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# The Geography of Equity Listing: Why Do Companies List Abroad?

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**ABSTRACT**

This paper documents aggregate trends in the foreign listings of companies, and analyzes their distinctive prelisting characteristics and postlisting performance. In 1986–1997, many European companies listed abroad, mainly on U.S. exchanges, while the number of U.S. companies listed in Europe decreased. European companies that cross-list tend to be large and recently privatized firms, and expand their foreign sales after listing abroad. They differ sharply depending on where they cross-list: The U.S. exchanges attract high-tech and export-oriented companies that expand rapidly without significant leveraging. Companies cross-listing within Europe do not grow unusually fast, and increase their leverage after cross-listing.

FOREIGN LISTINGS ARE BECOMING an increasingly important strategic issue for companies and stock exchanges alike. As companies become global in their product market and investment strategies, direct access to foreign capital markets via an equity listing can yield important benefits. At the same time, the international integration of capital markets has led to unprecedented levels of competition among stock exchanges. In this competitive struggle, the winners are the exchanges that manage to attract more foreign listings and the attendant trading volume and business opportunities.

Despite the importance of these issues, still little is known about which exchanges succeed in capturing more listings from abroad and why. This question is intimately related to a second issue, namely which advantages companies expect to get from a foreign listing: securing cheap equity capital for new investment, allowing controlling shareholders to divest on a liquid market, preparing for foreign acquisitions, or simply enhancing the compa-

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ny's reputation. The evidence presented in this paper is relevant for both issues, the determinants of exchanges' success and the microeconomic motives for listing abroad.

We start by providing a broad picture of the geography of cross-listings by European and U.S. companies, and by illustrating how that geography changed in recent years. This aggregate picture shows that European companies have become more "footloose" in recent years and that most of their cross-listings have been directed toward the U.S. exchanges, while U.S. companies have reduced their cross-listings in Europe. Correspondingly, the ability of European exchanges to attract listings from the rest of the world has declined, while the reverse has happened to U.S. exchanges. Interestingly, the European markets with the highest trading costs, lowest accounting standards, and worst shareholder protection have also fared worst in attracting or retaining foreign listings, and companies from those countries have been comparatively eager in seeking foreign listings.

We then turn to microeconomic data to gain a better understanding of these shifts in the geography of cross-listings, by linking companies' decisions to list abroad to their ex ante characteristics (e.g., size or foreign sales) and their ex post behavior (e.g., their growth rate after listing abroad). We investigate these relationships by using company-level data for nonfinancial European companies during the period 1986 to 1998. This data has been drawn from the Global Vantage and Worldscope databases.

We find that the European companies that list on other European exchanges and those that list in the United States have only a few common features: They are larger and more likely to be recently privatized than firms that do not cross-list. Instead, the differences between the two groups are numerous and striking. European companies that cross-list in the United States pursue a strategy of rapid, equity-funded expansion. They rely heavily on export markets both before and after the listing and tend to belong to high-tech industries. Companies that cross-list elsewhere in Europe, instead, have a higher return on assets before cross-listing, do not grow more than the control group, and increase their leverage after the cross-listing. Also, they do not rely on foreign sales to the same extent as firms cross-listing in the United States, and generally do not belong to high-tech sectors.

Thus, cross-listing in the United States appears to be driven by the need to fund growth and foreign sales expansion, generally in high-tech sectors. These motives are less common for European companies that cross-list on other European exchanges. Therefore, the changing geography of cross-listings across the Atlantic is associated with a difference in the type of companies that cross-list in the two continents. U.S. exchanges appear to be especially suited to the needs of high-growth, export-oriented or high-tech European companies.

The plan of the paper is as follows. In Section I, we outline the main reasons why companies may wish to list abroad and draw testable predictions from each hypothesis. In Section II, we analyze the overall pattern of cross-listings, studying the geographical origin and destination of firms that went public on the world's major equity exchanges in the period 1986 to

1997. In Section III, we perform a first exploration of company-level data using descriptive statistics centered on the year of cross-listing. Section IV presents an econometric analysis of the variables that affect the choice to list abroad for the first time, as well as the choice between listing in the United States or in Europe. In Section V, we try to gauge if listing abroad affects the subsequent performance of companies relative to our control sample and how this differential performance hinges on cross-listing in the United States as opposed to Europe. Finally, Section VI summarizes the results of the paper, compares them with those of related studies, and discusses their implications for the comparison between U.S. and European exchanges.

## I. Hypotheses and Related Literature

In this section, we outline the reasons why companies may want to list on an exchange outside their country of incorporation, either as their first port of entry into the public equity market or after having already listed on their domestic exchange.[1]

First of all, companies may list abroad for financial reasons: Funding abroad may be cheaper or more easily available. This can happen for various reasons, detailed below in Section I.A jointly with the empirical implications of those reasons. Second, a cross-listing may strengthen the competitive position of the company in its industry, by enhancing its reputation with suppliers, employees, and customers, as explained in Section I.B. On the other side of the ledger, the costs of listing abroad may deter certain companies, as discussed in Section I.C. Table I summarizes the testable implications of the various reasons for cross-listing, relating them both to the company characteristics and to its likely effect on subsequent performance.

### *A. Financial Benefits of Cross-listing*

By listing abroad, firms may improve the terms on which they can raise capital or on which their shareholders can sell existing securities. This motive is strongest if the firm or its shareholders need to raise capital and if financial constraints in the home market are significant. Some empirical predictions have to do with the reason why capital is needed, and others have to do with why cross-listing makes it cheaper.

The salient reason why a company may need equity funding is to carry out new investment programs. The required funding is likely to be especially large for fast-growing companies and for companies that have already exhausted their debt capacity. Therefore, companies that cross-list to raise capital should have high investment, growth rate, and leverage before cross-

[1] The decision to list on a foreign exchange is related to the more general issue of why firms go public, recently explored by Pagano (1993), Röell (1996), Bolton and von Thadden (1998), Mello and Parsons (1998), Pagano and Röell (1998), Chemmanur and Fulghieri (1999), Subrahmanyam and Titman (1999), and Stoughton, Wong and Zechner (2001).

**Table I**
**Motives for Cross-listing and Their Empirical Implications**

| Hypothesis about Motive for Cross-listing | Predicting Cross-listing (ex ante evidence) | Consequences of Cross-listing (ex post Evidence) | Stock Market Characteristics that Attract Cross-listings |
|---|---|---|---|
| 1. Raising capital for investment | High leverage; high growth, P/E, and real investment | High growth, P/E, and real investment | Deep and liquid stock market |
| 2. Stock sales by existing shareholders | Newly privatized firms | High share turnover | Deep and liquid stock market |
| 3. Broadening shareholders' base | High-risk firms | More foreign investors and high foreign turnover | Large stock market |
| 4. Foreign expertise | High-tech sector, large R&D spending | | Knowledgeable investors and analysts |
| 5. Commitment to disclosure and governance standards | Low domestic regulatory standards | Higher profitability than other companies | High regulatory standards |
| 6. Liquidity | | Higher share turnover | Stock market with low spreads, low brokerage fees, and high volume |
| 7. Relative mispricing | Low domestic E/P ratio relative to foreign E/P ratio | | Recent bull market |
| 8. Capitalizing on product market reputation | High fraction of foreign sales, especially in consumer products | | Stock market located where company's foreign sales are high |
| 9. Strengthen the company's output market | Product market competitors already cross-listed in the same exchange | Higher foreign sales and profits, without necessarily raising more capital | Market located where company's foreign sales have large growth potential |
| 10. Listing costs are low relative to benefits | Large size | | Low listing fees and disclosure requirements |

listing, other things being equal,[2] and engage in a primary equity offering at the time of the cross-listing or shortly afterwards. Moreover, such companies would be more likely to cross-list on a deep stock market. Since higher expected

[2] Since debt capacity depends on the firm's growth prospects and the nature of its assets, in relating the probability of cross-listing to leverage, we shall control for growth and various firm characteristics.

growth should translate into higher price-earning ratios (P/E), one would also expect them to have higher P/E ratios than comparable domestic companies.

Rather than via organic growth, a company may choose to expand by a merger or acquisition involving a foreign company. The acquisition of a target company is facilitated by using the bidder's shares as a medium of exchange, but the latter are an acceptable "currency" only if the two companies are listed on the same exchange.[3]

Even if the firm has no need to finance new investment, its current shareholders may want to sell out, and listing abroad can increase the market value of their stake. Privatizations are an important special case, where the government is the divesting shareholder. Therefore, newly privatized companies should be more likely to cross-list than other comparable companies. A more direct test would look at whether, in general, the main shareholders sell out at the time of cross-listing or shortly afterwards. An imperfect proxy for such divestment can be an abnormally high turnover.

We now turn to the reasons why listing abroad can raise a company's stock value.

### *A.1. Reducing Barriers for Foreign Investors*

Widening the clientele for a firm's shares improves risk sharing and thus lowers the cost of capital, as shown by Lombardo and Pagano (1999), Stulz (1999), and Martin and Rey (2000). The evidence surveyed by Karolyi (1998) on stock price behavior around cross-listings is mixed: The effect differs across companies and, even when initially positive, it often dissipates in the year after the cross-listing. On balance, non-U.S. companies listing in the United States earn positive cumulative excess returns (Foerster and Karolyi (1999)) and experience a reduction in the home market beta and thereby in the cost of capital (Karolyi (1998)). In principle, the cost-of-capital benefit should be larger for riskier firms, which therefore should have greater inducement to cross-list.[4]

Listing abroad can mitigate market segmentation by reducing barriers to foreign investors, arising from regulation (e.g., pension funds' ceiling on assets invested in foreign-listed stocks), transaction costs (e.g., the cost of converting dividends of foreign shares into domestic currency), or from lack of information. The latter ranges from total ignorance of foreign investment opportunities as in Merton's "awareness hypothesis,"[5] to an informational

[3] Listing abroad may also enhance future growth by creating the necessary contacts and reputation in the local financial community and by facilitating the identification of potential target companies.

[4] No study so far has examined if cross-listing companies have lower betas with the destination market and higher home market betas than comparable domestic companies. Consistently with Merton's (1987) model, such firms would reap the highest risk sharing gains from listing abroad.

[5] Merton (1987) derives a simple model of market equilibrium with incomplete information. Listing in a foreign market can be easily incorporated in his framework by assuming that it involves a cost but broadens the firm's investor base. Risk characteristics should then determine which firms are most likely to incur the cost of broadening their shareholder base by listing in a foreign market.

disadvantage in trading foreign stocks, as in Gehrig (1993), Brennan and Cao (1997), and Kang and Stulz (1997).[6] A foreign listing may reduce such frictions, supplying local investors with more abundant, timely, and transparent information.[7]

Foerster and Karolyi (1999) provide the most direct evidence connecting Merton's awareness hypothesis to the drop in the cost of capital at the time of cross-listing: They show that the prices of cross-listing companies rise more when they are accompanied by a greater expansion of the shareholder base. Kadlec and McConnell (1994) report related evidence for over-the-counter shares that listed in the New York Stock Exchange (NYSE): They find that the listing is accompanied by a five percent abnormal return, by an increased number of shareholders, and by a reduction of the bid-ask spread. Similarly, Miller (1999) shows that the price reaction to a cross-listing is positively correlated both with the increase in the shareholder base and with the barriers to capital flows.[8] Also consistent with the awareness hypothesis, cross-listing in New York and London is associated with increased analyst coverage and media attention (Baker, Nofsinger, and Weaver (1999)), and managers of cross-listed firms report increased prestige and visibility and growth in shareholders as the main benefits of cross-listing (Bancel and Mittoo (2001)).

### *A.2. Relying on Foreign Expertise*

The exchange where a company lists may be determined by the location of analysts with superior technological knowledge of the industry. Especially in high-tech sectors, the availability of such skills may substantially affect the availability of equity finance and the terms at which it is available by reducing informational asymmetries in the primary market. This hypothesis predicts, for example, that high-tech companies may be more likely to list in the United States where the corresponding industries are well developed. Blass and Yafeh (2000), in fact, show that Israeli and Dutch firms that list in the United States (bypassing their respective home markets) are relatively high-tech and fast growing.

### *A.3. Committing to Disclosure and Corporate Governance Standards*

The listing location may also be affected by differences in regulation. By selecting a tightly regulated foreign exchange, a firm precommits to adhere to high standards of corporate governance and/or disclosure. Exchanges com-

[6] The "home bias" induced by informational frictions may take the form of overconfidence about domestic shares relative to foreign ones, as shown by Kilka and Weber's (1997) experimental study. The publicity associated with a cross-listing could change this perception.

[7] Cross-listed firms may gain access to cheaper capital not only in the stock market but also in bond and credit markets, because more information is available about the company.

[8] Also, the long-run returns for non-U.S. firms raising equity in the United States are related to the magnitude of investment barriers that segment their home markets from world markets (Foerster and Karolyi (2000)).

pete to attract listings by designing a regulatory environment that is expected to lower the cost of capital of their companies. Huddart, Hughes, and Brunnermeier (1999) show that exchanges competing for trading volume engage in a "race to the top" regarding disclosure requirements.[9] Cantale (1996) and Fuerst (1998) argue that firms signal quality by listing on strictly regulated markets. Similarly, according to Stulz (1999), companies from countries with poor legal standards can secure a lower cost of capital by subjecting themselves to tighter standards, thus reducing the agency cost of external finance.

These models suggest that companies located in countries with particularly inadequate supervision and disclosure standards should be more likely to cross-list abroad. The evidence on this point is at best mixed. Ashbaugh (1997) documents that non-U.S. firms voluntarily adopt the tighter U.S. accounting standards. In contrast, Biddle and Saudagaran (1989) and Saudagaran and Biddle (1992) find that stringent disclosure requirements deter the listing of foreign companies. Similarly, Reese and Weisbach (2001) find that firms from countries that give weak protection to minority shareholders are less likely to list in the United States than firms from other countries, once one controls for other factors such as firm size. They interpret this as evidence that, in deciding about cross-listing, the managers of companies from low-protection countries give more weight to the reduction of their private benefits than to the public value of their shares. However, Reese and Weisbach also report some evidence that the firms from weak-protection countries that do cross-list in the United States issue more equity after the listing.

The signaling models by Cantale (1996) and Fuerst (1998) also predict that the postlisting profitability of companies cross-listing on a more demanding exchange should be better than that of companies cross-listing on other exchanges. This should be reflected in a positive stock price reaction to the cross-listing announcement. This prediction is consistent with several studies surveyed in Karolyi (1998) that report a significant price reaction for non-U.S. companies listing in the United States, which has the tightest disclosure standards, and a negligible price reaction otherwise.

Of course, if exchanges compete for new listings by adjusting their regulatory standards, this motive for cross-listing may diminish over time. For example, Fanto and Karmel (1997) suggest that current improvements in European regulatory standards are attracting U.S. institutional investors to stocks exclusively listed in Europe.

### *A.4. Liquidity*

Some markets may be better than others in the production of liquidity, for instance, because of a superior microstructure. The competitive pressure from

[9] On this point, see also Chemmanur and Fulghieri (1998).

another exchange and the greater turnover associated with a wider shareholder base can also narrow the spreads on the domestic market and raise its trading activity, as found by Kadlec and McConnell (1994), Noronha, Sarin, and Saudagaran (1996), Smith and Sofianos (1997), and Foerster and Karolyi (1998).

However, cross-listing may not always enhance liquidity, due to the potentially offsetting impact of market fragmentation, as in the models by Pagano (1989), Chowdry and Nanda (1991), and Madhavan (1995). Domowitz, Glen, and Madhavan (1998) show that liquidity may suffer in both the domestic and the foreign market if intermarket information linkages are poor, and support this point with evidence concerning Mexican companies issuing American Depository Receipts (ADRs).

To test if the competition or the fragmentation effect prevails, one can analyze indicators of home market liquidity after cross-listing, such as turnover volume, turnover ratios, or bid-ask spreads on the domestic market. Additional insights can come from considering the same statistics for the foreign market.[10]

### *A.5. Relative Mispricing*

Firms may decide to list abroad to take advantage of a temporarily high price for their shares abroad relative to their home market, due either to an overvaluation in the foreign market or to an undervaluation in the domestic market. This hypothesis can be tested by including the price indices of the two exchanges (or the relevant sectoral indices) in regressions explaining the probability of a foreign listing.

### *A.6. Capitalizing on Product Market Reputation*

Companies that sell popular brands abroad may find it easier to place their shares in foreign markets because local investors already trust them as consumers. A simple strategy to test this hypothesis is to look at indicators of the degree of sales internationalization for companies that cross-list. One would expect a larger fraction of revenue coming from abroad to encourage eventual cross-listing. Saudagaran (1988) shows that 104 companies already listed abroad in 1981 had a higher proportion of foreign sales than a control sample. This, however, begs the question of which came first, the outward orientation of these companies or the cross-listing. Only in the former case may these companies have cross-listed to capitalize on their product market reputation.

[10] A related issue is whether foreign trading volume of cross-listed stocks tends to remain permanently high after the foreign listing or gravitates back towards the home market over time ("flowback").

### *B. Product and Labor Market Spillovers*

In the hypothesis laid out in the previous paragraph, foreign market presence improves the firm's ability to access foreign capital markets via a cross-listing. But the reverse can also be true. A cross-listing can be an advertisement for the firm's products and thereby increase its foreign sales, by raising consumer demand and improving relationships with suppliers and employees.[11] In the model by Stoughton et al. (2001), a company lists to signal its high product quality to consumers, and as a result, captures a larger market share and increases its profits. In this case, a listing is not associated with the need to raise capital or with the shareholders' plan to sell out.

The importance of this motive is underscored by anecdotal evidence[12] as well as by the results of the survey by Bancel and Mittoo (2001): 16 percent of European cross-listed companies rate easier implementation of global marketing and production as a motive for cross-listing.

The product market spillover hypothesis predicts that cross-listed companies increase their fraction of foreign sales. It is also consistent with higher overall sales growth and profits after the cross-listing.[13] Furthermore, it should be relevant only for industries where product market reputation is particularly important, such as producers of retail goods. An additional twist to this hypothesis is the prediction that companies in a particular industry should cross-list on the same exchange, if indeed being listed on that exchange confers a competitive advantage. Therefore, a company's probability of cross-listing on a given exchange should be positively related to the number of other companies in the same industry already cross-listed on that exchange.

### *C. Cost of Listing Abroad*

Listing abroad also involves a variety of costs. There are direct costs, such as listing charges and fees for professional advice. But the main costs cited in survey evidence regarding potential cross-listings in the United States (see Fanto and Karmel (1997)) are the cost of complying with U.S. GAAP

[11] It may also improve the quality of its managerial decisions since, after the foreign listing, its stock price incorporates information, which, otherwise, managers may have overlooked.

[12] For instance, a prominent corporate lawyer explains Glaxo's cross-listing as follows: "When we helped Glaxo into the U.S. markets for the first time, they weren't interested in raising funds; they were just interested in increasing their name recognition and market following here in the United States. Believe it or not, at that time, hardly anybody had ever heard of Glaxo in the United States, and now it's pretty much a household name" (Decker (1994), p. 512). On the same score, the NYSE features regular advertising events for listed firms on its premises or at the opening bell, which is the most televised daily event in the world. For instance, on April 24, 2000, Honda Motor Company announced at the opening bell the next day's official groundbreaking of a new $400 million plant in Alabama.

[13] As far as profitability is concerned, caution is in order because this effect is also consistent with other hypotheses. Moreover, the corresponding test may be biased because companies may choose to list when their earnings performance is abnormally good, and may even manipulate their accounts (as found by Teoh, Welch, and Wong (1998a, 1998b)).

accounting standards and the risk of lawsuits. Presumably, shareholders' power to interfere in managerial decisions increases with a U.S. listing. This survey evidence agrees with the results of the above-quoted studies by Biddle and Saudagaran (1989) and Saudagaran and Biddle (1992).

Since the costs of cross-listing include a large fixed cost element, they bear most heavily on small companies. Thus, we expect larger companies to be more likely to cross-list. This prediction is borne out by Saudagaran's (1988) study.

## II. The Changing Geography of Equity Listings

This section describes the cross-listing behavior of European and U.S. companies in the last decade. First, we document the "geography" of cross-listings, by gauging regional clusters in cross-listing behavior. Second, we inquire if these patterns have changed over time, and how. In particular, we investigate if there have been substantial changes in "transatlantic listings," that is, in the tendency of European companies to list in the United States and of U.S. corporations to list in Europe. Third, we try to relate these changes to characteristics of the exchanges concerned. The sources of the cross-listing data used in the tables and figures of this section are described in Table A1 in the Appendix.

### *A. Geographical Pattern of Cross-listings*

Table II summarizes the pattern of foreign listings in the period 1986 to 1997 on the following stock exchanges: Amsterdam, Brussels, Frankfurt, London, Madrid, Milan, Paris, Stockholm, Vienna, Easdaq, AMEX, Nasdaq, and NYSE.[14] Since until November 1998, European companies could not list their shares directly on U.S. exchanges, all the cross-listings on U.S. markets in our sample were effected via American Depository Receipts (ADRs).[15] ADRs are issued by a U.S. depository bank and represent shares held overseas. They confer to their holders the same income and voting rights as the underlying shares and trade in the United States like other securities, although a small fee per share must be paid to the depository bank for each trade and when dividends are cashed.

Panel A displays a matrix of foreign listings, with the country of incorporation appearing in the columns and the destination stock exchange along the rows. Each cell of the table contains three values: the top one refers to

[14] The figures in the table refer to the stock of foreign listings on a given market, not the flow of new listings in a given year. Moreover, the figures do not include shares traded in foreign markets without a cross-listing, such as those traded on SEAQ-International in London or in the German "third market." The inception of such trading activity does not require any involvement of the company concerned. In addition, it does not confer most of the benefits of a listing (such as the ability to raise equity capital or the added reputation), nor does it entail the corresponding costs.

[15] Some Dutch companies issue "New York shares," which are very similar to ADRs.

1986, the middle to 1991, and the bottom one to 1997. For each stock exchange, the table displays only the foreign listings originating in the countries of our sample: Netherlands, Belgium, Germany, Italy, United Kingdom, Spain, France, Sweden, Austria (henceforth shortened to EU9 countries), and the United States. For instance, Japanese, Australian, or Canadian companies are excluded (evidence on these is deferred to Panel C of Table II).

The column of a given country shows where the companies originating from that country have cross-listed, and the column EU9 shows in which exchanges European (EU9) companies have cross-listed. The last column shows how cross-listing companies from the EU9 and U.S. area have distributed themselves within the area. Looking instead at each row across columns, one gauges each country's contribution to the total number of foreign listings in a given market.

The table suggests that common language and similar institutions foster cross-listings. For example, the Vienna stock exchange is the single largest destination for German companies and vice versa. The same is true for the United States and the United Kingdom. This "clustering" indicates that companies tend to cross-list in countries geographically or culturally close to their country of incorporation, presumably for informational reasons. For a U.S. investor, for instance, the accounting data and the performance of a British company are easier to decipher than those of a French or Spanish company. This parallels the findings by Portes and Rey (1999) and by Tesar and Werner (1995) that geographical proximity and cultural homogeneity (especially language) enhance cross-border securities transaction flows.

### *B. Changes in the Geography of Cross-listings*

The information in Panel A of Table II also gives a picture of how the geography of European and U.S. cross-listings has changed between 1986 and 1997. The two bottom lines give an overall view of the change in the cross-listings pattern. The row "Total listings" displays the number of *listings* that companies from a given country have in the foreign exchanges included in our sample. The bottom row "Total companies" eliminates double counting by reporting the number of *companies* from a given country with at least one foreign listing. The number of foreign listings originating in a given country is greater than (or at least equal to) the corresponding number of companies listed abroad, because the same company can be listed in several foreign exchanges.

The numbers in these two rows reveal that European companies have become more outward looking in their search for investors: the number of EU9 companies listed abroad doubled (from 177 to 337) and the total number of their foreign listings increased by 61 percent (from 320 to 516).

In contrast to European companies, European stock exchanges do not appear to have become equally outward oriented. Foreign listings on most European exchanges exhibit an inverse U-shaped time pattern over time. In

**Table II**

## Number of Cross-listings in 1986, 1991, and 1997 (End-of-Year Values)

Panel A: EU9–USA Cross-listings Matrix

| Stock Exchange | Country of Origin | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Netherlands | Belgium | Germany | Italy | U.K. | Spain | France | Sweden | Austria | EU9 | USA | Total Comp. |
| Amsterdam | | 7 | 12 | 3 | 14 | | | 2 | | 38 | 129 | 167 |
| | | 8 | 11 | 3 | 20 | | 2 | | | 44 | 108 | 152 |
| | | 7 | 10 | 1 | 11 | | 2 | | | 31 | 83 | 114 |
| Brussels | 15 | | 10 | 5 | 14 | | 8 | 2 | | 54 | 36 | 90 |
| | 15 | | 9 | 4 | 17 | | 13 | 1 | 1 | 60 | 36 | 96 |
| | 14 | | 8 | 2 | 11 | | 12 | 1 | 1 | 49 | 34 | 83 |
| Frankfurt | 12 | 2 | | 4 | 14 | 6 | 5 | 3 | 2 | 48 | 51 | 99 |
| | 16 | 4 | | 6 | 21 | 4 | 10 | 4 | 9 | 74 | 58 | 132 |
| | 19 | 4 | | 5 | 13 | 4 | 8 | 4 | 8 | 65 | 42 | 107 |
| Italian | | | 2 | | | | | | | 2 | | 2 |
| | | | 3 | | | | 1 | | | 4 | | 4 |
| London | 7 | 2 | 8 | 1 | | 4 | 4 | 15 | | 41 | 193 | 234 |
| | 10 | 1 | 11 | 1 | | 4 | 7 | 13 | | 47 | 159 | 206 |
| | 11 | 2 | 11 | | | 4 | 5 | 14 | | 47 | 111 | 158 |
| Madrid | | | 3 | | | | | | | 3 | | 3 |
| | | | 3 | | | | 1 | | | 4 | | 4 |
| Paris | 10 | 12 | 12 | 6 | 14 | 5 | | 5 | | 64 | 52 | 116 |
| | 9 | 11 | 15 | 6 | 24 | 5 | | 5 | 1 | 76 | 52 | 128 |
| | 8 | 9 | 13 | 3 | 17 | 4 | | 5 | 2 | 61 | 37 | 98 |
| Stockholm | | | | | | | | | | 0 | 1 | 1 |
| | | | 1 | | | | 2 | | | 3 | 1 | 4 |
| | 1 | | 1 | | | | 2 | | | 4 | 5 | 9 |
| Vienna | 4 | | 17 | | 1 | | | | | 22 | 3 | 25 |
| | 5 | | 21 | 3 | 1 | | | | | 30 | 4 | 34 |
| | 5 | | 20 | 1 | | | | | | 26 | 2 | 28 |
| Easdaq | | 6 | | 2 | 3 | | 5 | | 2 | 18 | 2 | 20 |
| European exchanges | 48 | 23 | 59 | 19 | 57 | 15 | 17 | 27 | 2 | 267 | 465 | 732 |
| | 55 | 24 | 73 | 23 | 83 | 13 | 34 | 23 | 11 | 339 | 418 | 757 |
| | 58 | 28 | 69 | 14 | 55 | 12 | 36 | 24 | 13 | 309 | 316 | 625 |
| AMEX | | | | | 3 | | | | | 3 | | 3 |
| | | | | | 4 | | 1 | | | 5 | | 5 |
| | | | | | 4 | | | | | 4 | | 4 |
| Nasdaq | 6 | | 1 | | 18 | | 2 | 7 | | 34 | | 34 |
| | 5 | | 1 | | 25 | | 2 | 6 | | 39 | | 39 |
| | 17 | 3 | 1 | 2 | 55 | | 8 | 10 | | 96 | | 96 |
| NYSE | 4 | | | | 11 | 1 | | | | 16 | | 16 |
| | 6 | | | 4 | 26 | 7 | 3 | | | 46 | | 46 |
| | 16 | 1 | 7 | 11 | 46 | 9 | 14 | 3 | | 107 | | 107 |
| Total listings | 58 | 23 | 60 | 19 | 89 | 16 | 19 | 34 | 2 | 320 | 465 | 785 |
| | 66 | 24 | 74 | 27 | 138 | 20 | 40 | 29 | 11 | 429 | 418 | 847 |
| | 91 | 32 | 77 | 27 | 160 | 21 | 58 | 37 | 13 | 516 | 316 | 832 |
| Total companies | 27 | 17 | 26 | 10 | 54 | 8 | 15 | 18 | 2 | 177 | 284 | 461 |
| | 32 | 15 | 29 | 11 | 89 | 9 | 22 | 15 | 9 | 231 | 234 | 465 |
| | 48 | 24 | 31 | 19 | 130 | 10 | 43 | 21 | 11 | 337 | 184 | 521 |

**Table II**—*Continued*

Panel B: Summary of Transatlantic Listings

| | Country of Origin | | | |
|---|---|---|---|---|
| | EU9 Countries | | U.S. | |
| Stock Exchange | Foreign Listings | Foreign Companies | Foreign Listings | Foreign Companies |
| EU9 exchanges | 267 | 147 | 465 | 284 |
| | 339 | 182 | 418 | 234 |
| | 309 | 180 | 316 | 184 |
| U.S. exchanges | 53 | 52 | | |
| | 90 | 89 | | |
| | 207 | 206 | | |

Panel C: Listings on EU9–USA Exchanges from the Rest of World, by Country or Region of Origin

| | Country of Origin | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Stock Exchange | Australia, New Guinea, New Zealand | Canada | Central and Eastern Europe | Central and South America | Israel | Japan | Rest of Africa | Rest of Europe | Rest of Asia | South Africa | West Indies |
| Amsterdam | 2 | 13 | | | | 23 | 1 | 4 | 1 | 2 | |
| | 5 | 8 | | | | 24 | 1 | 5 | 2 | 1 | |
| | | 4 | | | | 21 | | 3 | 2 | 1 | |
| Brussels | | 9 | | | | 6 | 6 | 7 | | 16 | |
| | 1 | 11 | | 1 | | 6 | 6 | 9 | | 16 | 1 |
| | | 9 | | 1 | | 5 | 4 | 6 | | 18 | |
| Frankfurt | | 2 | | | | 57 | | 12 | | 5 | |
| | 6 | 4 | | 1 | | 60 | | 23 | | 5 | |
| | 3 | 2 | | | | 56 | | 18 | | 6 | |
| Italian | | | | | | | | | | | |
| London | 18 | 25 | 1 | 7 | 3 | 8 | 8 | 14 | 22 | 90 | 4 |
| | 19 | 29 | 1 | 16 | 3 | 27 | 7 | 24 | 15 | 94 | 15 |
| | 14 | 22 | 14 | 19 | 2 | 29 | 6 | 18 | 50 | 55 | 5 |
| Madrid | | | | | | | | | | | |
| Paris | 1 | 15 | 1 | 3 | | 16 | 11 | 8 | | 22 | 1 |
| | 3 | 13 | 1 | 4 | | 37 | 12 | 8 | 2 | 22 | 1 |
| | 1 | 7 | | 3 | | 32 | 10 | 8 | 1 | 17 | 1 |
| Stockholm | | | | | | | | 6 | | | |
| | | 1 | | | | | | 7 | 1 | | |
| | | 1 | | | | | | 4 | | | |
| Vienna | | | | | | | | 1 | | | |
| | | | 2 | | | | | 5 | | | |
| | | | 2 | | | | | 2 | | | |
| Easdaq | | 1 | | | | | | 2 | | | |
| AMEX | | 34 | | 1 | 5 | | | | 3 | 1 | 1 |
| | | 44 | | 1 | 5 | | | 2 | 8 | 1 | 2 |
| | 1 | 40 | | 4 | 5 | | | | 4 | 1 | 3 |
| Nasdaq | 12 | 119 | | 11 | 16 | 16 | | 8 | 2 | 17 | 9 |
| | 10 | 125 | | 8 | 23 | 15 | | 6 | 1 | 17 | 9 |
| | 22 | 165 | | 26 | 71 | 16 | | 23 | 14 | 15 | 8 |
| NYSE | 1 | 21 | | 3 | 1 | 8 | | 2 | 2 | 1 | 4 |
| | 9 | 27 | | 4 | 1 | 9 | | 3 | 3 | 1 | 4 |
| | 15 | 65 | 2 | 93 | 6 | 11 | | 21 | 32 | 1 | 13 |
| Total listings | 34 | 238 | 2 | 25 | 25 | 134 | 26 | 62 | 30 | 154 | 19 |
| | 53 | 262 | 4 | 35 | 32 | 178 | 26 | 92 | 32 | 157 | 32 |
| | 56 | 316 | 18 | 146 | 84 | 170 | 20 | 105 | 103 | 114 | 30 |
| Total companies | 32 | 198 | 1 | 21 | 23 | 81 | 24 | 44 | 30 | 102 | 16 |
| | 36 | 221 | 3 | 26 | 31 | 99 | 24 | 63 | 32 | 105 | 29 |
| | 47 | 285 | 18 | 139 | 84 | 100 | 19 | 78 | 101 | 67 | 28 |

the European exchanges as a whole, the total number of foreign listings increased very slightly from 732 in 1986 to 757 in 1991, and then declined to 625 in 1997 (see the last cell in the row "European exchanges"). So these exchanges lost over 100 foreign listings in a decade.

The opposite picture emerges when one considers American companies and exchanges. U.S. companies have become less eager to list in Europe, with their number decreasing from 284 to 184. In contrast, U.S. exchanges (especially the Nasdaq and the NYSE) have captured an increasing share of foreign listings by European companies. The listings of EU9 companies in the United States went from 53 in 1986 to 207 in 1997, while in the same interval, their listings within Europe went from 267 to 309.

The contrast between these two opposite flows of "transatlantic listings" emerges very clearly in Panel B of Table II. While European listings in the United States almost quadrupled (from 53 to 207), the number of U.S. companies listed in Europe fell by over a third (from 284 to 184). In 1986, the U.S. firms listed in Europe were more than five times as many as the European firms listed in the United States. In 1997, the latter outnumbered the former. This suggests that the relative attractiveness of European equity markets declined in this time window.

Panels A and B of Table II do not account fully for the outward orientation of each exchange, because they neglect the listings originating outside our sample of countries. Panel C completes the picture, by reporting cross-listings originating from the rest of the world. Canadian, Latin American, and Israeli companies are major sources of listings in U.S. exchanges, while they list much less frequently in Europe. In contrast, South African and Asian companies list predominantly in London—with the exception of Japanese corporations, which gravitate primarily towards Frankfurt. Considering instead how the overall pattern changed over time, one sees again that the U.S. exchanges have captured the lion's share of the increase in cross-listings from the rest of the world, especially those from Australia, Canada, Latin America, and Israel. In contrast, in most cases, European exchanges have lost cross-listings originating from these regions.

The data in Table II raise three questions. First, is the decline of foreign listings on European exchanges part of a general decline in their ability to attract new listings, including domestic ones? Second, are the three data points reported in Table II representative of the history of cross-listings between 1986 and 1997? Third, how did the foreign listings of the various markets considered evolve before 1996?

Figure 1a addresses the first question. It displays the time pattern of domestic and foreign companies listed on each exchange, as well as their total number. The European exchanges' inability to attract new listings appears not to be confined to foreign listings alone. Most of them have not attracted a large number of new domestic listings either, especially in the 1990s, with the exception of Frankfurt and, to some extent, London. The opposite is true of U.S. exchanges, where both domestic and foreign listings

increased over the sample period: Domestic listings rose from 6,168 in 1986 to 7,950 in 1997 (a 29 percent increase), while foreign listings increased from 350 to 873 (a staggering 150 percent increment, mostly accounted for by the NYSE).

Figure 1b shows how cross-listings from our EU9 countries and the United States evolved in each exchange. It is based on the same data as Table II, except that it reports figures for all the years of our sample. The dotted line is the number of foreign companies (from the rest of EU9 and the United States) listed on a given domestic exchange, whereas the solid line is the number of domestic companies listed in other EU9 and U.S. exchanges. For almost all the European exchanges, the dotted lines are declining and the solid lines are rising, especially toward the end of the sample period, whereas the opposite is true for U.S. exchanges. This confirms the findings of Table II.

Finally, we present some evidence to check if the trends documented so far are recent or have been present already for a long time. Figure 2 displays the time series of the total number of foreign listings on the NYSE and the subtotal of these NYSE listings originating in the EU9 countries. The two series feature very modest growth from 1956 to the mid-1980s and accelerate sharply in the last 15 years. Table III provides comparable data for European exchanges in 1975, 1980, and 1985. The resulting picture is somewhat heterogeneous, but on the whole, it is not as negative as in later years. London and Frankfurt experienced a large increase in the number of foreign listings. Vienna and Stockholm had large proportional increases, though starting from a small base. Paris, Brussels, Milan, and Madrid featured very little change, as they do after 1985. Only foreign listings in Amsterdam decreased sharply, in line with their post-1985 downward trend.

Therefore, the growing internationalization of U.S. exchanges and the decreasing attractiveness of European ones are recent phenomena, which largely occur in the interval covered in the present study. The mid-1980s mark a sharp break from a period in which U.S. stock exchanges were insular, some European exchanges substantially expanded their foreign listings, and companies were less footloose.

### *C. Relationship with Characteristics of Stock Exchanges*

The changes in the geography of equity listings documented so far raise the question of whether they are related to some characteristics of the exchanges and countries concerned. Table IV provides some information on market characteristics, based on the hypotheses outlined in Section I and summarized in the last column of Table I: accounting standards, degree of investor protection, market index performance, market capitalization, and trading costs.

In the first three columns, we report information on the gross and net change in cross-listings of each exchange, based on the same data used for

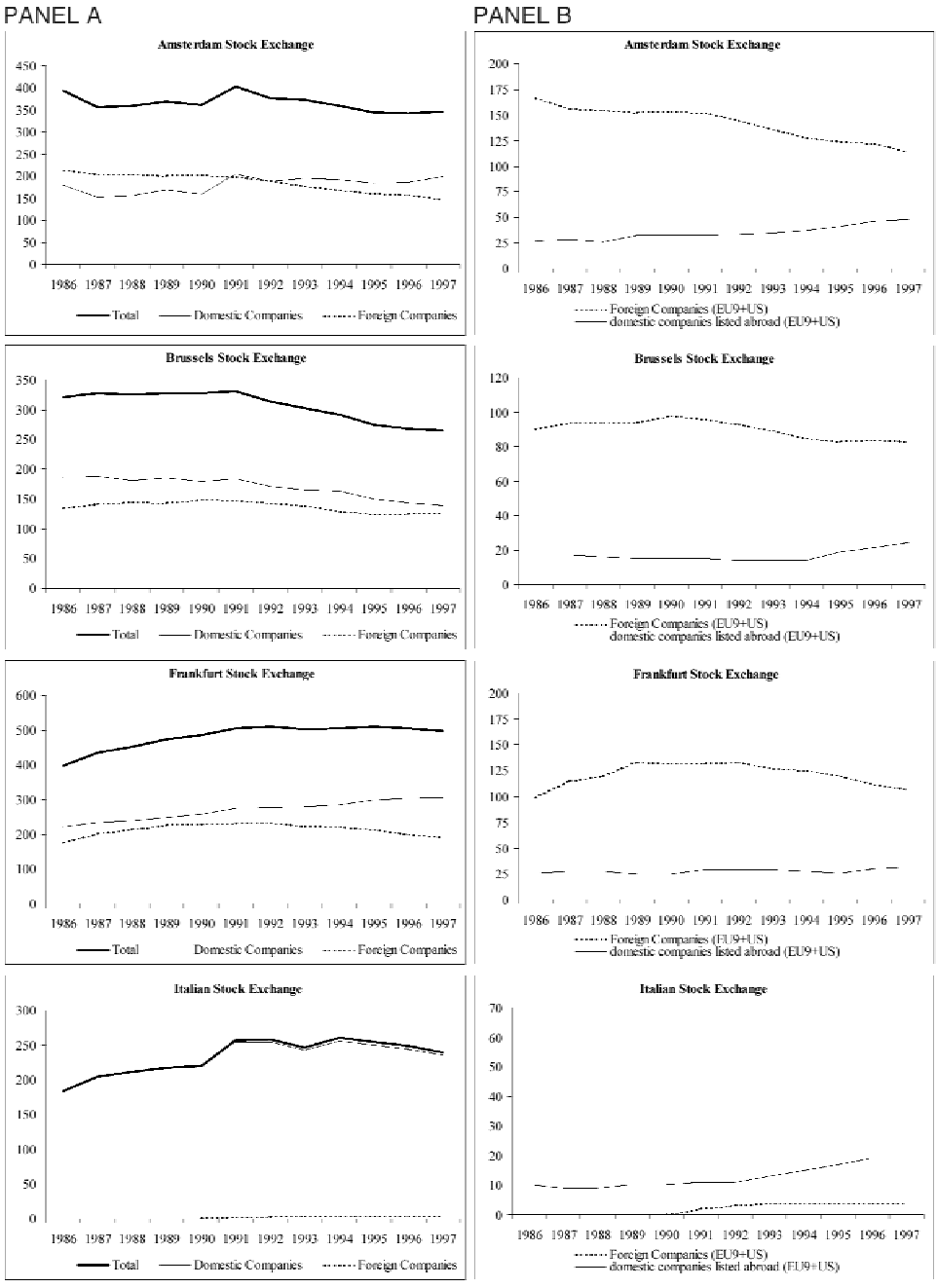


**Figure 1. (a) Number of companies listed on each exchange, domestic, foreign, and total. (b) Number of foreign listings from EU9 and the United States present on each exchange, and number of domestic companies cross-listed on EU9 and U.S. exchanges.**

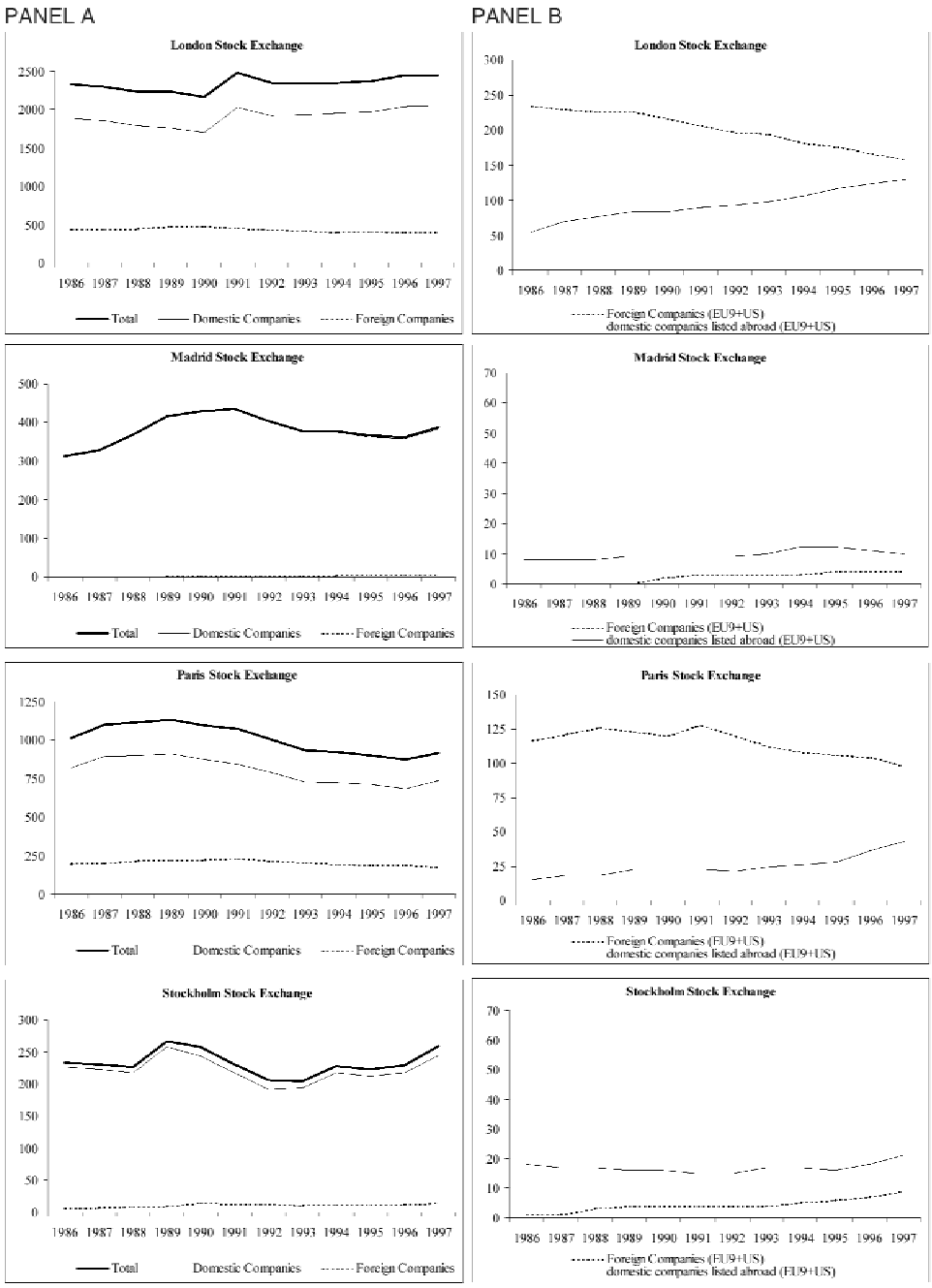


**Figure 1. Continued.**

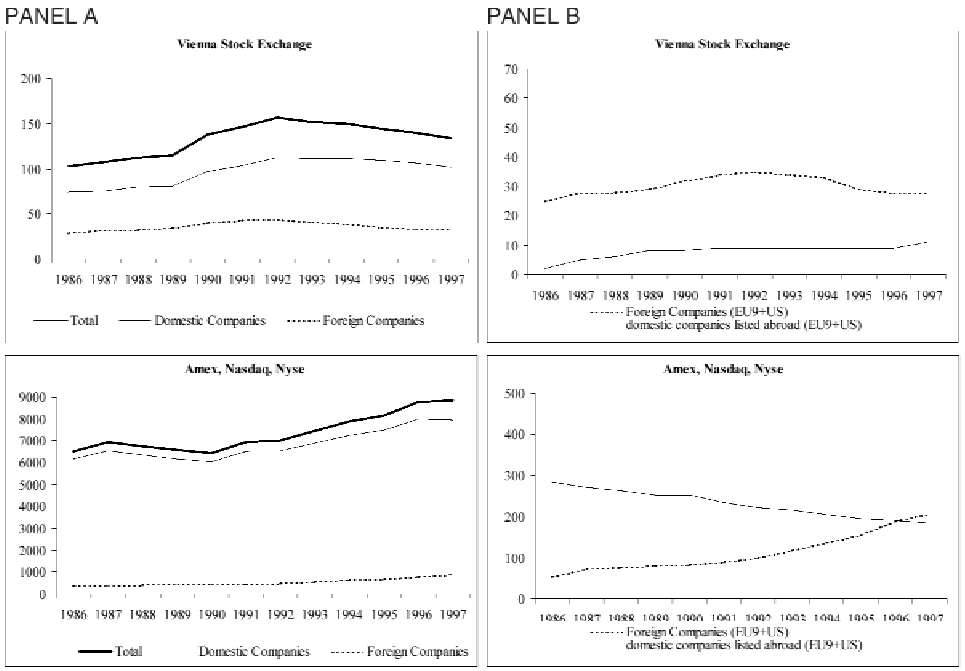


**Figure 1. Continued.**

Table II, Panel A. In accord with the results so far illustrated, most EU9 markets are net losers of listings (Sweden being the only exception), while the U.S. market experiences a net gain. The normalized net change in the fourth column of the table indicates that the net loss has been particularly large in the Netherlands, followed by Great Britain, Austria, and Belgium (in this order).

Of all the market characteristics measured in Table IV, trading costs is the indicator that appears to have the closest correlation with the normalized net change in cross-listings. The two markets with the highest trading costs, Great Britain and Austria, both feature a large net outflow of cross-listings.[16] By contrast, U.S. exchanges, which attract most cross-listings, have the lowest trading costs. Also investor protection and accounting standards appear to be positively correlated with the net change in cross-listings, with the glaring exception of Great Britain. The relationships between the net change in cross-listings and other market characteristics are less clear-cut.

[16] The only other country with a high net outflow of listings, the Netherlands, has high trading costs only if measured to include market impact.

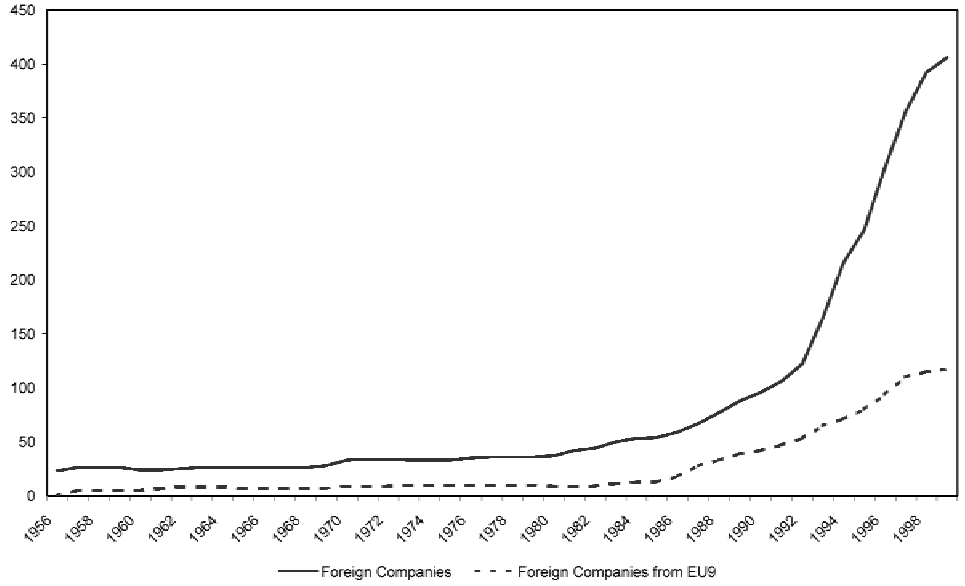


**Figure 2. Number of foreign listings on the New York Stock Exchange.** The top line in the figure is the total number of non-U.S. common and preferred shares listed on the New York Exchange at the end of each year, from 1956 to 1999. The bottom line shows the corresponding figure for the EU9 countries (Austria, Belgium, France, Germany, Italy, Netherlands, Spain, Sweden, and United Kingdom).

To shed further light on these relationships, one must go beyond correlations between aggregate data such as those reported in Table IV. Pagano et al. (2001) take a first step in this direction, by computing correlations between companies' cross-listing decisions and the differential characteristics of their destination and origin exchange (or country). Their evidence confirms that companies tend to cross-list in markets more liquid than their own, as suggested by the descriptive statistics in Table IV, as well as larger markets. They also prefer exchanges where several companies from their industry are already cross-listed, as well as countries with better investor protection.

While market and country attributes may shed some light on where companies cross-list, the very decision to list abroad is likely to depend mainly on company-specific characteristics, as highlighted by the theories discussed in Section I. In the rest of the paper, therefore, we turn to the analysis of company-level data. We also explore whether companies with different characteristics tend to cross-list on European or U.S. exchanges, since these two sets of exchanges differ significantly in several potentially relevant dimensions, as shown in Table IV.

**Table III**

**Foreign Listings on European Exchanges, 1975 to 1985**

This table reports the total number of foreign listings on European exchanges, end-of-year values. The figures are not fully comparable to those of Table II, because they include investment trusts and, for Paris, do not include the listings of the Second Marché. The data for the Frankfurt Stock Exchange are drawn from the Stock Exchange Statistics of Frankfurter Wertpapierboerse, 1988 issue. All other data were provided by the Federation International de Bourses de Valeurs (FIBV).

| | Year | | |
|---|---|---|---|
| Stock Exchange | 1975 | 1980 | 1985 |
| Amsterdam | 323 | 294 | 242 |
| Brussels | 149 | 152 | 144 |
| German | 129 | 173 | 177 |
| Italian | 1 | 0 | 0 |
| London | 370 | 482 | 572 |
| Madrid | 3 | 0 | 0 |
| Paris | 160 | 162 | 189 |
| Stockholm | 0 | 0 | 7 |
| Vienna | 27 | 35 | 38 |

## III. Company-Level Data: Descriptive Statistics

In the rest of this paper, we investigate the characteristics and performance of the companies that cross-list, using companies that do not as our control sample. The sample includes all the companies listed domestically in the main segment of our nine European exchanges at any time during the period 1986 to 1997, and for which balance sheet information is available in the Global Vantage database (at least partly) for the 1986 to 1998 interval. We exclude from the sample financial companies and investment funds, as well as companies not listed in their country of incorporation.[17] Table A2 in the Appendix contains the definitions of the variables.

Summary statistics for the entire sample are provided in Panel A of Table V. The total number of companies is 2,322. The median company has assets of U.S. $350 million, sales of U.S. $380 million, and 2,760 employees. The median growth rate is 7.46 percent for assets, 6.55 percent for property plant and equipment, and 7.40 percent for sales. The median company has leverage of 9.30 percent, market-to-book ratio of 2.11, and earns about one third of its revenue from foreign sales.

[17] Within the database, we select only the companies in the Global Vantage sections named "industrial active" or "industrial research" and listed on their home-country stock exchange. To exclude financial companies, all companies with SIC codes starting with 6 have been dropped. We scrutinized companies whose name (or, in the case of U.K. companies, SEDOL codes) changed during the sample period to identify cases where mergers occurred: When a merger was identified and the merged company listed on any foreign market, the new merged company was treated as a new listing.

**Table IV**

## Foreign Listings, Market, and Country Characteristics

This table merges information on cross-listings within the EU9 and U.S. area with market and country characteristics. Change in Cross-Listings into Market is the change in the number of cross-listings of EU9 and U.S. companies on a given market between 1986 and 1997. Change in Cross-Listings Out of Market is the change in the number of listings by domestic companies on other EU9 and U.S. markets between 1986 and 1997. Net Change is the difference between Change in Cross-Listings into Market and Change in Cross Listings Out of Market. Normalized Net Change is the ratio of Net Change to the total number of EU9 and U.S. companies listed in 1991 on the relevant market, multiplied by 100. Accounting Standards is the rating reported by La Porta et al. (1998) on the basis of 1990 accounting information. Investor Protection is the Antidirector Rights Index from LaPorta et al. (1998). Yearly Market Return is the percent annual change in the corresponding MSCI market return index in U.S. dollars, with dividend reinvested, between 1986 and 1997, year-end values. Capitalization is measured in billions of U.S. dollars in 1991 (source: International Federation of Stock Exchanges). Trading Cost is measured in basis points as of the third quarter of 1998. It is the average sum of commission and fees (with market impact added in on the second line of each cell) in a given market based on global trading data from 135 institutional investors (source: Elkins/McSherry Co., Inc.).

| Market | Change in Cross-listings into Market | Change in Cross-listings out of Market | Net Change | Normalized Net Change | Accounting Standards | Investor Protection | Yearly Market Return | Market Capitalization | Trading Costs (Including Market Impact) |
|---|---|---|---|---|---|---|---|---|---|
| Netherlands | −53 | +33 | −86 | −24.2 | 64 | 2 | 18.68 | 135.98 | 23.01<br>(34.56) |
| Great Britain | −76 | +71 | −147 | −6.6 | 78 | 5 | 15.73 | 986.11 | 41.20<br>(51.88) |
| Austria | +3 | +11 | −8 | −5.8 | 54 | 2 | 7.31 | 26.04 | 32.44<br>(51.29) |
| Belgium | −7 | +9 | −16 | −5.7 | 61 | 0 | 15.10 | 71.11 | 24.28<br>(33.21) |
| Germany | +8 | +17 | −9 | −2.2 | 62 | 1 | 10.13 | 392.47 | 24.23<br>(29.70) |
| France | −18 | +39 | −21 | −2.2 | 69 | 3 | 11.07 | 373.36 | 22.84<br>(27.63) |
| Italy | +4 | +8 | −4 | −1.6 | 62 | 1 | 4.14 | 158.81 | 24.40<br>(29.84) |
| Spain | +4 | +5 | −1 | −0.2 | 64 | 4 | 13.81 | 127.30 | 26.80<br>(37.99) |
| Sweden | +8 | +3 | +5 | +2.3 | 83 | 3 | 16.85 | 97.06 | 24.66<br>(32.26) |
| AMEX | +1 | | | | | | | 124.45 | N.A. |
| Nasdaq | +62 | −149 | +303 | +4.6 | 71 | 5 | 17.02 | 490.68 | 3.51<br>(30.64) |
| NYSE | +91 | | | | | | | 3484.34 | 13.40<br>(24.57) |

There is huge variation in the values of some variables, even though we eliminated economically meaningless outliers, such as negative sales figures (see the Appendix for details). For instance, total assets range from U.S. $174 thousand to $159 billion, and the growth rate of plant property and equipment ranges from −100 percent to over 1.88 million percent. This points to the need for robust statistical analysis in our tests.

**Table V**

## Company Data: The Sample

The sample includes all the companies listed domestically in the main segment of our nine European exchanges at any time in the period 1986 to 1997 and for which balance sheet information is available in the Global Vantage database (at least partly) for the 1986 to 1998 interval. Financial companies and investment funds, as well as companies not listed in their country of incorporation, are excluded. Table A2 in the Appendix contains the definitions of the variables.

Panel A: Summary Statistics

| | Mean | Std. Dev. | Min | Max | Median | No. of Obs. | No. of Comp. |
|---|---|---|---|---|---|---|---|
| Total assets | 2.01 | 6.13 | 0.00 | 158.61 | 0.35 | 18,066 | 2,312 |
| Total assets growth | 23.13 | 1,078.48 | −92.24 | 134,846.02 | 7.46 | 15,676 | 2,287 |
| Com. shares traded/outst. | 3,624.40 | 134,872.78 | 0.00 | 9,167,796.00 | 29.96 | 14,112 | 1,802 |
| Employees growth | 40.37 | 1,751.64 | −98.76 | 136,633.34 | 1.45 | 14,209 | 2,190 |
| Employees | 11.62 | 29.54 | 0.00 | 1,017.00 | 2.76 | 16,644 | 2,246 |
| Foreign sales percentage | 34.13 | 29.50 | 0.00 | 100.00 | 31.71 | 12,672 | 1,576 |
| Leverage | 13.37 | 13.72 | 0.00 | 90.47 | 9.30 | 14,434 | 2,159 |
| Issue market-to-book ratio | 4.36 | 18.92 | 0.00 | 1,130.94 | 2.11 | 21,274 | 1,858 |
| Market value | 1.58 | 7.02 | 0.00 | 316.55 | 0.27 | 15,170 | 2,203 |
| Prop. plant equipm. growth | 226.56 | 17,619.38 | −100.00 | 1,881,866.63 | 6.55 | 15,649 | 2,283 |
| Research per employee | 14.21 | 127.00 | 0.01 | 3,432.75 | 2.73 | 3,351 | 621 |
| Research/revenue | 8.19 | 67.84 | 0.00 | 2,922.22 | 1.77 | 3,405 | 627 |
| Research/labor expense | 16.37 | 225.23 | 0.00 | 3,715.45 | 0.13 | 2,121 | 396 |
| Total revenue | 1.88 | 5.11 | 0.00 | 146.84 | 0.38 | 18,038 | 2,311 |
| Total revenue growth | 29.83 | 1,081.61 | −98.57 | 128,384.62 | 7.40 | 15,638 | 2,279 |
| Labor cost/employee | 73.18 | 1,193.60 | 0.00 | 33,976.00 | 17.36 | 7,917 | 1,108 |
| High-tech dummy | 0.11 | 0.32 | 0.00 | 1.00 | 0.00 | 30,186 | 2,322 |
| Return on assets | 4.66 | 11.70 | −95.18 | 949.00 | 4.66 | 15,652 | 2,288 |

Panel B: Number of Companies by Country of Incorporation

| Country of Incorporation | Total Number of Companies | Number of Companies Already Cross-listed in 1986 | Number of Companies that Cross-list in 1987–1997 | Fraction of Companies Cross-listed in Any Year between 1986 and 1997 | Number of Companies Delisting from all Foreign Markets in 1986–1997 and Keeping Their Home Listing | Number of Companies Delisting from All Markets (Including Domestic Exchange) in 1986–1997 |
|---|---|---|---|---|---|---|
| Austria | 86 | 2 | 7 | 0.11 | 0 | 1 |
| Belgium | 84 | 9 | 2 | 0.13 | 2 | 2 |
| Germany | 256 | 17 | 11 | 0.11 | 3 | 2 |
| Spain | 98 | 1 | 2 | 0.03 | 0 | 0 |
| France | 417 | 14 | 14 | 0.07 | 2 | 3 |
| United Kingdom | 947 | 29 | 76 | 0.11 | 14 | 18 |
| Italy | 124 | 6 | 6 | 0.10 | 3 | 0 |
| Netherlands | 154 | 17 | 17 | 0.22 | 3 | 2 |
| Sweden | 156 | 16 | 6 | 0.14 | 1 | 5 |
| Total | 2,322 | 111 | 141 | 0.11 | 28 | 33 |

R&D data is only provided for a very small proportion of the companies in the sample. The median company spends 1.77 percent of its revenue on R&D.[18] To remedy the paucity of observations on R&D, we construct an alternative "high-tech intensity" indicator, based on the company's SIC four-digit classification code (see the Appendix for details). This dummy classifies 11 percent of the sample as high-tech companies.

Panel B of Table V illustrates the composition of the sample in terms of country of incorporation and proportion of companies cross-listed, distinguishing those that were already cross-listed in 1986 from those that cross-listed during the sample period. For all countries of origin, only a small proportion of sample companies, about 11 percent, list abroad at all. In terms of the country composition of our sample, the United Kingdom is heavily represented: Nearly half of all companies studied, and over half of the companies that first list abroad in our sample period, are British. Nevertheless, the composition by country reflects closely the relative stock market capitalizations of European exchanges, as reflected for instance in Jorion and Goetzmann (1999, Table 5).[19] In the last two columns of Panel B, we provide some information about delistings. In our sample period, 28 companies delist from all foreign markets while staying listed on their home market, and 33 more delist even from their own exchange.[20]

We now turn to a first comparison of the companies that list abroad with those that do not, mainly focusing on balance sheet variables (such as total assets and sales) and ratios (such as leverage and market-to-book value). Panel A of Table VI reports the difference between the median values of

[18] One may wonder if, besides being sparse, our data for R&D may not be affected by self-selection. In many countries, such data are not mandatorily disclosed, so companies may report them only after a cross-listing in a market with more stringent disclosure requirements. Indeed, the number of companies reporting R&D expenses in our sample increases steeply around the cross-listing date. However, we also find that, if anything, this introduces a bias against our result that R&D expenses increase around the cross-listing date (see Table IX). Average R&D expenses rise much more if they are computed for the subsample of companies that already reported them before the cross-listing than if they are computed including in the sample all companies for which R&D is reported at any date.

[19] We computed the stock market capitalization of all the companies of each country in our sample in 1995 and compared the resulting weights with the corresponding weights in Table 5, page 973, of Jorion and Goetzmann (1999), which also refers to 1995 (rescaling them to take into account only European exchanges). The average absolute deviation of the two sets of weights is 2.2 percent. British companies are only slightly overweighted in our sample: They account for 38.2 percent of total capitalization of the companies in our sample, whereas the corresponding figure using the data in Jorion and Goetzmann would be 40 percent. Only French companies are considerably overweighted in our sample.

[20] We have estimated logit regressions (not reported) to understand why companies delist within our sample. Companies that delist from some but not all foreign markets have lower asset growth before delisting. Those that delist from all foreign markets have low size, as measured by total assets and other scale variables. Companies that delist from all markets, including their own, feature low size and high leverage. This suggests that many such delistings occur when companies are experiencing financial problems or are involved as targets in mergers or acquisitions.

**Table VI**

## Cross-listing Companies versus Domestic Companies: Descriptive Statistics

Panel A reports the differences in medians between companies that cross-list and those that do not. Columns give the differences in medians in the years −3, −2, and so forth relative to the year of cross-listing. The control sample consists of companies that are not cross-listed during the whole sample period. The differences are computed by a least absolute value (LAV) regression, where the variable of interest (e.g., total assets) is regressed on a relative-listing-year dummy, controlling for calendar year and country of incorporation. The sample includes observations from 1986 to 1998. The relative-listing-year dummy for year $+n$ $(-n)$ takes the value one for observations taken $n$ years after (before) the year in which the company is first cross-listed abroad. A separate LAV regression is run for each cell in the table. The value reported is the coefficient of the relative-listing-year dummy. Significance at the 1 percent level is indicated by ***, 5 percent by **, and 10 percent by *.

Panel B reports differences in medians of companies that cross-list in the United States relative to the control sample and of companies that cross-list within EU9 relative to the control sample. We consider companies that cross-list for the first time, divided into two groups, depending on whether this cross-listing takes place in the United States or in Europe. Companies that cross-list in the same year in the United States and in EU9 are excluded and so are companies already cross-listed in both continents before 1986. For columns −3 to +3, subsequent cross-listings in the other geographical area are ignored. The sample period is from 1986 to 1998. The calculation is in the form of a LAV regression. The dependent variable is regressed on a U.S.-relative-listing-year dummy and an EU9-relative-listing-year dummy, controlling for country of incorporation and calendar year effects. The coefficients of the relative-listing-year dummies are the differences in medians. This method assumes that the country and calendar year effects are the same for the whole sample and allows a simple test for equality of the medians for the United States and EU9 subsamples. Companies that cross-list for the first time simultaneously in European and U.S. exchanges are not included in the sample. Because of different samples, this table cannot be compared directly to Panel A of Table V; in particular the >3 column, where a relatively large number of observations are excluded. Significance is denoted as in Panel A.

Panel A: Difference of Medians around Date of First Cross-Listing

| | −3 | −2 | −1 | 0 | 1 | 2 | 3 | >3 |
|---|---|---|---|---|---|---|---|---|
| Total assets | 1.88*** | 1.54*** | 1.17*** | 1.33*** | 1.62*** | 1.98*** | 2.17*** | 4.97*** |
| Total assets growth | 5.57* | 2.98 | 5.07** | 5.30** | 4.89** | 2.47 | −0.84 | −1.04* |
| Com. shares traded/outst. | 45.77*** | 35.34*** | 31.84*** | 30.46*** | 19.27*** | 34.84*** | 33.53*** | 29.13*** |
| Employees growth | −1.80 | 3.89** | −0.08 | 4.01*** | 2.63** | 0.84 | −1.46 | −1.60*** |
| Employees | 7.32*** | 6.62*** | 6.43*** | 5.62*** | 8.26*** | 8.38*** | 9.74*** | 25.03*** |
| Foreign sales percentage | 24.03*** | 23.86*** | 25.04*** | 24.06*** | 27.59*** | 34.41*** | 36.85*** | 31.24*** |
| Leverage | 5.38** | 6.49*** | 4.71** | 4.59*** | 2.13 | 4.39*** | 4.13** | 2.80*** |
| Issue market-to-book ratio | 0.40* | 0.42* | 0.65*** | 0.74*** | 0.66*** | 0.56** | 0.60** | 0.33*** |
| Issue market value | 1.24*** | 1.13*** | 1.12*** | 1.56*** | 1.53*** | 1.73*** | 1.33*** | 3.21*** |
| Prop. plant equipm. growth | 1.19 | 1.26 | 3.49 | 6.69*** | 3.80* | 3.79* | −0.46 | −0.85 |
| Research per employee | 0.48 | 0.92* | 1.31** | 2.10*** | 1.29*** | 1.62*** | 1.92*** | 1.69*** |
| Research/revenue | −0.36 | 0.20 | 0.07 | 0.11 | 0.27 | 0.19 | 0.57 | 0.04 |
| Research/labor expense | 0.03 | 0.03 | 0.11*** | 0.08*** | 0.08*** | 0.26*** | 0.17*** | 0.07*** |
| Total revenue | 1.48*** | 1.14*** | 1.26*** | 1.29*** | 1.53*** | 1.73*** | 2.43*** | 4.62*** |
| Total revenue growth | −0.78 | 3.37 | 4.06** | 5.52*** | 3.60** | 0.11 | 1.37 | −1.69*** |
| Labor cost/employee | 5.76*** | 6.54*** | 5.24*** | 3.61*** | 3.72*** | 4.27*** | 6.86*** | 2.20*** |
| Return on assets | 0.77 | −0.08 | 0.91 | 0.91* | 0.85* | −0.57 | −0.96* | −0.34** |

**Table VI**—*Continued*

Panel B: Difference of Medians around Date of First Cross-listing, by Continent of First Cross-Listing

| | −3 | −2 | −1 | 0 | 1 | 2 | 3 | >3 |
|---|---|---|---|---|---|---|---|---|
| U.S. | | | | | | | | |
| Total assets | 1.77*** | 1.46*** | 0.88*** | 1.09*** | 1.42*** | 1.50*** | 1.47*** | 3.31*** |
| Total assets growth | 5.19 | 3.34 | 0.54 | 15.03*** | 5.19** | 1.53 | −1.38 | 2.35* |
| Com. shares traded/outst. | 53.83*** | 36.19*** | 30.33*** | 18.48*** | 16.18*** | 35.34*** | 38.95*** | 35.80*** |
| Employees growth | 0.44 | 3.89* | 0.36 | 5.09*** | 3.80** | −0.29 | −2.76 | 0.10 |
| Employees | 5.51*** | 3.47*** | 2.30*** | 2.53*** | 3.38*** | 4.35*** | 6.83*** | 17.09*** |
| Foreign sales percentage | 25.08*** | 24.12*** | 21.51*** | 24.98*** | 35.56*** | 38.24*** | 44.20*** | 34.38*** |
| Leverage | 7.06** | 6.52** | 4.57* | 2.70 | 1.09 | 1.46 | −2.07 | 1.13 |
| Issue market-to-book ratio | 1.31*** | 0.83*** | 1.20*** | 1.34*** | 1.18*** | 0.96*** | 1.27*** | 1.09*** |
| Issue market value | 1.20*** | 0.89*** | 0.960*** | 1.56*** | 2.03*** | 2.19*** | 1.82*** | 4.45*** |
| Prop. plant equipm. growth | 0.64 | 1.95 | 2.58 | 6.72** | 4.40 | 3.79 | −3.62 | 1.00 |
| Research per employee | 1.83*** | 2.87*** | 1.92*** | 3.01*** | 1.59*** | 1.62*** | 4.17*** | 2.00*** |
| Research/revenue | 1.56** | 2.52*** | 0.40 | 0.51 | 0.32 | 0.08 | 0.57 | 0.43** |
| Research/labor expense | 0.20*** | 0.11** | 0.20*** | 0.11*** | 0.09*** | 0.26*** | 0.11** | 0.11*** |
| Total revenue | 1.74*** | 0.66*** | 0.77*** | 0.78*** | 1.16*** | 1.31*** | 1.80*** | 3.84*** |
| Total revenue growth | 1.76 | −0.85 | 3.86 | 2.73 | 6.37*** | 0.51 | 1.78 | −0.74 |
| Labor cost/employee | 8.46*** | 6.80*** | 5.74*** | 3.39*** | 3.73*** | 5.16*** | 16.20*** | 7.65*** |
| Return on assets | 0.77 | −0.31 | −0.06 | −0.12 | 1.14* | −0.57 | −0.40 | −0.05 |
| EU9 | | | | | | | | |
| Total assets | 2.70*** | 1.54*** | 1.58*** | 1.94*** | 2.01*** | 2.76*** | 3.23*** | 4.52*** |
| Total assets growth | 5.62 | 0.76 | 8.01** | 5.30 | 4.44 | 3.36 | 1.07 | −1.43** |
| Com. shares traded/outst. | 40.78*** | 34.72*** | 32.40*** | 54.98*** | 19.80*** | 26.71*** | 30.71*** | 26.47*** |
| Employees growth | −5.34 | 1.40 | −0.55 | 1.08 | 0.10 | 1.83 | −1.12 | −1.68*** |
| Employees | 14.13*** | 10.04*** | 10.23*** | 14.69*** | 11.23*** | 10.35*** | 10.84*** | 21.95*** |
| Foreign sales percentage | 21.41** | 21.09** | 31.72*** | 24.06*** | 22.09*** | 29.09*** | 30.02*** | 27.62*** |
| Leverage | 5.41 | 7.38** | 5.47* | 5.58** | 8.62*** | 11.16*** | 14.95*** | 2.86*** |
| Issue market-to-book ratio | −0.17 | 0.20 | −0.06 | 0.10 | 0.38 | 0.38 | 0.28 | 0.14* |
| Issue market value | 2.35*** | 1.46*** | 1.69*** | 1.66*** | 1.00*** | 1.35*** | 1.30*** | 2.47*** |
| Prop. plant equipm. growth | 1.34 | 0.75 | 3.92 | 4.12 | 3.05 | 4.74 | 0.94 | −0.99 |
| Research per employee | −0.11 | −0.54 | 0.05 | −0.30 | −0.37 | 0.57 | 0.31 | 0.16 |
| Research/revenue | −0.65 | −1.16 | −0.67 | −0.75 | −0.77 | 0.07 | −0.11 | −0.23* |
| Research/labor expense | −0.03** | −0.04 | −0.03 | −0.04 | −0.04 | −0.05 | *No obs.* | 0.02 |
| Total revenue | 1.32*** | 1.19*** | 1.30*** | 1.72*** | 1.78*** | 2.34*** | 2.66*** | 4.06*** |
| Total revenue growth | −7.81* | 5.08 | 4.18 | 5.68** | 1.74 | 0.17 | 2.50 | −1.92*** |
| Labor cost/employee | 2.07 | 4.70** | 2.48 | 5.91*** | 3.17** | 0.00 | −0.68 | 0.58 |
| Return on assets | 0.44 | −0.12 | 1.13 | 0.91 | 0.05 | −0.55 | −1.20 | −0.25 |

these variables for the cross-listed companies and the companies listed only domestically, controlling for calendar year and country of incorporation. More precisely, the values reported in the table are obtained by estimating a least absolute value (LAV) regression on a constant, a cross-listing dummy variable, as well as control dummies for calendar year and country.[21] There are eight cross-listing dummy variables: Each one represents a particular year

[21] Being based on the minimization of the sum of absolute deviations, the LAV estimator assigns a lower weight to outliers than the OLS estimator.

relative to the year of cross-listing, ranging from year −3 (three years before) to year 3 (three years after) and a "permanent" dummy (four or more years after).

The table shows that cross-listing companies are significantly larger than companies that are only listed domestically. This is the case for all the years relative to the listing period and for every size measure considered: total assets, market value of common stock, revenue, and number of employees. The relatively large size of cross-listed companies agrees with the presence of economies of scale in cross-listing, reflecting fixed costs combined with benefits that increase with company size.

Turning to the relationship between cross-listing and company growth, the table displays growth in total assets, sales, and plant and equipment. For all these variables, there is a marked peak in growth in the three years surrounding the cross-listing date. In that period, the growth rates for cross-listing firms exceed the growth rates of the control sample by about four to six percent, peaking in year 0 and reverting to normal two years later: strikingly, the growth differential is not sustained in the long run. The higher growth of cross-listing firms is also mirrored in their significantly higher market-to-book ratios. The fact that cross-listing is associated with a period of exceptional growth is consistent with the notion that new capital needs to be raised.

As an indicator of international orientation, the table includes foreign sales as a proportion of total sales. This variable is significantly larger for the cross-listing companies in all the years considered, but particularly so after the cross-listing date. So the data suggest that a foreign listing is more likely to be pursued by export-oriented companies and, at the same time, is part of a strategy of expansion on foreign markets.

The relatively high leverage of cross-listing firms decreases upon cross-listing. Before, leverage is about five percent above that of the control group, but the difference becomes insignificantly different from zero in the year after cross-listing and reverts to about three percent in the long run.

There is also some weak evidence that cross-listing firms are R&D-intensive (the ratio of R&D expense per employee is larger from year −2 onwards). They also pay significantly higher average wages in all the years around the cross-listing date. Thus, they seem to be skill-intensive firms.

Trading activity on the home exchange, as measured by the number of common shares traded divided by their total number outstanding, is larger for companies which cross-list, both before and after the cross-listing date. This is consistent with the fact that these are large companies in their home market, with accordingly high turnover ratios. Based on these data, cross-listing appears to correlate neither with enhanced liquidity on the home market nor with trade diversion away from it.

Finally, the return on assets (ROA) of cross-listing companies does not differ significantly from that of the control group, except for a marginally significant increase around the time of cross-listing followed by a drop starting three years after.

In Panel B of Table VI, we repeat the comparison separately for companies which cross-list for the first time in the United States and for those that do so within Europe. Compared with the control group, the companies that cross-list in Europe tend to be larger than those that cross-list in the United States in terms of total assets and number of employees, both before and after the cross-listing date. But the most visible differences between the two groups concern R&D intensity and market-to-book ratio relative to the control group. First, the companies that cross-list in the United States spend more on R&D than the control sample, using the three measures of Table VI, whereas this is not true of the companies that cross-list within Europe. The high-tech nature of the companies listing in the United States is also mirrored by their higher labor cost per employee. Second, the companies that cross-list in the United States appear to have a larger market-to-book ratio, compared to those that cross-list in Europe, and a correspondingly higher long-run growth rate.

## IV. Predicting Cross-listing from Company Characteristics

The descriptive statistics discussed in the previous section provide some exploratory evidence concerning the reasons why European companies list abroad. However, to compare the explanatory power of the competing hypotheses and filter out spurious correlations, we must turn to regression analysis. In this section, we use duration analysis to investigate which company characteristics predict listing abroad and multinomial logit analysis to predict where they cross-list.

In Table VII, we analyze the determinants of the cross-listing decision using a Cox proportional hazard model. This method is particularly suited to the prediction of discrete events in a panel setting. It relates the hazard rate $h(t)$ (i.e., the probability of listing at time $t$ conditional on not having listed yet) to a set of observable variables $X$:

$$h(t) = h_0(t)\exp(X'\beta), \tag{1}$$

where $h_0(t)$ is the baseline hazard rate at time $t$ for the covariate vector set at 0, and $\beta$ is a vector of coefficients. This semiparametric estimator assumes that the hazard ratio $h(t)/h_0(t)$ is constant over time and requires no assumptions about the baseline hazard. Table VII reports the estimates as exponentiated coefficients ($\exp(\beta_1)$, $\exp(\beta_2), \ldots$) rather than as coefficients ($\beta_1, \beta_2 \ldots$), because exponentiated coefficients can be immediately interpreted as the effect of a unit change in the explanatory variable on the hazard ratio $h(t)/h_0(t)$. For instance, a coefficient of 1.023 implies that a unit change of the dependent variable increases the relative hazard by 2.3 percent.

The set of determinants $X$ includes the previous year's values of the leverage ratio, the proportion of sales abroad, the market-to-book ratio of the company, total asset growth, the ROA, the logarithm of total assets, and the average of the three highest foreign market-to-book ratios minus the domes-

**Table VII**

## Predicting the First Cross-listing by Cox Regression

This table reports the Cox estimates of the hazard ratio of foreign listing. The dependent variable takes the value one in the year of the first foreign listing in the EU9 countries or in the United States, and zero otherwise. After the first cross-listing, observations are excluded from the estimation. The sample includes observations on the dependent variable from 1987 to 1997. Standard errors and resulting *p*-values are adjusted for clustering on companies. All explanatory variables are lagged, with the exception of the High-tech dummy. The Mean of 3 highest countries' PBV is the arithmetic mean of the three highest values of the price-to-book-value ratio in each year within the countries of our sample.

| | | | |
|---|---|---|---|
| No. of subjects: 1,276 | | Log likelihood: −222.39 | |
| No. of failures: 42 | | $\chi^2$ (12): 264.87 | |
| Time at risk: 7,727 | | Prob > $\chi^2$: 0.00 | |
| | Hazard Ratio | *Z* | $P > \|z\|$ |
| Leverage | 1.009 | 0.57 | 0.57 |
| Foreign sales percentage | 1.023 | 3.53 | 0.00 |
| Issue market-to-book ratio | 1.013 | 5.59 | 0.00 |
| Total assets growth | 1.002 | 9.21 | 0.00 |
| Privatization dummy | 19.919 | 4.03 | 0.00 |
| Return on assets | 0.959 | −1.66 | 0.10 |
| Log of total assets | 1.855 | 4.34 | 0.00 |
| High tech dummy | 2.290 | 2.01 | 0.05 |
| Mean of 3 highest foreign PBV − domestic PBV | 0.199 | −2.12 | 0.03 |
| Regional dummy (North) | 1.374 | 0.66 | 0.51 |
| Regional dummy (South) | 0.626 | −0.75 | 0.45 |
| Regional dummy (East) | 0.510 | −1.33 | 0.19 |

tic exchange's market-to-book ratio.[22] The regression also includes a lagged privatization dummy,[23] the "high-tech" dummy defined above, calendar year dummies, and regional origin dummies for each company: South (France, Italy, and Spain), East (Austria and Germany), North (Sweden, Belgium, and Netherlands), and the default (United Kingdom). Standard errors and *p*-values are adjusted for clustering on companies, that is, we take into account that the errors for the same company are not independent.

[22] The foreign sales variable in our data set is missing for roughly one third of all companies. We impute these missing values via regressions which generate predicted values of the percentage of foreign sales based on the following regressors: the company mean value of the fraction of foreign sales (for the companies where at least one data point is available), the logarithm of total assets, the growth rates of total assets and sales, dummies for SIC codes at the one-digit level, country of incorporation, calendar year, and the high-tech dummy. The regression results reported in Tables VI and VII use the data obtained with this imputation method. Since a regional breakdown of sales may be missing more frequently for companies with no foreign sales, we perform a robustness check via an alternative imputation method whereby the percentage of foreign sales is set equal to zero wherever it is missing. The estimates of the coefficients in Table VI and VII are practically unaffected and so are their estimated standard errors.

[23] This dummy equals one when the government makes a public offering of shares in the company.

The variables that have the largest impact on the decision to list abroad are the proportion of sales abroad and the size of the company (as measured by the log of total assets). To interpret the economic magnitude of their effect, we multiply the logarithm of the hazard ratios in Table VII by one standard deviation of the relevant variable. A one-standard-deviation increase in the proportion of sales abroad (26.8) increases the (relative) probability of observing a first cross-listing over a 10-year period by 84 percent (that is from 2.9 to 5.3 percent).[24] This suggests that listing abroad is partly a means of capitalizing on the reputation acquired through a presence on foreign output markets. Conversely, companies that depend on foreign sales value the positive publicity associated with a foreign listing, as suggested by Stoughton et al. (2001). Size also raises the probability of listing abroad: A one-standard-deviation increase in the logarithm of total assets (1.47) raises the probability of observing a first cross-listing over a 10-year period by 148 percent (that is from 2.9 to 7.0 percent). The fact that the probability of listing abroad increases with company size suggests that there are substantial fixed costs involved and that benefits are increasing in size: For instance, a large company places larger demands on equity markets, thus benefiting more from a wider shareholder base.

Several other variables are significant at the one percent level: the privatization dummy, the asset growth rate, and the company's own market-to-book value ratio.

The one-year probability of cross-listing increases from a baseline 0.3 percent per year if the privatization dummy is set equal to zero (and all other variables at their average values) to 5.7 percent if the privatization dummy is set equal to one. Therefore, privatization raises the chances of a first cross-listing in the subsequent year by over five percentage points. Privatization issues tend to be very large, so that the depth of the international equity market is likely to be needed to obtain a good price.

There is also support for the view that companies list abroad after experiencing a spurt in growth and investment, as found for domestic Italian initial public offerings (IPOs) by Pagano, Panetta and Zingales (1998). Past growth of assets plays a significant role in the regression: A one-standard-deviation increase in the growth rate (60.9) is associated with a 13 percent increase in the probability of a cross-listing in the subsequent 10 years. Also the company's own market-to-book ratio, an indicator of the company's future growth, has a positive effect. A one-standard-deviation increase in the market-to-book ratio (11.8) has approximately the same quantitative effect (16 percent) as the corresponding change in past growth.

[24] The base probability of a sample firm cross-listing over a 10-year period is 2.9 percent, evaluated at the sample means of the explanatory variables. The hazard ratio of a one-standard-deviation change in variable $i$, $\sigma_i$, is $\exp(\sigma_i \beta_i)$. This calculation yields 1.84 for the proportion of foreign sales. Multiplication with the base probability of 2.9 gives 5.3 percent, which is the probability of a sample firm cross-listing over a 10-year period, after increasing foreign sales by one standard deviation and holding all other variables at their sample means.

The high-tech dummy is significant at the five percent level. The 10-year probability of cross-listing rises from 2.7 percent for traditional companies to 6.0 percent for high-tech companies. This agrees with the idea that high-tech companies turn to foreign equity markets for capital because foreign investors and intermediaries know more about the company's business than their domestic counterparts, and thus, can better evaluate its stock.

The difference between foreign and domestic price-to-book ratio has a small negative impact on the cross-listing probability (a one-standard-deviation change of 0.40 decreases the probability over 10 years by 1.4 percentage points). So we do not find evidence of companies trying to exploit "windows of opportunity" in the pricing of foreign stock markets relative to their own country stock market. On the contrary, a booming domestic stock market seems to encourage its companies to cross-list.

Finally, the coefficients of leverage, profitability, and of the regional origin dummies are imprecisely estimated.

We next investigate where companies cross-list for the first time. We wish to predict whether a company is more likely to cross-list in Europe, in the United States, or not at all. This is done in the multinomial regression shown in Table VIII. As before, all the regressors are lagged. Standard errors are adjusted to allow for dependence within clusters of data concerning the same company.

The estimates confirm that large and recently privatized companies are more likely to cross-list, be it in the United States or in Europe. But the similarities between the two groups end here. High growth and large market-to-book ratio, large foreign sales, and high-tech industry classification are significant predictors of a cross-listing in the United States, but not in Europe. Instead, high past profitability is a significant predictor only for Europe.

Therefore, the overall picture is that a U.S. listing is a more natural choice for high-growth and high-tech companies. European stock exchanges have instead been chosen more often by companies with a stronger record of past profitability, but this may reflect the tighter listing requirements of European exchanges (regarding a track record of accounting profits) compared to Nasdaq.[25]

The choice of cross-listing location also differs considerably by country of origin, other factors being equal. British companies (the default regional dummy) are more likely to cross-list in the United States and less likely to cross-list within Europe than Continental European companies. This agrees with the greater tendency of British companies to list in the United States noted in the aggregate statistics of Section II.

So far in our paper, we have only focused on the first cross-listing in either continent and have not yet analyzed how cross-listing in one continent affects the probability of a subsequent cross-listing in the other. To investigate

[25] The marketwide price-to-book ratios are mostly insignificant, with the exception of the difference between the United States and the domestic price-to-book ratio, which has a negative impact on the probability of cross-listing within Europe.

**Table VIII**

## Predicting the Location of Cross-listing by Multinomial Logit

This table reports multinomial logit estimates of the probability of the first cross-listing taking place in the United States or in Europe. The possible outcomes are: no cross-listing in either continent, first cross-listing in the United States, and first cross-listing in Europe. The first group (companies with no cross-listing) is the comparison group. One company, whose first cross-listing occurred simultaneously in Europe and the United States, is included in both the second and third groups. The sample includes observations on the dependent variable from 1987 to 1997. All explanatory variables are lagged, with the exception of the High-tech dummy. The Mean of 3 highest EU PBV − domestic PBV is the difference between the arithmetic mean of the 3 highest EU9 price-to-book values and the PBV of the domestic market. U.S. PBV − Domestic PBV is the difference between the United States and the domestic price-to-book value. Standard errors and resulting *p*-values are adjusted for clustering on companies.

| | Number of obs.: 7732 | | |
|---|---|---|---|
| | Wald $\chi^2$ (28): 352.87 | | |
| | Prob > $\chi^2$: 0.00 | | |
| Log Likelihood: −221.09 | Pseudo $R^2$: 0.25 | | |
| Region of Foreign Listing | Relative Risk Ratio | $z$ | $P > \|z\|$ |
| United States | | | |
| Leverage | 1.032 | 1.49 | 0.14 |
| Foreign sales percentage | 1.025 | 2.56 | 0.01 |
| Issue market-to-book ratio | 1.014 | 4.01 | 0.00 |
| Total assets growth | 1.003 | 3.39 | 0.00 |
| Privatization dummy | 15.708 | 2.17 | 0.03 |
| Return on assets | 0.954 | −2.15 | 0.03 |
| Log of total assets | 1.599 | 2.64 | 0.01 |
| High-tech dummy | 4.560 | 2.54 | 0.01 |
| U.S. − domestic PBV | 0.785 | −0.25 | 0.80 |
| Mean of 3 highest EU PBV − domestic PBV | 1.035 | 0.03 | 0.98 |
| Domestic PBV | 1.128 | 0.17 | 0.87 |
| Regional dummy (North) | 0.326 | −1.08 | 0.28 |
| Regional dummy (South) | 0.200 | −1.50 | 0.14 |
| Regional dummy (East) | 0.129 | −1.91 | 0.06 |
| Europe | | | |
| Leverage | 0.990 | −0.55 | 0.58 |
| Foreign sales percentage | 1.015 | 1.48 | 0.14 |
| Issue market-to-book ratio | 1.009 | 1.59 | 0.11 |
| Total assets growth | 0.994 | −0.81 | 0.42 |
| Privatization dummy | 16.513 | 3.05 | 0.00 |
| Return on assets | 1.090 | 3.63 | 0.00 |
| Log of total assets | 3.004 | 4.60 | 0.00 |
| High-tech dummy | 0.507 | −1.08 | 0.28 |
| U.S. − domestic PBV | 0.107 | −2.92 | 0.00 |
| Mean of 3 highest EU PBV − domestic PBV | 0.956 | −0.04 | 0.97 |
| Domestic PBV | 0.756 | −0.42 | 0.68 |
| Regional dummy (North) | 5.969 | 2.76 | 0.01 |
| Regional dummy (South) | 2.466 | 0.84 | 0.40 |
| Regional dummy (East) | 2.031 | 1.16 | 0.25 |

this issue, we estimate two separate Cox regressions predicting cross-listing in the United States or within Europe, where one of the explanatory variables is a dummy for previous cross-listings in the other continent. We find that a previous listing in Europe significantly encourages a company to list in the United States as well, but the converse is not true.[26] We do not report the full estimation results for brevity. The decision to access equity markets appears to be a one-way trip, which accords with the growing imbalance in transatlantic cross-listings noted in Section II.

## V. Ex Post Evidence on Cross-listed Companies

In this section, we assess the effects of listing abroad on the subsequent performance of companies. In the model to be estimated, each variable $y_{it}$ (e.g., the logarithm of total assets of company $i$ at time $t$) is modeled as depending on fixed effects and a set of cross-listing dummies (first introduced in Table V):

$$\begin{aligned} y_{it} = {} & \alpha_0 + \alpha_1 f_i + \beta_1 d_{it}^{0,EU} + \beta_2 d_{it}^{1\text{–}3,EU} + \beta_3 d_{it}^{p,EU} \\ & + \gamma_1 d_{it}^{0,US} + \gamma_2 d_{it}^{1\text{–}3,US} + \gamma_3 d_{it}^{p,US} + \varepsilon_{it}, \end{aligned} \tag{2}$$

where $f_i$ denotes a company fixed effect, $d_{it}^{0,EU}(d_{it}^{0,US})$ is a dummy intended to capture the impact effect of the *first* cross-listing of company $i$ in Europe (the United States), $d_{it}^{1\text{–}3,EU}$ ($d_{it}^{1\text{–}3,US}$) is a dummy corresponding to the three years after listing in Europe (the United States), and $d_{it}^{p,EU}$ ($d_{it}^{p,US}$) captures the permanent shift in the dependent variable after cross-listing. To limit the effect of influential observations, we estimate least absolute value (LAV) regressions, and to eliminate fixed effects, we difference both sides of the equation, so that the specification becomes

$$\begin{aligned} \Delta y_{it} = {} & \beta_1 \Delta d_{it}^{0,EU} + \beta_2 \Delta d_{it}^{1\text{–}3,EU} + \beta_3 \Delta d_{it}^{p,EU} \\ & + \gamma_1 \Delta d_{it}^{0,US} + \gamma_2 \Delta d_{it}^{1\text{–}3,US} + \gamma_3 \Delta d_{it}^{p,US} + \eta_{it}, \end{aligned} \tag{3}$$

where $\eta_{it} \equiv \Delta\varepsilon_{it}$. Table IX reports the estimation results of the differenced model.

After a foreign listing, some variables appear to change irrespective of the listing's location. First, companies become more export oriented, an effect somewhat stronger for companies cross-listing in the United States than for those cross-listing within Europe. Second, home market liquidity decreases: The turnover ratio on the home market drops significantly, in contrast with

[26] In our sample, two-thirds of the companies that cross-listed in the United States had not previously cross-listed elsewhere in Europe. Eighty-eight firms that cross-listed in the United States had no prior EU cross-listing, 17 had one, 9 had two, 7 had three, 4 had four, and 7 had five cross-listings in Europe prior to listing in the United States.

**Table IX**

## Effect of Listing Location: Ex Post Regressions Distinguishing Cross-listings in Europe and the United States

This table reports estimates of the ex post effects of cross-listing, distinguishing U.S. cross-listings and EU9 cross-listings. Each row in the table gives the results of a LAV regression, for a dependent variable (e.g., Total assets). The sample includes observations from 1990 to 1998. The explanatory variables are dummies capturing the timing of the first listing in the United States and within Europe. For each continent, they are: an impact dummy (one in the year of cross listing and zero elsewhere), a three-year dummy (one in the three years after cross-listing), and a permanent effect dummy (one after the third year subsequent to cross-listing and later). We take first differences of all variables in order to eliminate fixed effects. The following dependent variables have been used in logarithmic form: total assets, employees, issue market value, and total revenue. A constant and additional control dummies are included in nondifferenced form: calendar year dummies in all regressions; country of incorporation dummies only in the regressions explaining total assets, employees, issue market value, and total revenue. The coefficients of these variables are not reported for brevity. Significance at the 1 percent level is indicated by ***, 5 percent by **, and 10 percent by *.

| | U.S. Impact | U.S. Three Year Effect | U.S. Permanent Effect | EU9 Impact | EU9 Three Year Effect | EU9 Permanent Effect | Pseudo $R^2$ | No. of Obs. |
|---|---|---|---|---|---|---|---|---|
| Total assets | 0.03 | 0.04* | 0.05* | −0.01 | −0.01 | −0.03* | 0.12 | 13,540 |
| Total assets growth | 1.83 | −1.53 | 3.21 | 3.35 | −0.19 | −2.23 | 0.08 | 12,210 |
| Common shares traded/outst. | −1.01 | −1.23 | −5.32*** | −1.98 | −5.08*** | −7.23*** | 0.00 | 10,932 |
| Employees growth | −0.13 | 0.06 | 2.04 | −0.19 | −1.38 | −2.40 | 0.00 | 11,130 |
| Employees | −0.01 | 0.01 | −0.01 | 0.01 | 0.01 | −0.01 | 0.01 | 12,591 |
| Foreign sales percentage | 0.20*** | 0.22*** | 0.22*** | 0.12*** | −0.14*** | 0.16*** | 0.00 | 9,270 |
| Leverage | −0.08 | 0.01 | −0.10 | 0.10 | 0.09 | 0.52*** | 0.00 | 11,115 |
| Issue market-to-book ratio | −0.01 | −0.03 | −0.03 | −0.04 | 0.05* | 0.00 | 0.02 | 15,437 |
| Issue market value | 0.08 | 0.07 | 0.11* | 0.03 | −0.04 | −0.08** | 0.04 | 11,793 |
| Property plant equipm. growth | −1.69 | 0.26 | 5.53 | 1.63 | 2.32 | −1.90 | 0.01 | 12,193 |
| Research per employee | 0.04 | 0.09 | 0.19** | 0.67*** | 0.56*** | 0.71*** | 0.01 | 2,517 |
| Research/revenue | 0.01 | 0.04 | −0.04 | 0.06 | 0.06 | 0.06* | 0.00 | 2,559 |
| Research/labor expense | 0.00 | 0.02*** | 0.01** | 0.00 | −0.01 | 0.00 | 0.00 | 1,620 |
| Total revenue | 0.02 | 0.02 | 0.01 | 0.00 | 0.00 | −0.02 | 0.10 | 13,498 |
| Total revenue growth | −1.96 | −1.85 | 0.46 | −5.24 | −6.53** | −4.96* | 0.07 | 12,165 |
| Labor cost/employee | −0.58* | −0.82** | 0.35 | −3.02*** | −1.67*** | −0.99*** | 0.01 | 6,032 |
| Return on assets | 0.52* | −0.13 | 0.02 | 0.14 | 0.11 | 0.34 | 0.01 | 12,129 |

the findings of Noronha et al. (1996) and Foerster and Karolyi (1998). The drop is larger after a cross-listing in Europe, consistently with the "time zone" hypothesis proposed by Pulatkonak and Sofianos (1999), who show that NYSE trading in non-U.S. stocks decreases with the time zone difference.[27] Third, companies become more R&D-intensive throughout the postlisting period. On a per-employee basis and as a percentage of sales, R&D spending increases more after European cross-listings, whereas as a percentage of total labor expenses it rises more after U.S. listings.

For other variables, the location of the cross-listing seems to play an important role. The companies that cross-list in the United States experience a five percent permanent increase in total assets. In contrast, companies that cross-list within Europe end up with a three percent permanent reduction of total assets and a five percent long-run decrease in the growth rate of sales, relative to the control sample.

The estimates for the leverage ratios show that the expansion of total assets for the companies which cross-list in the United States is funded by an increased amount of equity and no significant leveraging. In contrast, there is a significant permanent increase in the leverage of companies cross-listing within Europe. These different developments in the capital structures of the two types of companies are also mirrored in the opposing time patterns of the market value of their outstanding stock after the cross-listing.

Overall, cross-listings in the United States appear to be prompted by the need to fuel rapid expansion via new equity issues, while those within Europe are at best used to increase the debt capacity of the company and are hardly followed by rapid growth. This striking difference is consistent with the results of Table VIII, where cross-listings in the United States (but not in Europe) are shown to follow rapid expansion of the asset base.

## VI. Conclusions

We can now bring together the results in the two parts of this paper: the account of the aggregate trends in the geography of listings in Europe and the United States in the period 1986 to 1997 and the analysis of European company-level data in the same time interval. In particular, it is worthwhile asking if our findings about the individual cross-listing decisions help us explain the changes in the geography of equity listings.

Our aggregate figures show that the number of European companies cross-listing their shares increased considerably, but most of the increase went to U.S. exchanges (of which the NYSE absorbed more than half). At the same time, the number of U.S. companies cross-listing in Europe fell by a third.

[27] In Table 9 (p. 47) of their study, they show that for European, non-U.K. stocks, the share of NYSE trading is considerably lower than that of London trading: For the cross-listed stocks of the Netherlands, Spain, Germany, Italy, France, and Sweden, the NYSE share of total trading is on average 12 percent, while the U.K. share is 28 percent. Being effected on a closer marketplace, a cross-listing within Europe tends to "eat" into domestic turnover much more than a listing effected in the United States.

The end result has been a decline of foreign listings in Europe and a large increase in European listings in the United States.

The decline of foreign listings on European exchanges appears to be part of a more general decline in their ability to attract new listings. Most of them have not attracted a large number of new domestic listings either, especially in the 1990s, with the exception of Frankfurt and, to some extent, London. The opposite is true of U.S. exchanges, where both domestic and foreign listings increased over the sample period.

Interestingly, the European countries whose companies have been more eager to seek foreign listings and whose exchanges have been least able to attract or retain foreign listings are those with the highest trading costs and (with the exception of the United Kingdom) with the lowest accounting standards and worst shareholder protection. Conversely, the United States offers lower trading costs, tighter accounting standards, and better shareholder protection than most European countries.

The microeconomic analysis of the characteristics and behavior of European companies helps to shed light on the motives of their cross-listing decisions, and thus, on the reasons behind the one-way flow of cross-listings from Europe to the United States. Apart from a few common features, European companies that cross-list in Europe and in the United States appear to have sharply different characteristics and performances.

The single major common feature is size. The importance of size suggests that the cross-listing decision involves nonnegligible fixed costs and economies of scale, consistent with the findings of studies of the decision to list in domestic markets, such as Pagano et al. (1998). In addition to size, being a newly privatized company also increases the probability of cross-listing both in Europe and in the United States. This is consistent with the hypothesis that cross-listing is particularly advantageous for firms that need to sell a large number of their shares. Apart from these common features, European companies that cross-list in the United States differ considerably from those that do so within Europe. In the first case, companies pursue a strategy of rapid, equity-funded expansion after the listing. They feature significant reliance on export markets before the listing and tend to belong to high-tech industries. Companies that cross-list in Europe, instead, have a higher return on assets in the years before the cross-listing, do not grow more than the control group, and increase their leverage in the long run. Moreover, they do not rely on foreign sales to the same extent as firms cross-listing in the United States and generally do not belong to high-tech sectors. Therefore, on the whole, a U.S. listing appears to be motivated by the need for an equity infusion by rapidly expanding companies that expand their sales internationally and/or belong to high-tech industries. The latter finding is consistent with Blass and Yafeh (2000), who report that Israeli and Dutch firms that choose Nasdaq for the first listing are overwhelmingly high-tech oriented. The motivations for cross-listing within Europe are not equally clear, but the companies that take this route are definitely less dynamic, less outward oriented, and in more mature sectors than those of the other group.

The contrast between these two groups is reminiscent of the contrast between European and U.S. companies' domestic IPOs, documented by Planell (1995); Rydqvist and Högholm (1995); Mikkelson, Partch, and Shah (1997); and Pagano et al. (1998). These studies, respectively conducted on Spanish, Swedish, U.S., and Italian panel data, investigate the characteristics and behavior that distinguish companies listing for the first time (on their domestic market) from those that decide to stay private. In Italy, Spain, and Sweden, domestic IPOs do not appear to finance subsequent investment and growth, while in the United States, they feature phenomenal growth. Moreover, European IPOs are, on average, much older than their U.S. counterparts.

These studies on domestic IPOs therefore suggest that in European countries, the stock market mainly caters to large, mature companies with little need to finance investment, while the opposite is true of the United States. In the present paper, we find that this applies equally to cross-listing decisions: When it comes to cross-listing, the most dynamic and outward-oriented European companies self-select in U.S. exchanges. The main remaining puzzle is why European exchanges are judged to be less attractive by this group of companies. Probably the answer has several pieces.

First, the high-tech nature of the European companies listing in the United States suggests that a key advantage of the U.S. market is the presence of skilled analysts and institutional investors specializing in evaluating these companies. This agrees with the finding by Baker et al. (1999) that listing on the NYSE induces higher analyst coverage than listing in London. This comparative advantage of the U.S. market may partly reflect its sheer size, combined with the fixed costs of expertise in high-tech industries. The costly investments in human capital required to evaluate high-tech companies are worthwhile only if many such companies are already listed, and this is true of a large continental market such as the United States, but not of European markets.

Second, as already stated, American exchanges are more liquid than most European exchanges, and the United States has better accounting standards and shareholder rights' protection than most European countries. Insofar as these comparative advantages translate in a lower cost of equity capital, they may be particularly important to companies who need to raise large amounts of fresh equity.

Last, but not least, the U.S. economy has not only a large capital market but also a huge product market, one that has grown at a consistently higher pace than European markets in the last decade. Therefore, it has been the natural springboard for foreign companies with a strong export orientation, since it has allowed them to capitalize on their product market reputation and expand their foreign sales rapidly, possibly via acquisitions in the United States.

If these are the main factors of comparative advantage of U.S. exchanges relative to European ones, they may attenuate gradually as the process of integration of European capital markets proceeds. The removal of capital controls and the more homogeneous regulatory framework of European di-

rectives is likely to lead to the birth of a truly continental equity market and to increasing integration of markets for goods and services in Europe. If many of the factors of comparative advantage discussed above depend on sheer market size, European companies may become less interested in cross-listing on U.S. exchanges. But this will not apply to companies from many non-European countries, for which the U.S. market is likely to retain its attraction.

## Appendix: Data Sources and Definitions

Table A1 lists the market segments used in this study and the data sources, and Table A2 lists definitions of variables used in the study and their sources.

**Table A1**

### Market Segments Used and Data Sources

The number of domestic companies used for Figures 1 and 2 are obtained by adjusting FIBV data on main and parallel markets in various ways. First, since the FIBV 1986 to 1988 figures include investment funds, 1986 to 1988 figures are adjusted downwards by the proportion of investment funds in 1989. Second, we had to make a number of market-specific adjustments. For the Paris Stock Exchange, the FIBV numbers before 1997 do not include the Second Marché. We therefore use FIBV data only for 1997 and, before 1997, draw our data from the SBF 1997 factbook. For the Frankfurt Stock Exchange, we restrict ourselves to the Amtlicher Handel and leave out foreign companies traded in the Freiverkehr (which contains an inflated number of foreign companies, since their shares are traded even if they do not apply for a listing). We could not obtain data on the Geregelter Markt, but only very few companies in this segment would qualify for our sample. For Nasdaq before 1997, the number of domestic firms was provided by Nasdaq, the total number of listings is drawn from the Nasdaq Factbook 1997, and the number of foreign firms is calculated as the difference between the two. For the Stockholm Stock Exchange, the total number of listings and the number of foreign listings are drawn from the 1997 and 1998 fact books; the number of domestic listings is the difference between the two. For the Amsterdam Stock Exchange, for 1993 and 1994, the FIBV reports the number of shares, not companies. To obtain a proxy for the number of domestic companies, we multiply the FIBV figures by the ratio of the number of domestic companies (OM) to the number of domestic shares (OM) reported in the 1993 Amsterdam Stock Exchange fact book.

| Stock Exchange | Market Segment (foreign companies) | Market Segment (domestic companies) | Data Sources |
|---|---|---|---|
| AMEX | Foreign and Canadian Issues | — | Stock Exchange |
| Amsterdam | Aandelen Buitenland | Aandelen Binnenland, (excl. Parallel market) | Het Financieele Dagblad; Officiele Prijscourant; Stock Exchange |
| Brussels | Premier Marché | Premier Marché | Stock Exchange |
| Easdaq | EASDAQ market | — | *Financial Times* 27/11/1997 and FT Information |
| Frankfurt | Amtlicher Handel | Amtlicher Handel | Amtliches Kursblatt der Frankfurter Wertpapierbörse, 1986–1997 |
| Milan | Listino Ufficiale, including Mercato Ristretto | Listino Ufficiale, including Mercato Ristretto | Stock Exchange |

*continued*

**Table A1**—*Continued*

| Stock Exchange | Market Segment (foreign companies) | Market Segment (domestic companies) | Data Sources |
|---|---|---|---|
| London | Overseas Listings (excl. Ireland) [Official List] | Constituents of the F.T. All Shares Index | Official price list, Financial Times Business Research Centre fact books, *LSE Quarterly*, LBS Risk Measurement Service, 1986–1997 |
| Madrid | Continuous and Floor | Primero Mercado | Stock Exchange |
| Nasdaq | International Listings | — | Stock Exchange |
| NYSE | Non-U.S. corporate issuers | — | Stock Exchange |
| Paris | Premier and Second Marché | Premier and Second Marché | Stock Exchange |
| Stockholm | A, O, und OTC-list | A, O, und OTC-list | Stock Exchange |
| Vienna | Amtlicher Handel and Geregelter Freiverkehr | Amtlicher Handel and Geregelter Freiverkehr | Stock Exchange |

**Table A2**

## Variable Definitions and Sources

Derived variables are constructed from data corrected for measurement error. The variables marked "issue item" concern only a selected class of securities issued by the company. Where available, we select common/ordinary shares; otherwise, we select an issue as close as possible to common shares. Additional adjustments: Several variables for Fiat 1988; DAF 1989, 1992; Heidelberger 1989; and ENI 1986–88 are set to "not available" due to unrealistic values in those years. If Total revenue is zero or the ratio of Total revenue to Total assets is below 0.01, the company is assumed to be a holding company. All accounting variables are set to "not available" for these companies.

| Variable | Source and/or Definition | Method Used to Correct for Measurement Error |
|---|---|---|
| Calendar year dummies | The calendar dummy for year $t$ equals 1 in year $t$ and 0 in all other years, for $t = 1986,\ldots,1997$. | |
| Common shares outstanding | Global Vantage "issue item": net number of common/ordinary shares outstanding as of the company's fiscal year-end. | Set to "not available" whenever smaller than or equal to zero. |
| Common shares traded | Global Vantage "issue item": monthly number of shares traded (in December). | Set to "not available" whenever smaller than zero. |
| Common shares traded/outstanding | Common shares traded divided by common shares outstanding. | |
| Countries' PBV | Morgan Stanley Capital International; year-end price-to-book ratios for the countries investigated. | |
| Country dummies | Set to 1 for the country where the company is incorporated or legally registered. The country of incorporation is drawn from Global Vantage. | |

*continued*

**Table A2**—*Continued*

| Variable | Source and/or Definition | Method Used to Correct for Measurement Error |
|---|---|---|
| Employees (in 1,000s) | Global Vantage: number of company workers as reported to shareholders (for some companies, the average number of employees; for others, the number of employees at year-end). | Negative sign on number of employees changed to a positive sign for: Greenall Whitley, 1994; Rugby Cement, 1991; Spring Ram Corp. PLC, 1991; Bluebird Toys, 1996. Otherwise, set to "not available" when negative or when employee growth rate below −99%. |
| Employees growth (in percent) | Percent change in employees, year $t - 1$ to year $t$. | |
| Foreign sales proportion (in percent) | Worldscope. | Set to "not available" whenever negative or larger than 100 percent. |
| High-tech sector dummy | Set to 1 for the following SIC codes, 0 otherwise:<br>2830 Drugs<br>2833 Medicinal chemicals, botanical products<br>2834 Pharmaceutical preparations<br>2835 In vitro, in vivo diagnostics<br>2836 Biological products, ex diagnostics<br>3570 Computer and office equipment<br>3571 Electronic computers<br>3572 Computer storage devices<br>3575 Computer terminals<br>3576 Computer communication equipment<br>3577 Computer peripheral equipment<br>3651 Household audio and video equipment<br>3660 Communication equipment<br>3661 telephone and telegraph apparatus<br>3663 Radio, TV broadcast, communication equipment<br>3669 Communications equipment<br>3670 Electronic components and accessories<br>3671 Electron tubes<br>3672 Printed circuit boards<br>3674 Semiconductor and related device<br>3760–3761 Guided missiles, space vehicles<br>3764 Guided missiles, space vehicles propulsion<br>3769 Guided missiles, space vehicles parts<br>3810–3812 Search, detection, naval, guided, aero systems<br>3820 Laboratory apparatus, optical, measure, control instruments | |

*continued*

**Table A2**—*Continued*

| Variable | Source and/or Definition | Method Used to Correct for Measurement Error |
|---|---|---|
| High-tech Sector (*continued*) | 3821 Laboratory apparatus and furniture<br>3822 Automatic regulating controls<br>3823 Industrial measurement instruments<br>3826 Laboratory analytical instruments<br>3840–3841 Surgical, medical, dental instruments<br>4800 Communications<br>4810 Telephone communications<br>4812 Radiotelephone communications<br>4813 Phone comm. excl. radiotelephone<br>4820–4822 Telegraph and other communication<br>4830–4832–4833 Radio, TV broadcasting stations<br>4840–4841 Cable and other pay TV services<br>4890–4899 Communication services<br>7370 Cmp programming, data processing<br>7371 Computer programming service<br>7372 Prepackaged software<br>7373 Component integrated system design | |
| Issue market-to-book ratio | Global Vantage "issue item": December closing price multiplied by common shares outstanding and divided by book value of common/ordinary equity. If the current figure for common shares outstanding is not available, the previous year's value is used. | Set to "not available" whenever smaller than or equal to zero, and/or if total shareholders' equity is smaller than zero. |
| Market value (in billion USD) | December closing price multiplied by common shares outstanding. If the current figure for common shares outstanding is not available, the previous year's value is used. | Set to "not available" whenever smaller than or equal to zero. |
| Labor & related expense (in million USD) | Global Vantage: direct payments to, and indirect payments on behalf of, all employees. | Set to "not available" whenever smaller than zero. |
| Labor cost/employee (in 1,000 USD) | Labor and related expense divided by employees. | |
| Leverage (in percent) | Total debt divided by (Total assets minus Book value of common stock plus the Market value of common stock), multiplied by 100. The Book value of common stock includes any common shareholders' interest and any reserves in the Shareholders' equity section. It excludes participation right certificates and preferred stock. | |

*continued*

**Table A2**—*Continued*

| Variable | Source and/or Definition | Method Used to Correct for Measurement Error |
|---|---|---|
| Privatization dummy | Data kindly provided by Bernardo Bortolotti, Fondazione ENI Enrico Mattei: dummy set to 1 in the year of a privatization (or seasoned offering) and 0 in other years. | |
| Property plant equipment (net) | Global Vantage: net cost or valuation of tangible fixed property used in the production of revenue. Calculated by Global Vantage as: Total fixed assets (gross) less Depreciation, depletion, amortization (accumulated), less Investment grants and Other deductions. | Set to "not available" whenever negative. |
| Property plant equipment growth | Percent change in Property plant equipment (net), year $t - 1$ to year $t$. | |
| Regional dummy north | Set to 1 if country of incorporation is Netherlands, Sweden, or Belgium, 0 otherwise. | |
| Regional dummy east | Set to 1 if country of incorporation is Germany or Austria, 0 otherwise. | |
| Regional dummy south | Set to 1 if country of incorporation is France, Italy, or Spain, 0 otherwise. | |
| Regional dummy U.K. | Set to 1 if country of incorporation is Great Britain, 0 otherwise. | |
| Research/labor expense | Research and development expenses divided by labor and related expense. | |
| Research/revenue (in percent) | Research and development expenses divided by Total revenue, divided by 10 to yield percentage. | |
| Research and development expenses (in million USD) | Global Vantage: all costs incurred to develop new products or services. | Set to "not available" whenever smaller than zero. |
| Research per employee (in 1,000 USD) | Research and development expenses divided by employees | |
| Return on assets (in percent) | Global Vantage: income before extraordinary items divided by the average of the most recent two years of Total assets multiplied by 100. | Set to "not available" whenever return on assets is below −100%. |
| SIC codes | Global Vantage: 4-digit Standard Industry Classification code. | |
| Total assets (in billion USD) | Global Vantage: total value of assets reported on the balance sheet. | Set to "not available" whenever total assets is zero or negative, or total assets growth is below −95%. |
| Total assets growth (in percent) | Percent change in Total assets, year $t - 1$ to year $t$. | |
| Total debt (in billion USD) | Global Vantage: sum of Long-term debt (total) and Current liabilities. | Set to "not available" whenever negative. |
| Total revenue (in billion USD) | Global Vantage; represents sales/turnover (net). | Set to "not available" whenever negative. |

*continued*

**Table A2**—*Continued*

| Variable | Source and/or Definition | Method Used to Correct for Measurement Error |
|---|---|---|
| Total revenue growth (in percent) | Global Vantage: percent change in Total revenue, year $t-1$ to year $t$. | Set to "not available" if below −99%. |
| Total shareholders equity | Global Vantage; common/ordinary and preferred/preference shareholders' interest in the company plus any reserves reported in the Shareholders' equity section. | |
| Variables concerning foreign listings | Based on data sources described in Table A1 in the Appendix. Definitions of these variables are reported in the legends of the tables where they appear. | |

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