their shares than low-tech ones.

To the extent that **protection against insider trading** prevents losses by uniformed traders at the advantage of informed ones, for cross-listed stocks investors should tend to trade in the exchange where the rules against insider trading are stricter or more tightly enforced. Foreign trading volume should therefore be larger if the home market has less stringent rules or weaker enforcement of insider trading rules.[1]

2.1.3 Influence of Trade Frictions on the Geographic Distribution of Trade

Pagano (1989) shows that with differential trading costs a two-market equilibrium is possible where one market features a higher number of traders, larger trades, but higher transaction costs. Coexistence between markets can also obtain if one of the two markets is an auction market and the other is a search market. Also, Glosten (1994) and Parlour and Seppi (2001) demonstrate that competing markets can coexist if the two markets have different microstructures. Therefore we compare the fee and commission levels of home and foreign markets and their market microstructure to explore if the distribution of trade is related to differences in these variables.

2.2 Trading Dynamics after Cross-listing

The previous discussion indicates that, depending on various factors, the long-run distribution of trading after a cross-listing may entail either (i) the prevalence of the home market, or (ii) the prevalence of the foreign market, or (iii) the coexistence of markets. Of these three outcomes, the continued prevalence of the home market appears as the most likely one, insofar as this market has the twin advantages of a captive base of uninformed investors and of localized information production about the company.

[1] In contrast, one should not expect the relative degree of shareholder protection to affect the ratio between foreign and domestic demand for a company's stocks. While protection against insider trading is determined by the security regulations that apply to the exchange where the stock is traded, the protection against managerial diversion is mainly determined by the corporate law of the country where the company is incorporated, and therefore cross-listing should not make a difference to the degree of protection enjoyed by shareholders, whether domestic or foreign.

In the short-run, trading activity may be affected by the same factors that drive it in the long run: for instance, companies with a large fraction of foreign owners and a strong presence on international markets may feature a more active foreign market not only in the long run but also immediately after the cross-listing. However, this need not be always the case. In the short-run trading activity may display a variety of dynamic patterns. For instance, if the long-run outcome is foreign-market prevalence, trading activity could move gradually towards the foreign market. If instead the long-run outcome is home-market dominance, trading on the foreign market may fail to materialize altogether, or else still display a short-lived boom. We shall refer to the latter scenario as "flow-back" of trading activity.

A temporary bulge of trading abroad after cross-listing could arise as a result of a one-off portfolio rebalancing by foreign investors, after cross-listing by the company. Suppose that, along the lines of Merton (1987), foreign investors become aware of the existence of the stock at the moment it becomes listed on their exchange. Then, risk diversification will dictate to add this stock to their portfolios, which will generate a temporary bulge of activity around the cross-listing date. Afterwards, the trading activity of foreign investors will revert to the level dictated by their "normal" trading needs – whether these originate from liquidity or information-related motives.

Depending on how the shares demanded by foreign investors are introduced in their market, this temporary bulge in trading activity can have a mirror image in the domestic market. If the company does not issue new equity at the time of the cross-listing, the demand expressed by foreign investors can be satisfied only if financial intermediaries buy the stock in the domestic market and resell it abroad. In this case, a bulge in trading activity should occur both in the home and in the foreign market around the cross-listing date, possibly in short sequence. If instead the company issues new shares to the foreign investors, this may be sufficient to fulfill the demand of foreign investors, so that no corresponding increase in trading activity will be recorded in the home market. This can be tested by computing the correlation between domestic and foreign trading around the cross listing, and relating it to data about capital raised abroad.

The "support" activity of investment banks in the foreign market after a cross-listing may concur to generate a temporary bulge of trading abroad. The banks that assist the corporation in listing abroad are often willing to maintain a specially liquid market for some time in the foreign exchange. As long as this activity lasts, it may induce higher trading activity by foreign investors.

So far, we have discussed which factors affect foreign trading volume for a *given* level of domestic trading volume – or equivalently what determines the ratio of foreign to domestic volume for cross-listed stocks – and the dynamics of trading volume at our close to the cross-listing event. However, it is quite possible that opening a new trading venue abroad affects the level of domestic trading volume. Specifically, the cross-listing may determine *trade diversion* away from the home exchange, if foreign investors relocate their trades abroad. Alternatively, it may determine net *trade creation*, so that new trading abroad does not occur at the detriment of the domestic exchange, or even a *positive spillover* effect for the domestic exchange, whereby foreign trading activity increases domestic trading beyond what it would have been otherwise. For instance, competition between foreign and domestic market-makers may enhance the liquidity of the domestic market. But this effect may not materialize if the two markets remain segmented. Domowitz, Glenn and Madhavan (1998) show that home-market liquidity may suffer if information linkages between the two markets are poor, and support this point with evidence concerning Mexican companies issuing American Depository Receipts (ADRs).

3. Data Description

The data set used for our analysis consists of European companies whose shares were cross-listed in the U.S. or in Europe during 1986-1997. We include companies that cross-listed in this time interval as well as those that were already cross-listed as of 1986. We select the sample from the set of all the companies listed domestically in the main segment of thirteen European exchanges: Amsterdam, Brussels, Copenhagen, Frankfurt, Helsinki, Milan, Lisbon, London, Madrid, Oslo, Paris, Stockholm, Switzerland, and Vienna.

Table 2 provides a description of our sample. In Panel A, each cell indicates how many companies cross-listed from the exchange indicated in the corresponding row (home stock exchange) to the exchange listed at the top of the corresponding column (target stock exchange). Altogether, we have 407 cross-listing events. These are concentrated mainly in Frankfurt and NYSE, followed by Paris, Switzerland, Brussels and Nasdaq. The home markets from which most cross-listings originate are London, Paris and Amsterdam.

Several companies in our sample have effected multiple cross-listings. Since in the empirical analysis we want to explain foreign trading volume with a set of company characteristics, we focus on the "most significant listing" for companies with multiple cross-listings. We define the most significant listing as the listing with the highest foreign volume relative to domestic volume in the first year after cross-listing date. Panel B describes the resulting sample. The number of listings reduces to 111, as multiple listings of the same stock issue appear only once. More than half of the U.S. listings in our initial dataset, reported in Panel A, re-appear in Panel B. This reflects the fact that frequently the U.S. listing is the most significant one for companies with multiple cross-listings. Most European listings appear to be followed by relatively low trading volume. Only about ten percent of the listings in Frankfurt, Paris and the Swiss market turn out to be among the most significant listings. No London listing is in our final sample. This is partly due to the fact that many London listings took place in the early 1980s, a period for which trading volume data for London are not available.

For the 111 companies identified we collect the following information:

(a) Daily stock prices and trading volume on the relevant stock exchanges;
(b) Company data and annual balance sheet information: total assets, sales, industry classification, ratio of foreign sales to total sales;
(c) Ownership structure information;
(d) Capital raised on foreign markets;
(e) Analyst coverage.

In addition to the company-level variables listed above, we collect data on stock exchange characteristics and security market regulation: trading costs, market design, investor protection, insider trading regulation and enforcement. A detailed list of the data, their sources and definitions is provided in the Data Appendix. The Data Appendix also describes the procedure followed to purge the data from measurement error.

Table 3 provides descriptive statistics about our sample. The typical company is very large and export-oriented, with over half of its sale revenues arising abroad. It is also a high-growth company, although generally belongs to a traditional sector. Its stock returns correlate more closely with its home stock exchange than with the foreign one: the home-market beta is 0.91, while the foreign-market one is 0.77. It typically cross-lists on an exchange with lower trading costs, though the difference with the home exchange is only 5 basis points. It has a large foreign shareholder base, over a fifth of its shares being on average foreign-owned. When the cross-listing occurs in the U.S., where data on institutional investors are available, companies have on average 55 institutional investors and 8-percent institutional ownership.

Table 2 Structure of the Sample, by Home and Destination Exchange

Panel A breaks the total number of cross-listings by home stock exchange and target exchange. The home stock exchange is indicated in each row and the target stock exchange is listed at the top of the corresponding column. Panel B provides the same breakdown for a sample that includes only the most successful cross-listing for each company, chosen as the cross-listing followed by the highest ratio of foreign to domestic trading in the first year after the cross-listing date.

Panel A: All Cross-listings

		Destination exchange												
Home exchange		Amsterdam	Brussels	Frankfurt	London	Milan	Nasdaq	NYSE	Paris	Stockholm	Vienna	Swiss	Madrid	Total
	Amsterdam		11	18	2		6	11	8	1	1	12		71
	Brussels	3		2	1			1	4					11
	Frankfurt	7	8		8	3	1	7	10		7	32	3	86
	London	2	8	13			17	32	15			8		96
	Milan		3	9			1	5	3					21
	Paris		11	8	2	1	5	9		1			1	38
	Stockholm		1	4	10		9	2	4					30
	Vienna		2	8					1					11
	Swiss	1		14			1	1	4					21
	Madrid			2				2	3					7
	Denmark						1	1						2
	Finland			1			1	1	1	1				5
	Portugal							1						1
	Norway			2			1	3	1	1				8
	Total	13	44	81	23	4	43	76	54	4	8	53	4	407

Panel B: Cross-listings in our Final Sample

		Destination exchange												
Home exchange		Amsterdam	Brussels	Frankfurt	London	Milan	Nasdaq	NYSE	Paris	Stockholm	Vienna	Swiss	Madrid	Total
	Amsterdam		1	4			2	8						15
	Brussels							1						1
	Frankfurt	1					1	7	1			4	2	16
	London		1				8	26	3					38
	Milan						1	3						4
	Paris		1			1	2	8		1			1	14
	Stockholm						7	2						9
	Vienna			3					1					4
	Swiss			1			1	1	1					4
	Madrid							1						1
	Denmark													
	Finland							1						1
	Portugal							1						1
	Norway						1	2						3
	Total	1	3	8		1	23	61	6	1		4	3	111

Table 3 Company Characteristics: Summary Statistics

This table reports descriptive statistics for all the 111 companies of our sample, for the 1986-2001 interval. All variables are defined in details in the data appendix. The foreign market beta refers to the foreign market where the company has its most significant cross-listing, defined as the cross-listing followed by the highest ratio of foreign to domestic trading in the subsequent year. Betas are calculated annually as the regression coefficient of weekly stock returns on weekly foreign or domestic stock index returns. Volatility is calculated annually as the standard deviation of weekly returns. Number of Brokers is the number of brokerage companies that cover a firm in a specific year. Number of Forecasts is the number of forecasts issued in a specific year for a firm. Capital Raised in Europe (or in the U.S.) is the value of the equity issued in Europe (or in the U.S.) after the most significant cross-listing, as previously defined.

	Mean	Median	Standard Deviation	Min.	Max.	Number of Company-Years
Total Assets (million dollars)	26079.94	5270.00	65925.79	0.17	508647.30	963
Sales (million dollars)	9770.50	4410.00	14732.52	0.00	159968.10	861
Foreign Sales, percent	58.92	60.56	26.52	0.05	160.68	815
Asset Growth, percent	24.46	9.86	137.87	-67.89	4100.21	1029
Equity Growth, percent	82.14	9.88	1232.42	-98.26	34198.17	980
Sales Growth, percent	0.27	0.10	1.65	-1.00	35.58	794
High Tech Sector, percent	0.15	0.00	0.36	0.00	1.00	1301
Beta with Foreign Market	0.77	0.77	0.34	-0.17	2.54	1224
Beta with Home Market	0.91	0.94	0.36	-0.12	3.06	1190
Volatility	0.05	0.04	0.03	0.01	0.46	1242
Difference in Trading Costs between Foreign and Domestic Exchange (b.p.)	-5.33	-5.05	5.42	-13.45	5.00	1301
Number of Brokers	18.99	18.00	13.36	0.00	54.00	1180
Number of Forecasts	155.73	123.50	150.55	0.00	1090.00	1180
Fraction of Foreign Ownership, percent	22.97	13.11	22.23	0.96	100.00	90
Capital Raised in Europe after cross-listing (million dollars)	174.00	0.00	839.00	0.00	11000.00	428
Capital Raised in US after cross-listing (million dollars)	35.90	0.00	148.00	0.00	1420.00	428
Shares held by institutional investors after cross-listing, percent (US Listings)	7.80	2.00	14.31	0.00	89.00	547
Number of Institutional Investors after cross-listing (US Listings)	54.88	21.50	83.39	0.00	638.00	547

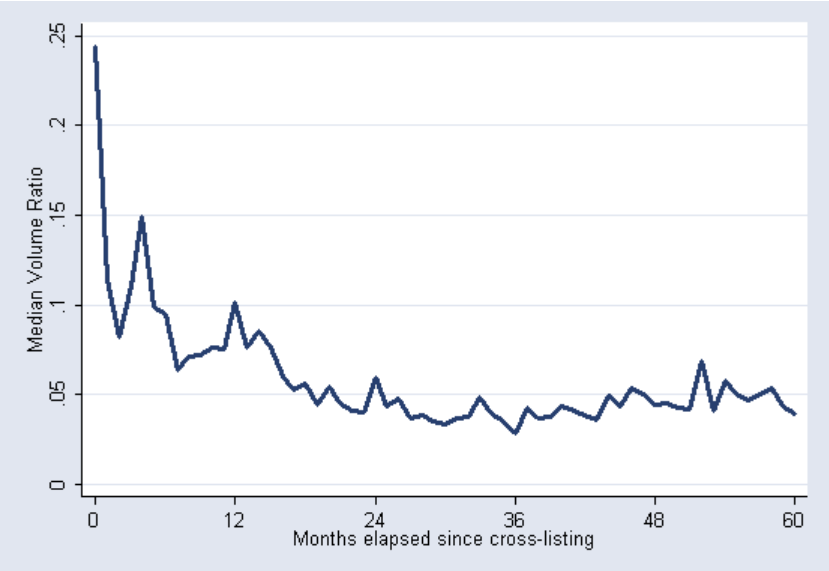
4. Evidence on the Geographic Distribution of Trading Volume

Once a company is listed on several exchanges, how does trading activity distribute itself across them? In this section, we address this question at two levels. First, we describe how trading volume on foreign markets evolves after the cross-listing date. Second, we correlate foreign trading volume with company characteristics and with features of the exchanges and countries where companies cross-listed, by reporting both bivariate correlations and multivariate regressions.

4.1 Descriptive Evidence

In Figure 1 we analyze the monthly ratio of foreign volume to home volume over the first 5 years after cross-listing for all the companies for which we have data for all the first 60 months after cross-listing (to avoid composition effects). The figure shows that, after an initial period of active trading, foreign volume quickly abates: after 18 to 20 months, the median ratio of foreign to domestic volume reaches about 5 percent, and remains stable at that level for the remaining three and half years. It is striking how quickly the home market reasserts its dominance, after the initial blip in foreign trading, and how small is the steady-state portion of total trading activity that the foreign exchange manages to retain for the median company.

Figure 1 Monthly Ratio of Foreign to Domestic Volume in the 5 Years after Cross-Listing, Median Values

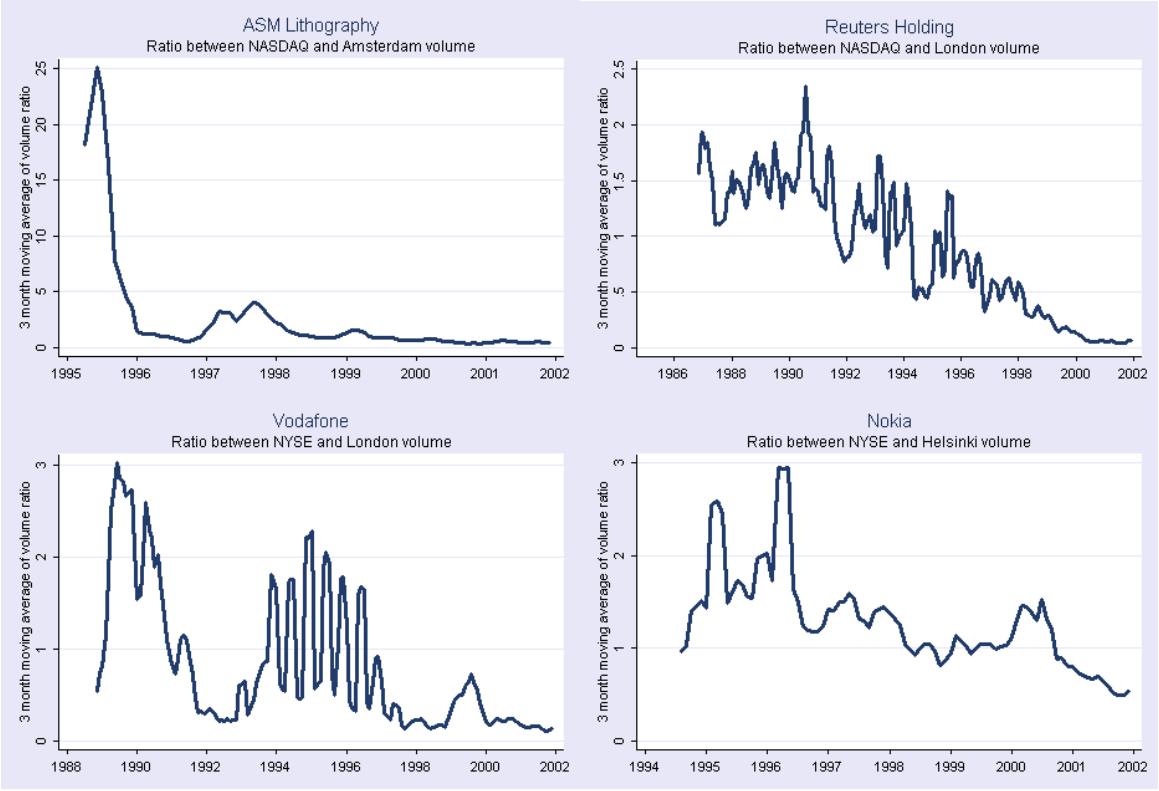


However, Figure 1 does not tell the full story, since it hides a large cross-sectional variability in trading patterns. To give an idea of this variability, Figure 2 displays the ratio between foreign and domestic volume for four specific companies in our sample: ASM Lithography, Reuters Holding, Vodafone, and Nokia. The foreign trading of ASM Lithography is qualitatively similar to that of the median company portrayed in Figure 1, with three differences: the bulge of foreign trading following the cross listing is much larger (25 times domestic volume versus 0.25 for the median company), the subsequent decline is correspondingly more dramatic, and the long-run level of foreign trading is about 10 times the median company's corresponding figure. The other three companies in Figure 2 display a much slower decline in foreign trading volume than the median company. In the case of Reuters, foreign trading volume declines steadily over approximately 15 years, in contrast with the median company where the decline takes place in about 1.5 years. Vodafone and

Nokia feature a much more variable pattern over time, with sharp declines followed by sudden upswings, although also in those cases a long-run downward trend is present.

Despite these differences, all four companies display a common feature that sets them apart from the median company: several years after the cross-listing, their shares are still actively traded on the foreign market.

Figure 2 Ratio of Foreign to Domestic Trading Volume for Selected Companies



While uncommon in our sample, the heavy foreign trading volume of ASM Lithography, Reuters, Vodafone and Nokia is shared by several other companies. Table 4 reports the median ratio of foreign to domestic volume for the 20 companies that display the largest trading volume after cross-listing. Foreign volume ranges between 12.5 times domestic volume for Danka Business Systems to about a third of domestic volume for the bottom 8 companies. These ratios do not refer to a few months only, since they are computed for an interval that exceeds 5 years for all companies and that is as long as 10 years for some companies.

Most of the companies in Table 4 listed their shares on U.S. stock exchanges. The only exceptions are three companies that listed on German or Swiss stock exchanges. This regularity is confirmed by the more complete statistics reported in Table 5, which show how the time pattern of trading volume after the cross-listing differs across stock exchanges. Table 5 confirms that cross-listings in the United States are followed by a larger trading volume than those effected in European exchanges. It also confirms that within Europe, listings on German and Swiss exchanges are followed by larger trading volume than those established in other countries. (We do not display a finer breakdown by country because for some countries there are very few observations.)

Table 4 Most Significant Cross-listings in the Data Sample.

This table reports the company name, home market, foreign market, median ratio of foreign to domestic volume and number of monthly observations for the 20 companies that display the largest median trading volume in a period of 10 years after the cross-listing.

Company Name	Home	Foreign	Median Ratio	Monthly Obs.
Danka Business Systems	London	NASDAQ	12.499	100
Gucci Group	Amsterdam	NYSE	4.329	76
Genset	Paris	NASDAQ	1.710	68
Reuters Holding	London	NASDAQ	1.319	92
Nokia	Helsinki	NYSE	1.149	91
ASM Lithography Holding	Amsterdam	NASDAQ	0.951	83
ST Microelectronics	Paris	NYSE	0.789	86
Vodafone Group	London	NYSE	0.543	120
Fokker	Amsterdam	Frankfurt	0.499	103
Norsk Hydro	Oslo	NYSE	0.489	94
Hanson	London	NYSE	0.461	120
Glaxo Wellcome	London	NYSE	0.405	120
Repsol	Madrid	NYSE	0.359	111
Kuehne und Nagel	Zurich	Frankfurt	0.347	82
Philips Electronics	Amsterdam	NYSE	0.344	120
Merck	Frankfurt	Zurich	0.320	75
Arcadis	Amsterdam	NASDAQ	0.308	76
ICI	London	NYSE	0.303	99
Dassault Systemes	Paris	NASDAQ	0.291	67
Pfeiffer Vacuum Technology	Frankfurt	NYSE	0.286	64

Table 5 Time Pattern of Trading Volume

This table displays the median ratio of foreign to domestic trading volume in the 3 years after the cross-listing aggregated by country of foreign stock exchange.

Country of Foreign Stock Exchange	United States			Germany, Switzerland			France, Italy, Spain			Sweden		
Year	1	2	3	1	2	3	1	2	3	1	2	3
Total	0.103	0.069	0.049	0.051	0.060	0.047	0.011	0.013	0.007	0.035		

The striking diversity of foreign trading patterns revealed by Figure 2 and Tables 4 and 5 raises the question of which company and market characteristics are associated with larger and more persistent foreign trading and which are instead associated with dominance of the domestic stock exchange. The rest of this section addresses this question.

4.2 Bivariate Analysis

In this subsection we explore simple bivariate correlations between company characteristics and volume trading patterns after a cross-listing. The methodology that we employ to this purpose is best illustrated by an example. Suppose that the company characteristic of interest is the fraction of foreign sales, denoted by x_{it} for company i in month t. We compute the monthly ratio of foreign to domestic trading volume y_{it} for all the cross-listed stocks in our sample, and divide these month-company observations in two groups, depending on whether x_{it} is above or below its median. Then we compute the median value of y_{it} of each group separately, and test whether they are significantly different from each other, using the Wilcoxon rank-sum test. When a company cross-lists in two or more foreign exchanges, we focus on the "most significant" cross-listing, as already defined in Section 4.1.

4.2.1 Uninformed Foreign Trading

As suggested by the discussion in Section 2, a cross-listed stock is more likely to elicit uninformed trading on the foreign market, if (i) it has a low beta with respect to the foreign market, (ii) foreign investors represent a large fraction of the total shareholder base and (iii) the company raises a large amount of capital abroad. A strong presence of institutional investors in the shareholder base may also contribute to large foreign trading volume to the extent that is coincides with a strong presence of international investors. Table 6 summarizes the bivariate results for these variables for the first three years after a cross-listing.

Table 6 Bivariate Statistics: Uninformed Trading

We report the median ratio of foreign trading volume to domestic trading volume. For each variable, we split the sample in the upper and lower 50 percent quantiles and compute the medians for each quantile. The number of observations refers to the first year after cross-listing. *** and ** indicate that the medians for the top and bottom quantiles are significantly different at the 1 percent and 5 percent significance levels, respectively.

	Nr. of Obs.		Year 1	Year 2	Year 3
Number of institutional investors (only U.S. cross-listings)	242	Top 50 %	0.319***	0.190***	0.187***
		Lowest 50 %	0.050	0.032	0.030
Shares held by institutional investors (only U.S. cross-listings)	242	Top 50 %	0.386***	0.265***	0.244***
		Lowest 50 %	0.027	0.024	0.028
Fraction of foreign ownership	97	Top 50 %	0.333***	0.082	0.186
		Lowest 50 %	0.094	0.029	0.137
Total amount of equity raised in the 5 years after the cross-listing	509	Top 50 %	0.177***	0.093***	0.046
		Lowest 50 %	0.024	0.027	0.031
Equity raised in the US after cross-listing in the U.S..	376	Top 50 %	0.261***	0.126***	0.064
		Lowest 50 %	0.024	0.036	0.046
Beta with respect to the foreign market	1097	Top 50 %	0.070**	0.080***	0.061***
		Lowest 50 %	0.040	0.037	0.025

The results in Table 6 are consistent with most of our hypotheses: the most heavily traded shares are those of companies that have a considerable presence of foreign and institutional investors in their shareholder base, and that raise substantial amount of capital in the five years after cross-listing.[2]

The beta with respect to the foreign market is the only variable for which the results of Table 6 are at variance with our hypotheses. Foreign trading volume is relatively high for stocks, which are strongly correlated with respect to the foreign market. This suggests that the diversification motive is unlikely to play a major role in the trading decisions of foreign investors: they appear to trade more heavily cross-listed companies whose risk characteristics are more similar to those of the companies already listed on the local market.

In short, except for the beta, all the variables that are associated with a larger uninformed foreign investor base according to our hypotheses in Section 2, are also associated with relatively high foreign trading volume.

[2] Some of these variables can only be observed for a subset of our sample: the fraction of foreign ownership can only be observed for 97 company-months, while share ownership of institutional investors and equity raised abroad are observed only for U.S. cross-listings.

4.2.2. Informed Foreign Trading

In accordance to the discussion in Section 2, summarized in Table 1, we measure the influence of information-based trading on the distribution of trading volume using the following variables: (i) fraction of foreign sales, (ii) company size, (iii) sensitivity to private information, (iv) industry sector, and (v) institutional factors. Table 7 summarizes our results for these variables.

We expect that companies with a large fraction of foreign sales, being more familiar to foreign investors, feature a lower informational disadvantage for foreign investors. Consistent with this idea, Table 7 shows that high foreign sales correlate with high foreign trading volume in our sample. In the first year after a cross listing, the median foreign volume is 18 percent of domestic volume for the more export oriented companies in the sample, while foreign trading volume is only 3 percent for other companies. The difference between these groups is statistically significant also two and three years after the cross-listing, although it becomes smaller over time.

The informational disadvantage of foreign investors depends on the availability of public information and on the sensitivity of the market price to private information. In Section 2 we argued that public information should be more easily available for larger firms, which generally have a longer track record and can afford larger information dissemination costs. Conversely, the value of private information should be higher for companies whose value reflect more their future growth opportunities than the value of assets in place. Accordingly, we would expect foreign trading to be higher for larger companies and lower for high-growth, high-tech and high-volatility companies. Table 7 shows the opposite results: companies with larger sales and total assets have relatively less foreign trading, while high-growth, high-tech and high-volatility companies are heavily traded, in all three years after a cross-listing.

The puzzle is reinforced when one considers analyst following as a measure of the public information available for a company. Foreign trading volume is higher for companies with lower analyst following, as measured both by the number of brokers that follow their stock and by the number of the corresponding earnings forecasts.

While some of these results are weakened or reversed (in the case of volatility) in the context of the multivariate analysis contained in the following section, others, such as the effect of size, the number of brokers or growth are reasonably robust. This suggests that, perhaps, informational asymmetries between domestic and foreign investors are actually lower in the case of small, high-growth and high-tech firms with low analyst-following. This is plausible if such firms choose to cross-list in markets where local investors have a comparative advantage in evaluating their product markets, technologies and prospects.

Besides company characteristics, security market regulation and its enforcement may affect the ratio between the foreign and domestic trading volume of a company's stock. More specifically, for cross-listed stocks investors should tend to trade on the exchange where the rules against insider trading are more stricter or more tightly enforced. The evidence in Table 7 on this score is consistent with the hypothesis that better investor protection in the foreign market elicits significantly higher trading volume on that market.

Table 7 Bivariate Statistics - Variables Related to Informed Trading.

We report the median ratio of foreign trading volume to domestic trading volume. For each variable (except for Insider Trading Laws and Enforcement), we split the sample in the upper and lower 50 percent quantiles and compute the medians for each quantile. For Insider Trading Laws and Insider Trading Enforcement, we split the sample in three subsamples, according to whether the home market variable exceeds, equals or is less than the corresponding foreign market variable. The number of observations refers to the first year after cross-listing. *** and ** indicate that the medians for the top and bottom quantiles are significantly different at the 1 percent and 5 percent significance levels, respectively.

	Nr. of obs.		Year 1	Year 2	Year 3
Fraction of foreign sales	892	Top 50 %	0.184***	0.104***	0.046***
		Lowest 50 %	0.034	0.017	0.022
Total sales	1012	Top 50 %	0.038	0.028	0.025
		Lowest 50 %	0.157***	0.092***	0.069***
Total assets	1140	Top 50 %	0.027	0.027	0.026
		Lowest 50 %	0.132***	0.081***	0.053***
Total assets – growth rate	1106	Top 50 %	0.102***	0.066***	0.035
		Lowest 50 %	0.052	0.030	0.030
Sales – growth rate	794	Top 50 %	0.170***	0.129***	0.056***
		Lowest 50 %	0.024	0.022	0.033
Equity growth rate	1052	Top 50 %	0.085***	0.050***	0.036**
		Lowest 50 %	0.029	0.030	0.026
Volatility	1097	Top 50 %	0.232***	0.156***	0.065***
		Lowest 50 %	0.025	0.027	0.025
Number of brokers	1245	Top 50 %	0.023	0.017	0.020
		Lowest 50 %	0.168***	0.100***	0.060***
Number of forecasts	1245	Top 50 %	0.022	0.018	0.020
		Lowest 50 %	0.187***	0.143***	0.108***
Industrial sector	1277	Low-technology	0.045	0.035	0.028
		High-technology	0.230***	0.176***	0.082***
Insider Trading Laws[3]	1277	Foreign < Home	0.024	0.028	0.035
		Foreign = Home	0.068***	0.046**	0.035
		Foreign > Home	0.330***	0.409***	0.518***
Insider Trading Laws Enforcement[4]	1277	Foreign < Home	0.017	0.019	0.012
		Foreign = Home	0.066***	0.043***	0.032***
		Foreign > Home	0.194***	0.187***	0.282***

4.2.3. Trading Frictions

Theory predicts that multiple trading venues may be viable in the presence of differential trading costs and market microstructures. The first row of Table 8 shows that the ratio between foreign and home trading is higher when trading costs in the foreign stock exchange are lower than in the home exchange. The second row reports how the ratio between foreign and domestic trading volume differs depending on whether or not the two exchanges have the same or different market design, categorized as of one of three types: auction, dealer or hybrid market. Again, consistently with the theory, trading volume in the foreign market is significantly higher when the two markets have different design.

[3] Significance with respect to the category "foreign < home" is included in the table. Between the remaining two categories there is a significant difference on the 99%-level.

[4] Significance with respect to the category "foreign < home" is included in the table. Between the remaining two categories there is a significant difference on the 99%-level.

Table 8 **Bivariate Statistics - Variables Related to Trading Frictions.**

We report the median ratio of foreign trading volume to domestic trading volume. In the case of trading costs we split the sample in two subsamples, according to whether the home market variable exceeds or is less than the corresponding foreign market variable. For the market design variable we distinguish whether home and foreign market have the same or different designs. The number of observations refers to the first year after cross-listing. *** and ** indicate that the medians for the top and bottom quantiles are significantly different at the 1 percent and 5 percent significance levels, respectively.

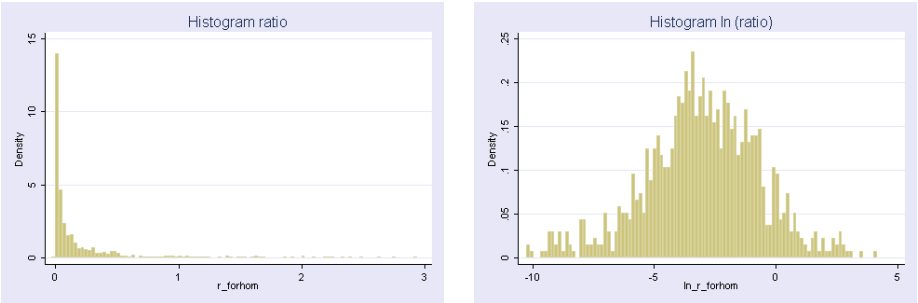
	nr. of obs.		**Year 1**	**Year 2**	**Year 3**
Trading Cost	1277	Foreign < Home	0.083***	0.058***	0.041***
		Foreign > Home	0.020	0.014	0.012
Market design (auction, dealer or hybrid)	1277	Same	0.034	0.026	0.017
		Different	0.078**	0.054***	0.040***

4.3 Multivariate Analysis of the Trading Volume Distribution

The bivariate statistics presented in Section 4.2 are suggestive of which company and market characteristics are correlated with trading volume abroad. However, we must turn to a multivariate analysis to analyze which explanatory factors have an effect on trading volume abroad. As in section 4.2, we measure foreign trading volume standardized by volume traded in the domestic market. Since this ratio can take extreme values when the denominator (domestic volume) is very low, a standard regression approach is not feasible due to the large realization of the error term for those companies where domestic volume is relatively low.

To ensure the normality of the regression residuals, we base inference on the logarithmic transformation of the dependent variable. Figure 3 shows the histograms of the ratio of foreign to domestic trading volume and its logarithmic transformation.[5]

Figure 3 Histograms of the Dependent Variable



Due to data restrictions and multicollinearity, we cannot include every variable investigated in section 4.2. Especially observations on ownership structure and on capital raised are sparse. We therefore focus on those variables, which proved important in the bivariate analysis, that are available for a large number of companies and where multicollinearity problems are not too severe. As a result we include total assets, the ratio of foreign sales to total sales, growth

[5] The logarithm of the ratio has the desired statistical properties (we cannot reject that errors from the multivariate regressions explaining this variable are normally distributed). However, in addition we have performed regressions on alternative variable transformations (especially discretizations) which yield qualitatively similar results.

in total assets, the number of analysts' forecasts covering a firm, the stock´s volatility and beta and the difference between foreign and domestic trading costs. We standardize these variables by dividing through their respective sample standard deviations. The regression coefficients can therefore be interpreted as effects of a one-standard-deviation-change of the variable. In addition to the variables mentioned we include a high-tech-sector dummy variable, the time elapsed since the cross-listing and the difference in insider trading regulation enforcement of the domestic and the foreign market.[6]

The multivariate analysis is based on a data panel including 425 company years from 79 foreign listings. The estimation is carried out for three alternative regression methods. First, we use OLS but adjust the standard errors for clustering on companies. Second, we estimate a standard random effects panel regression. Third, we allow for autocorrelation in the observation-specific error component in the random-effects panel regression.

Overall, the results displayed in Table 9 conform well with our findings in section 4.2. For all three regressions, company size has a significantly negative impact on foreign trading. While the sign of the coefficient of the number of analyst forecasts turns out to be negative, consistent with the bivariate findings, it is insignificant. This is not too surprising, since the number of analyst forecasts is positively correlated with firm size and thus looses explanatory power in a multivariate setting.

The fraction of foreign sales continues to be significantly positively related to foreign trading volume, even if other explanatory variables are considered. A one standard deviation increase in foreign sales raises the ratio of foreign trading by 17 percent![7] Similarly, being in a high-tech industry coincides with an average increase of the ratio of foreign trading by more than 100 percent.

The multivariate results also reveal that foreign trading volume decreases significantly with the time elapsed since cross-listing. Finally the effect of market and country characteristics remains significant. The foreign trading ratios in countries, which have demonstrated that insider trading laws are enforced, exceeds those from countries with lax enforcement by more than 78 percent. Furthermore, a one standard deviation increase in the difference between foreign and domestic trading costs leads to a decrease in the foreign trading ratio by approximately 36 percent.

The results in Table 9 contradict a number of our hypotheses on informed foreign trading. Large firms, and firms followed by a large number of analysts were expected to have lower informational asymmetries, leading to higher foreign trading activities. In contrast, the results in Table 9 show that small firms followed by few analysts and with high betas generate relatively more foreign trading. This may indicate that, contrary to our initial expectations, foreign investors have comparatively higher expertise in evaluating small, high-tech firms with low analyst coverage and high systematic risk. This is consistent with a situation where small, technically advanced and specialized firms list abroad in order to tap into a more sophisticated investor and analyst pool.

The results on firm size may also be consistent with Merton's investor recognition model. Large firms are already recognized by domestic and foreign investors even before a cross-listing. Even in the presence of some fixed cost barriers, foreign investors may find it optimal to incur these costs and trade in the large firms' stock in the foreign market. Thus, for these large firms a foreign listing does not generate much foreign trading. By contrast, it may not be worthwhile for foreign investors to start trading small stocks in the foreign stock market if there are barriers with some fixed cost elements. Such firms are therefore only "recognized" by foreign investors, if they are listed on the foreign market.

[6] Of course these variables are not divided by their standard deviations.
[7] The percentage change is calculated as $\exp(\beta) - 1$.

According to the above interpretation, information based trading can be viewed as a consistent explanation for the results in Table 9. Foreign markets have a comparative advantage in providing the expertise to evaluate small, high-tech firms, followed by few analysts, exhibiting high systematic risk. Furthermore, information based trading is also likely to occur in the foreign market for firms with high foreign sales, as indicated by the regression results. Finally the informational disadvantage abroad is likely to be less in markets with stricter insider trading enforcement.

The size results are also consistent with non-information based foreign trading. Small, high-tech companies may be raising more capital abroad, thus creating a relatively larger foreign shareholder base. This is consistent with the bivariate results indicating that firms raising more capital abroad create more foreign trading.

Table 9 Multivariate Regressions

The dependent variable is the logarithm of the ratio of foreign trading volume to domestic trading volume. We report the results of three multivariate regressions. First, we use OLS but adjust the standard errors for clustering on companies. Second, we estimate a standard random effects panel regression. Third, we allow for autocorrelation in the observation-specific error component in the random-effects panel regression.[8] The foreign market beta refers to the foreign market where the company has its most significant cross-listing, defined as the cross-listing followed by the highest ratio of foreign to domestic trading in the subsequent year. Betas are calculated annually as the regression coefficient of weekly stock returns on weekly foreign or domestic stock index returns. Volatility is calculated annually as the standard deviation of weekly returns. Number of forecasts is the number of forecasts issued in a specific year for a firm.

	Pooled RS	Random Effects	Random Effects with AR(1) Disturbances
LN(Total Assets)	-0.564**	-0.353***	-0.443***
Foreign Sales Ratio	0.451**	0.173**	0.158*
Asset growth	0.162*	0.040	0.022
Number of forecasts	-0.231	-0.088	-0.113
Volatility	-0.017	-0.038	-0.049
Beta	0.384**	0.108*	0.076
Trading cost difference	-0.639**	-0.365*	-0.449**
High tech sector	0.780	0.834*	0.731*
Time elapsed since cross-listing	0.050	-0.059***	-0.057***
Insider trading enforcement	0.900**	0.695***	0.578***
Number of observations (groups)	425	425 (79)	425 (79)
R^2	0.3477	0.2796	0.2763

[8] The AR(1) coefficient amounts to 0.385.

5. Trading Dynamics after Cross-Listing

In this section we analyze the dynamics of trading volume on the home and foreign market in the wake of a cross-listing. First, we analyze these dynamics in a six-months time window around the cross-listing: three months and two months after the month of cross-listing. Next, we investigate the relationship between trading volumes in different markets in order to identify spillover effects. We analyze whether one of the following effects is present: (a) *trade diversion* (the foreign market takes away trading volume from the home exchange), (b) *trade creation* (new trading abroad does not occur at the detriment of the domestic exchange), or (c) a *positive spillover* effect (foreign trading activity increases domestic trading beyond what it would have been otherwise). Therefore we use a different measure for this part of the empirical analysis, namely either the dollar trading volume (section 5.1) or the turnover ratio (section 5.2).

5.1 Empirical Analysis of Flow-back

As illustrated in Figure 2, we usually observe a peak in foreign trading volume shortly after the cross-listing date. Here we describe trading dynamics around the cross-listing dates, on both the foreign and the domestic market using the following statistics. To measure the change in volume immediately after the cross-listing, we calculate the ratio between trading in the three months *after* the cross-listing and the trading volume in the subsequent 3 months, for the home as well as for the foreign market. We denote this "post-listing trading ratio" by TR^{+}:

$$TR^{+} = \sum_{i=0}^{2} Vol_i \,/\, \sum_{i=3}^{5} Vol_i \ .$$

We also compute the ratio between trading in the three months *before* the cross-listing and the trading volume in the previous 3 months. Obviously this "pre-listing trading ratio" can be computed only for the home market, and we denote it by TR^{-}:

$$TR^{-} = \sum_{i=-2}^{0} Vol_i \,/\, \sum_{i=-5}^{-3} Vol_i$$

In both ratios, the denominator is chosen so as to try and capture the "normal" trading activity around the cross-listing. This explains why it refers to trading volume outside the six-months window around the cross-listing (the subsequent three months for TR^{+} and the previous three months for TR^{-}).

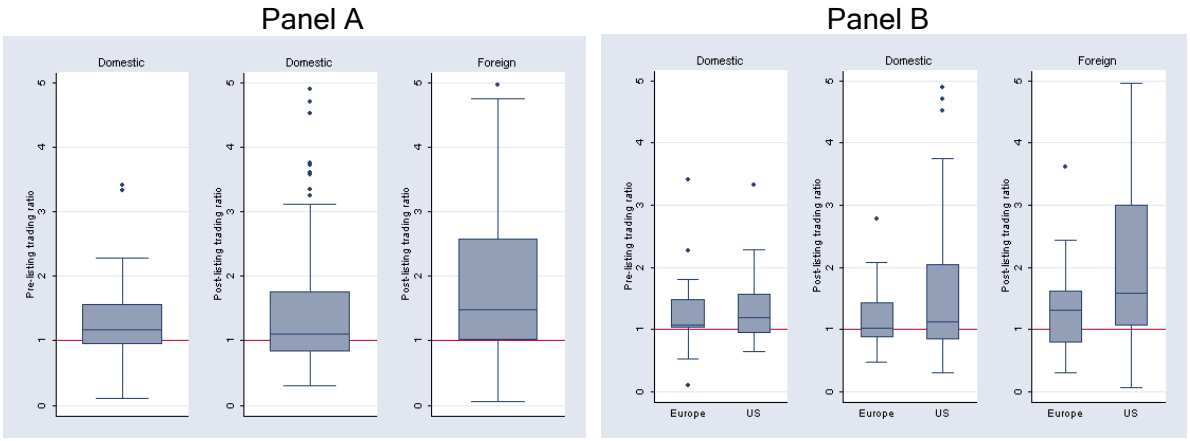
Panel A of Figure 4 displays the distribution of the statistics defined above. It demonstrates that TR^{+} is positive and significant, that is, immediately *after* the cross-listing date there is an abnormal bulge of trading activity *both* in the foreign and in the domestic market.[9] In addition, also TR^{-} is positive and significant, which reveals a run-up in domestic trading volume even *prior* to the cross-listing.

In Panel B the same statistics are reported separately depending on whether the cross-listing occurred in Europe or in the U.S.: the dynamics are qualitatively similar, but all the effects are more pronounced for the sample of U.S. cross-listings. The difference between the means of the two distributions of TR^{+} is significantly different at the 95 percent confidence level.

[9] We have also estimated Cox regressions explaining the time from cross-listing to falling below specific threshold levels. The results also document the existence of flow-back, but they do not uncover firm characteristics that influence the speed of flow-back.

Figure 4 Box Plots of Trading Pattern Immediately Before and After the Cross-listing.

In Panel A, the first two boxes describe the pre-listing and post-listing trading ratio on the home market. The third box describes the post-listing effect on the foreign market. Values above 1 indicate above-average trading activity. Statistical tests reveal at the 99%-level that the values are above 1. Panel B reports the same statistics as Panel A (in the same order), broken down by the target market, which is either Europe (24 observations) or the US (81 observations).



5.2 Spillover Effects between Domestic and Foreign Trading Volume

We now investigate the relationship between foreign and domestic trading volume, using the entire monthly time series of foreign and domestic trading volume after a cross-listing.

For each listing *i* in our sample for which at least 30 data points of monthly turnover ratios are available, we perform a set of two regressions designed to capture the dynamics of trading volume. We regress the logarithm of the home market's monthly turnover ratio (shares traded v_{it}^{H} divided by shares outstanding s_{it}) on its own first lag and on the foreign market's lagged turnover ratio:

$$\ln(v_{it}^{H} / s_{it}) = \alpha_i^{H} + \beta_{i,1}^{H} \ln(v_{it}^{H} / s_{it-1}) + \beta_{i,2}^{H} \ln(v_{it}^{F} / s_{it-1}) + \varepsilon_{i,t}^{H}$$

A similar regression is estimated for foreign trading volume:

$$\ln(v_{it}^{F} / s_{it}) = \alpha_i^{F} + \beta_{i,1}^{F} \ln(v_{it}^{F} / s_{it-1}) + \beta_{i,2}^{F} \ln(v_{it}^{H} / s_{it-1}) + \varepsilon_{i,t}^{F}$$

From each of these time-series regressions, we obtain vectors of estimated coefficients. To compute the coefficients for a "representative company" we average these coefficients. To test whether they are statistically different from zero, we notice that the ratio between the average coefficient and its standard deviation multiplied by $\sqrt{N}$-1 is distributed as a t-statistic under the assumption that the errors of each time-series regression are identically and independently distributed. The argument runs along the same lines as that used to justify the Fama-McBeth two-stage technique, with the difference that in our case we first estimate time-series regressions and then average their coefficients cross-sectionally, while the Fama-Mcbeth technique proceeds in the opposite order. We also implement a refined inference technique, by computing a weighted average of the time series coefficients where each estimated parameter is multiplied by the inverse of its estimated variance, in the spirit of Litzenberger and Ramaswamy (1979).

The results of these regressions are summarized in Table 10. Domestic trading volume is positively auto-correlated, the average coefficient of its first lag being 0.58. Out of 94 listings for which the regression is estimated, 87 have a significantly positive coefficient at the 10 percent level. Lagged foreign volume enters on average with a negative coefficient, although the dispersion across companies is large. In 18 regressions, the coefficient is negative and significant at the 10 percent level, but in 9 regressions it is positive and significant. The standard t-test rejects that the mean coefficient is statistically equal to zero. This is also confirmed by the refined test statistic that weighs the coefficient of each company by its precision.

The negative coefficient of lagged foreign turnover may be explained with the fact that as foreign investors start trading shares abroad around the cross-listing date, investment banks retire shares from the home market to issue the necessary ADRs or SDRs. This temporarily reduces trading volume abroad. The process operates in reverse when foreign trading subsides. In this sense, this result is consistent with the "flow-back hypothesis", since it indicates that the decline in foreign turnover observed after the cross-listing is followed by an increase in domestic turnover.

Foreign trading volume also exhibits significant autocorrelation. The coefficient on lagged foreign volume equals 0.54 and is estimated with high precision. However, there is no evidence that a shock in trading activity on the domestic market spills over to the foreign market. While the coefficient on domestic volume is positive on average, it is widely dispersed and both of our test statistics cannot reject the null hypothesis of a zero mean.

Table 10 Volume Dynamics

For each company we regress the logarithm of the home market's monthly turnover ratio on its own first lag and on the foreign market's lagged turnover ratio. From this set of 94 time-series regression we obtain a cross-section of coefficients. For these coefficients we report averages, standard errors and two test statistics: the standard t-test and an adjusted test in the spirit of Litzenberger and Ramaswamy (1979). We also report the weighted average and weighted standard errors required to derive the adjusted test statistic. Similarly, we report the results on the dynamics regressions for foreign turnover ratio.

Coefficient	Domestic Turnover Ratio		Foreign Turnover Ratio	
	Lagged domestic volume	Lagged foreign volume	Lagged foreign volume	Lagged domestic volume
Average	0.578	-0.030	0.536	0.050
Standard error	0.024	0.011	0.022	0.036
p-value of t-test	0	0.006	0	0.170
Weighted average	0.724	-0.015	0.622	0.004
Weighted standard error	0.009	0.005	0.009	0.012
p-value of weighted average	0	0.002	0	0.708

6. Conclusions

This paper explores how security trading volume distributes itself across competing trading venues by relying on evidence for cross-listed shares. The most striking fact that we document is the widespread presence of "flow-back": for most companies, after an initial blip in the wake of the cross-listing, foreign trading declines rapidly to very low levels.

Our second finding is that, behind this dominant pattern, there is considerable cross-sectional variation in the persistence and magnitude of foreign trading. The ratio between foreign and domestic trading volume is higher for smaller, more export and high-tech oriented companies. It is also higher for companies that cross-list on markets with lower trading costs and better insider trading protection. Most of these findings are consistent with the idea that foreign investors trade more actively share issues for which they feel less at a disadvantage relative to domestic investors.

Our third result is that there is a bulge of domestic trading activity immediately before and after the cross-listing date, while afterwards domestic trading is negatively correlated with past foreign trading activity. As a result, the decline of foreign trading after the cross-listing is followed by an increase in domestic trading, in accordance with the idea that trading volume "flows back" towards the home market.

The pervasiveness of "flow-back" documented in this paper has remarkable implications for the explanation of why companies list their shares abroad. In view of our evidence, this choice can hardly be motivated by the objective of providing an active marketplace to foreign investors. Therefore, companies that cross-list must be doing it for some other reason. The literature has identified and documented several such alternatives: making foreign investors aware of the company's existence (Foerster and Karolyi, 1999), committing to tough disclosure and corporate governance rules (Doidge, Karolyi and Stulz, 2003), accessing foreign analysts' expertise (Baker, Nofsinger and Weaver, 2002), exploiting existing product market reputation to access foreign capital markets or – conversely – supporting the company's expansion on foreign output markets (Pagano, Röell and Zechner, 2002).

The evidence that trading tends to converge toward a single trading venue is also relevant for the competition between stock exchanges. It implies that the situation in which the same stock is simultaneously traded in various exchanges is intrinsically unstable: soon or later one market ends up attracting most or even all trading activity, and in our data this dominant market invariably coincides with the exchange where the primary listing occurred. While it remains to be seen whether this finding extends also to non-European companies, it certainly underscores that it is hard for a foreign market to durably compete trading volume away from a company's domestic exchange.

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7. Data Appendix

Basic information about cross-listing events is drawn from the sources listed in Appendix A of Pagano, Röell and Zechner (2002). We extend the data set therein in the following ways, using information provided by the relevant stock exchanges:

- We include the main market segments of Denmark, Finland, Norway, Portugal, and Switzerland.
- The Swiss Exchange was formed in 1996 as a merger of the three local exchanges in Geneva, Basle, and Zurich. Before the merger we aggregate data from these three exchanges.
- For companies having a cross-listing in 1986, we determine the exact listing date if this information was available from the stock exchanges.
- We add up the time series for XETRA and the Frankfurt stock exchange.

Table 11 Variable Definitions and Sources

Variable	Source and/or Definition
Trading Volume in Dollars	Source: Financial Thomson Datastream, Reuters Equity 3000. Volume counting conventions may differ across exchanges. In particular, counting conventions generally favor high volume on dealer markets due to multiple inventory adjustments triggered by an initial trade. However, the use of a panel regression framework tends to mitigate the influence of this measurement issue. Frequency: daily, monthly and yearly (1980-2001)
Trading Volume in Shares	Source: Financial Thomson Datastream, Reuters Equity 3000 Frequency: daily, monthly and yearly (1980-2001)
Stock Prices in Dollars	Source: Financial Thomson Datastream, Reuters Equity 3000 Frequency: daily, monthly and yearly (1980-2001)
Ratio Foreign to Domestic Volume	Trading volume on foreign exchange divided by domestic trading volume.
Common Shares Outstanding	Source: GlobalVantage Frequency: yearly (1985-2000)
Turnover Ratio	Trading volume in shares divided by common shares outstanding.
Total Assets (million dollars)	Source: GlobalVantage Frequency: yearly (1985-2000)
Sales (million dollars)	Source: GlobalVantage Frequency: yearly (1985-2000)
Foreign Sales, percent	Source: Worldscope Frequency: yearly (1985-2000)
Asset Growth, percent	Source: Worldscope Frequency: yearly (1985-2000)
Equity Growth, percent	Source: Worldscope Frequency: yearly (1985-2000)
Sales Growth, percent	The difference between current sales and sales in the previous period is calculated. Sales growth equals the ratio between this difference and the sales in the previous period.
High Tech Sector	Dummy variable equalling 1 for high-tech companies and 0 otherwise. We use the same definition as applied in Pagano, Röell, and Zechner (2002). This definition is based on SIC Code provided by GlobalVantage.
Beta with Foreign Market	Yearly Beta estimates are calculated using robust regression of weekly stock returns on weekly foreign market index returns. We use a three-year estimation window. We set Beta to not available when fewer than 52 observations are available. Frequency: yearly (1983-2001)

Variable	Source and/or Definition
Beta with Home Market	Yearly Beta estimates are calculated using robust regression of weekly stock returns on weekly domestic market index returns. We use a three-year estimation window. We set Beta to not available when fewer than 52 observations are available. Frequency: yearly (1983-2001)
Volatility	Volatility is calculated annually as the standard deviation of weekly stock returns. Frequency: yearly (1983-2001)
Trading Costs	Trading Costs are calculated as the sum of commissions and fees in a given market based on global trading data from 135 institutional investors (source: Elkins/McSherry Co., Inc.). Missing values have been replaced by extrapolation. Frequency: yearly (1985-2000)
Difference in Trading Costs between Foreign and Domestic Exchange (b.p.)	Difference in trading costs is calculated as the difference between trading costs in the foreign and domestic market. Frequency: yearly (1985-2000)
Number of Brokers	The number of brokers issuing analysts' forecasts for a company in a specific calendar year aggregated from the I/B/E/S International Database. Frequency: yearly (1985-2000)
Number of Forecasts	The number of analysts' forecasts for a company in a specific calendar year aggregated from the I/B/E/S International Database. Frequency: yearly (1985-2000)
Fraction of Foreign Ownership, percent	Share ownership data on the five largest shareholders, their holdings and nationality were kindly provided by Klaus Gugler and Dennis Mueller (University of Vienna). The fraction of foreign ownership is calculated as the sum of the holdings of foreign shareholders. Frequency: yearly (but sparse) (1985-2000)
Capital Raised in Europe after cross-listing (million dollars)	We add up data for the 5 years subsequent to cross-listing, obtained from the Bank of New York for capital raised through ADRs and from Euromoney for capital raised in international markets. The data are kindly provided by Stijn Claessens, Daniela Klingebiel and Sergio L. Schmuckler. Frequency: yearly (1985-2000)
Capital Raised in US after cross-listing (million dollars)	We add up data for the 5 years subsequent to cross-listing, obtained from the Bank of New York for capital raised through ADRs and from Euromoney for capital raised in international markets. The data are kindly provided by Stijn Claessens, Daniela Klingebiel and Sergio L. Schmuckler. Frequency: yearly (1985-2000)
Shares held by institutional investors after cross-listing, percent (US Listings)	We aggregate data on institutional ownership in companies listed on US exchanges from the Financial Thomson Shareworld Database. Frequency: yearly (1985-2001)
Number of Institutional Investors after cross-listing (US Listings)	We aggregate data on the number of institutional investors in companies listed on US exchanges from the Financial Thomson Shareworld Database. Frequency: yearly (1985-2001)
Insider Trading Laws	Dummy variable that equals 1 if insider trading laws have been in place, and 0 otherwise based on Bhattacharya and Daouk (2002). Frequency: yearly
Insider Trading Law Enforcement	Dummy variable that equals 1 if insider trading laws have been enforced, and 0 otherwise based on Bhattacharya and Daouk (2002). Frequency: yearly
Market Design	We distinguish three basic market structures: auction, dealer and hybrid. London and Nasdaq are defined as dealer markets, Frankfurt and NYSE as hybrid markets, and all other markets as auction markets.
Difference in Market Design	Dummy variable equaling 1 if the market design of the foreign and domestic market are the same, and 0 otherwise.