Economic Consequences of International Cross-listing and Multimarket Trading

Olga Dodd

Abstract

This study examines the impact of cross-listing and multimarket trading on the stock's information environment. Cross-listing is associated with additional mandatory disclosure requirements and, thus, is expected to reduce information asymmetry between management and investors and among different groups of investors. Empirical findings confirm that the quality of information environment, measured by stock liquidity and price volatility, is improved after listing on a foreign exchange. Additionally, I distinguish between cross-listing and admission to trade on a foreign exchange or cross-trading, which, in contrast to cross-listing, does not entail additional disclosure. Contrary to expectations, the difference in the impact of cross-listing and cross-trading on the stock liquidity and price volatility is not significant. This finding suggests that the improvement in the information environment of cross-listed/traded stocks comes primarily from the intensified competition among traders rather than from mandatory disclosure requirements.

Key words: Information asymmetry, cross-listing, cross-trading, stock liquidity, volatility

JEL Classifications: G15, G32, G14

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1. Introduction

Companies choose to list on a foreign exchange with a view to improve stock visibility, prestige and stock liquidity (Bancel and Mittoo, 2001) and, ultimately, to enhance stock valuation (Chouinard and D'Souza, 2003). Potentially, the improvement in stock valuation stems from the fact that a listing on a foreign exchange results in an enhanced information environment due to the increased levels of information disclosure necessary to meet the mandatory listing and disclosure requirements on the home as well as foreign markets. An enhanced information environment should reduce adverse selection costs for investors and, thus, reduce the liquidity premium required (Kyle, 1985; Glosten and Milgrom, 1985), which in turn results in lower cost of capital (Baiman and Verrecchia, 1996). In the case of international cross-listing, Chemmanur and Fulghieri (2006) theoretically show that a foreign listing on an exchange with stricter disclosure requirements reduces investor's monitoring costs and improves stock valuation.

Existing empirical evidence shows that cross-listing in the US by a foreign company, on average, results in abnormal positive returns around cross-listing (Miller, 1999; Foerster and Karolyi, 1999), increased company visibility (Baker et al , 2002), improved analyst coverage, in terms of quantity as well as accuracy, (Lang et al, 2003), enhanced stock liquidity (Smith and Sofianos, 1997; Foerster and Karolyi, 1993 and 1998), lower cost of capital (Errunza and Miller, 2000; Hail and Leuz, 2009) and improved relative valuation (Doidge et al, 2004 and 2009). The findings on the improvements in stock liquidity and valuation can be interpreted as indirect evidence of the reduction in information asymmetry following a foreign listing. Bailey et al (2006) specifically examine the consequences of the increased disclosure of non-US firms listed in the US, and report a significant increase in stock return volatility and trading volume reaction to earnings announcements after cross-listing in the US, which they attribute to the changes in the company-level disclosure. Fernandes and Ferreira (2008) investigate the change in the quality of information environment around cross-listing and focus on the change in stock price informativeness, i.e. the level of private information incorporated into stock price. They find that cross-listing is positively associated with firm-specific stock return variation, interpreted as the measure of stock price informativeness, particularly, for stocks from developed markets.

The existing evidence on whether cross listing improves information environment is far from conclusive. Moreover, the quality of the information environment is not easily quantifiable or empirically testable and the results of empirical tests are sensitive to the choice of proxy. Proxy measures of information asymmetry include stock liquidity and stock price volatility (Leuz and Verrecchia, 2000). This would mean that the improvement in stock liquidity and the reduction in stock

price volatility after cross-listing would indicate the decrease in the level of information asymmetry between company managers and investors and between different groups of investors.

Existing empirical evidence on the change in stock liquidity and stock price volatility after cross-listing is mixed. Some studies report that after cross-listing there is a significant decrease in the stock's trading costs (Foerster and Karolyi, 1998; Domowitz et al, 1998; Hamet, 2002) and an increase in the stock's trading volume (Smith and Sofianos, 1997; Foerster and Karolyi, 1993 and 1998; Hamet, 2002). Other studies, however, report no impact of a cross-listing on the stock's trading costs (Noronha et al, 1996; Silva and Chavez, 2008) and no impact or even deterioration of trading activity on the stock's home market (Berkman and Nguyen, 2010; Domowitz et al, 1998; Foerster and Karolyi, 1998). Overall, existing empirical evidence on the consequences of cross-listing in terms of stock liquidity is not conclusive and in many cases is outdated. Empirical studies on the impact of cross-listing on stock price volatility report either no significant relationship (Lau et al, 1994; Martell, 1999) or an increase in stock price volatility after cross-listing, mainly associated with the increase in the stock's trading activity (Werner and Kleidon, 1996; Menkveld, 2008). None, of the studies, however, show the net impact of cross-listing on stock price volatility, i.e. after controlling for the increase in trading volumes after cross-listing.

This study contributes to the literature by examining the impact of cross-listing and multimarket trading on the stock's information environment, measured by stock liquidity and price volatility.
Several measures are used to capture various dimensions of stock's liquidity and price volatility, including trading costs and trading volume- based measures of stock liquidity and stock return variation and intraday stock price variation as measures of stock price volatility. The impact of the stock's presence (listed/traded) on a foreign exchange on the stocks' information environment is evaluated in a multivariate framework, controlling for other factors that potentially affect stock liquidity and stock price volatility including the change in company size, accounting practices, analyst coverage and trading activity around cross-listing.

An important contribution made by this study is that it allows a direct comparison between the impact of a foreign stock exchange listing, i.e. a cross-listing, and the impact of admission to trade on a foreign exchange, referred to in this study as a cross-trading, which includes admission to trade on over-the-counter (OTC) markets and new markets (e.g. Open market of Deutsche Borse). Cross-trading is similar to cross-listing in the way that it makes a stock accessible to foreign investors and, thus, facilitates inter-market competition. However, in contrast to a cross-listing, cross-trading does not impose additional mandatory disclosure requirements for the cross-listing company. While cross-

border equity trading on non-regulated markets has become wide spread in recent decades, the empirical evidence on the implications of foreign trading is limited[1]. Furthermore, there is no evidence in the literature about the different economic consequences of cross-listing and cross-trading. To address this gap, this study specifically investigates the differences, if any, in the implications of cross-listing and cross-trading in terms of stock's liquidity and price volatility, and, hence, the stock's information environment.

The sample includes 509 stocks from 20 European countries that were listed and traded in various foreign markets during the period from 1990 to 2007. While prior literature reports that a US cross-listing is beneficial in terms liquidity (Foerster and Karolyi, 1993 and 1998) and information environment improvement (Lang et al, 2003; Fernandes and Ferreira, 2008), the evidence on the implications of foreign listing/trading on other host markets is limited. Since the US differs significantly from other markets in terms of size of the investor pool, the level of liquidity, and the legal and information environment, it is reasonable to expect that the findings for the US market are not necessarily applicable to other markets. Moreover, inclusion of all foreign listing and trading accounts of the sample cross-listed stock, allows an assessment of the impact of foreign listing and trading on various host markets and an assessment of the impact of cross-listing on the stock's aggregate trading activity.

Stock liquidity and stock price volatility of cross-listed stocks are evaluated in cross-sectional analysis against liquidity and volatility of 3,702 domestic stocks from the same sample countries. Several studies find that the impact of a foreign listing in terms of liquidity (Halling et al, 2007) and corporate valuation (Gozzi et al, 2008) is concentrated around the cross-listing event and diminishes over time. This study contributes to the debate by providing evidence on the evolution of stock liquidity and stock price volatility before and after cross-listing and cross-trading and their long-run sustainability. Finally, the change in stock liquidity and stock price volatility is evaluated in an event-study framework against those of the cross-listed stocks over the pre-cross-listing period of time.

The primary empirical finding is that stocks that are listed and/or traded on a foreign exchange, in addition to the home market listing, are significantly more liquid and less volatile compared to domestic stocks. After controlling for the effects of factors that are known to affect stock liquidity and for the change in company characteristics after cross-listing/ trading in the multivariate analysis, I find that a presence on a foreign exchange, either through listing and/or admission to trade, is associated with significantly reduced trading costs for investors measured by bid-ask spread and also with a

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[1] Only a few studies examine the consequences of a foreign trading on stock liquidity (e.g. Hamet, 2002; Ellul, 2006) and stock price volatility (e.g. Bayar and Onder, 2005).

significant reduction in stock price volatility, measured by standard deviation of stock returns, variance ratio and high-low ratio. Home market stock turnover does not improve after cross-listing or after cross-trading, while total stock market turnover that accounts for trading on foreign exchange(s) improves for cross-listed stocks but not for cross-traded stocks. Moreover, the documented effects of cross-listing/ cross-trading are found to be sustained over a long period of time following the cross-listing/ trading event.

In contrast to the expectation that due to added mandatory information disclosure, stock exchange listing has a more profound impact on stock liquidity and volatility than an admission to trade on a foreign exchange, I find that the difference in the impact of cross-listing and cross-trading on the stock's information environment is not economically or statistically significant. This finding, arguably, can be attributed to the fact the additional information disclosure from cross-listing is not substantial and that the major improvement in the information environment of cross-listed and/or cross-traded stocks actually comes from the intensified competition among market makers and from the production of stock-specific information as a result of the increased number of market participants with an economic interest in the stock after cross-listing/ trading. Overall, empirical findings confirm that additional information production after a foreign listing/ admission to trade results in economically and statistically significant benefits for a cross-listed/ cross-traded stock.

2. Hypotheses development

By making the decision to list or trade on a foreign exchange a company commits to higher levels of disclosure and scrutiny by more market participants, which, in turn, should lower the information asymmetry between company insiders and outside investors. Consequently, the adverse selection component of trading costs should be lower. Similar to Leuz and Verrecchhia (2000), I use several measures of stock liquidity, such as bid-ask spread and turnover ratio, and stock return volatility as proxies for information asymmetry. The improved information disclosure, however, is not the only outcome of a foreign listing. Intensified inter-market competition, increased stock-specific information production and enhanced stock visibility after the stock becomes available for trading on a foreign exchange also potentially have an impact on the stock liquidity and risk. The following sections 2.1 and 2.1 discuss specifically how international cross-listing and cross-trading affect the stock liquidity and volatility.

2.1 Liquidity

There are several potential sources of improvement in stock's liquidity after a foreign listing. Firstly, in the case of a foreign stock exchange listing, enhanced disclosure as a result of compliance with listing requirements reduces information asymmetry (Brown and Hillegeist, 2007), and positively affects stock liquidity (Diamond and Verrecchia, 1991). Since the stock liquidity can be defined as the ability to trade large quantities of the stock at low cost, the two major dimensions of liquidity are trading quantity and trading cost. Bid-ask spread, proxy for trading cost dimension of liquidity, represents the cost that a trader must incur in order to execute trade. Thus, a lower bid-ask spread indicates higher stock liquidity. Kyle (1985) and Glosten and Milgrom (1985) theoretically establish a positive association between a bid-ask spread and the level of information asymmetry. Extensive empirical evidence (e.g. Healy et al, 1999; Leuz and Verrecchhia, 2000; Krishnamurti et al, 2005) confirms that improved disclosure is associated with improved liquidity in terms of spreads, trading volumes, depth and adverse selection spread component.

The other sources of improved liquidity apply both for foreign listings and for admissions to trading on a foreign exchange. Improvement in the information environment could also be driven by the increase, after international cross-listing and cross-trading, in the number of market participants that have economic incentives to generate stock-specific information in order to profit from informed trading. Kyle (1985) shows that information arrival increases trading volumes. Noronha et al (1996) empirically confirm the increase in informed trading after cross-listing. Furthermore, the presence of foreign traders and market makers for cross-listed and cross-traded stocks boosts inter-market competition. Stoll (2001) and Amihud and Mendelson (1995) theoretically show that increased competition forces the market makers to reduce the spreads. This proposition is confirmed empirically by Werner and Kleidon (1996). Finally, a more liquid trading environment after cross-listing could be expected as an outcome of increased stock visibility and investor recognition (Merton, 1987).

> H1.1: Stocks that can be traded (listed and/or traded) on a foreign stock exchange are more liquid.

When a stock is admitted to trading on a foreign exchange without listing, or in other words, without meeting listing requirements, it does not benefit from enhanced disclosure. Although the level of disclosure requirement does not change, exposure of the stock to more traders enhances the level of information available in the market as more trading brings more information to the market (Glosten and Milgrom, 1985). Furthermore, the sources of potential change in stock liquidity in case of cross-trading include increased competition among market makers, improved accessibility to foreign

investors, and change in the composition of investor base, but not the improved disclosure. Consequently, trading without listing should have a less significant impact on stock liquidity.

H1.2: Listing compared to admission to trade, on a foreign stock market leads to better improvement in stock's liquidity.

2.2 Volatility

Limited stock-specific information is a source of risk and, accordingly, of higher stock price volatility due to higher level of uncertainty about the stock's future cash flows (Barry and Brown, 1986; Wang, 1993) and higher probability of a large one-time stock price responses to new information (Lang and Lundholm, 1993). The other significant contributor to higher stock volatility in the presence of information asymmetry, is noise trading (Campbell and Kyle, 1993; Wang, 1993), since more active noise trading reduces stock price informativeness, meaning it further increases the uncertainty about stock fundamentals to the uninformed traders, and, consequently, increases the stock's fundamental risk. Therefore, lower levels of information asymmetry between the corporate managers and shareholders and/or among different groups of investors and traders are generally associated with lower stock price volatility. Accordingly, since a foreign listing is associated with higher levels of information disclosure due to the presence of listing requirements, it should reduce stock risk (Barry and Brown, 1985) and, specifically, stock price volatility (Wang, 1993; Leuz and Verrecchia, 2000).

H2.1: Stock presence on a foreign exchange (listed and/or traded) improves stocks' information environment and, thus, reduces stock price volatility.

Compared to a stock exchange listing, the change in information asymmetry after admission to trade on a foreign exchange is less profound as it does not impose additional disclosure requirements. However, foreign trading does increase the production of stock-specific information as the result of the increase in the number of market participants that have an interest in the stock as a potential source of trading profit.

H2.2: A stock exchange listing on a foreign market is associated with greater reduction in stock price volatility compared to an admission to trade.

Empirical evidence on the relationship between the level of information asymmetry and price volatility, however, contradicts the theoretical prediction: Leuz and Verrecchia (2000) and Brown and Hillegeist (2007) find that increased disclosure is associated with higher stock return volatility. Furthermore, there is evidence (Werner and Kleidon, 1996; Menkveld, 2008) that stock volatility generally increases after cross-listing and cross-trading, particularly, when cross-listing and cross-

trading is associated with an increase in trading activity. I recognize the complexity of the relationship between the improved disclosure and stock return volatility and explicitly control for other important components of the change in price volatility after a foreign listing. Particularly, the change in trading volume after cross-listing is one of the most important components with the expected impact on price volatility is directly opposite to that of the impact from the increased disclosure, as discussed in the following section 2.3.

2.3 Other determinants of stock liquidity and volatility

There are several channels of the enhanced information environment and, accordingly, improved stock liquidity and decreased stock volatility after cross-listing. I account for the fact that the changes in stock liquidity and volatility after cross-listing are potentially driven by the changes in company size, accounting information disclosure practices, analysts following, and the level of trading activity, and evaluate whether a cross-listing and a cross-trading have an impact on the stock liquidity and volatility after controlling for the change in these factors.

Firstly, documented larger size of cross-listed companies (Pagano et al, 2002) provides them with an information advantage as predicted by the differential information hypothesis (Freeman, 1987). However, based on the findings of Dodd and Louca (2010) and Dodd (2010), the implications of cross-listing in terms of the valuation impact and trading activity are more profound for smaller companies. Arguably, smaller companies overcome larger information barriers by the means of cross-listing and, consequently, experience greater incremental reduction to the level of information asymmetry. Thus, the expectation is that larger companies have a lower level of information asymmetry and, accordingly, better liquidity and lower price volatility; but, the improvement in stock liquidity and volatility after cross-listing is more significant for smaller companies. Secondly, a cross-listed company is more likely to have adopted superior accounting practices (Lang, Raedy and Yetman, 2003). Leuz and Verrecchia (2000) show that higher quality information disclosure as the outcome of adopting internationally recognized accounting standards and principles is associated with lower levels of information asymmetry, measured by bid-ask spreads and trading volume. Thus, the expectation is that an improvement in the quality of accounting information around cross-listing enhances stock liquidity and reduced stock volatility. Thirdly, cross-listing results in increased attention of financial analysts (Baker et al, 2002; Lang, Lins and Miller, 2003). The quality of the information environment is positively related to the level of analyst coverage of the company (Draper and Paudyal, 2008). Thus, the expectation is that an increase in analyst coverage after cross-listing improves stock liquidity and reduces stock volatility.

In the case of volatility, however, the evidence (e.g. Chan et al, 1996; Werner and Kleidon, 1996; Menkveld, 2008) supports the argument that higher price volatility is associated with higher information flows, in line with Black (1986), and with higher trading volumes, in line with Karpoff (1987) and Chang and Fong (2000). Therefore, it is important to control for the change in the level of trading activity after cross-listing. The expectation is that the increase in trading activity after foreign listing/ trading significantly increases stock price volatility.

3. The sample

The sample consists of cross-listed as well as domestic European stocks. Cross-listed stocks are those that have had their stock cross-listed on at least one foreign exchange in addition to listing on the exchange in the home market. Cross-listing data includes events up to December 2007 and comes from the stock exchanges' web-sites, Factiva news database and foreign listings dataset of Sarkissian and Shill (2004, 2009). Data on depository receipts is from the BNY, Citibank, Deutsche Bank, JP Morgan DRs databases available on-line. The additional requirement for sample inclusion is the availability of home market listing, i.e. direct foreign IPOs are excluded. The analysis is performed on the security level rather that the company level: all related listings for each cross-listed stock is identified by ISIN (data source: Datastream). Underlying ISINs and depository receipts conversion ratios for depository receipts are from the mentioned above Depository receipts (DRs) databases. Only common equity and major securities are included in the sample.

The initial sample included 820 European cross-listed stocks with multiple foreign listing and trading accounts. For each of these stocks I determine its foreign listing/ trading status, as defined in section 4.3.2 Methodology, for each month from January 1990 to December 2007. Stock price and other financial data are drawn from Datastream. After checking for the availability of daily data required to calculate stock liquidity and volatility measures, the dependent variables, we are left with the sample of 509 cross-listed/ traded stocks from 20 European countries. The final sample used in regression analysis with data available for all explanatory and control variables includes 425 stocks with foreign presence from 17 European countries. Columns (2) and (5) of Table 1 present the distribution of stocks with foreign presence by home country. The most represented country is the United Kingdom, followed by France and Germany.

For the purpose of the cross-sectional analysis, the sample of cross-listed stocks is supplemented by the sample of European domestic stocks, i.e. stocks that have not been listed or traded on a foreign exchange. The list of listed and traded stocks for each European country in the sample is obtained from DataStream. For each stock in the list I identify related listing and trading accounts using the

DataStream database. The list of domestic stocks is obtained by eliminating stocks with at least one foreign listing/ trading account from the DataStream's list of European stocks. Initially, I identify 4,844 European domestic stocks. After checking for the availability of daily data required to calculate stock liquidity and volatility measures, we are left with the sample of 3,702 domestic stocks from 20 European countries. The final sample used in regression analysis with data available for all explanatory and control variables includes 1,755 stocks with foreign presence from 17 European countries. Columns (3) and (6) of Table 1 presents the distribution of domestic stock by home country. The most represented country is Germany, followed by the United Kingdom[2] and France.

The final sample used in the cross-sectional analysis includes observations from January 1990 to December 2007 and consists of 4,211 stocks, including 509 stocks with a foreign presence. The sample used in regression analysis is reduced due to the unavailability of data for some of the explanatory and control variables; the smallest sample used to estimate some model specifications is 2,180 stocks, including 425 stocks with a foreign presence. Columns (4) and (7) of Table 1 presents the distribution of the sample by home country.

4. Empirical analysis

4.1 Variables definition and Summary statistics

Dependent variables: Stock liquidity and price volatility measures

Analysis is focused on the stock price behaviour on the stock's home market. Dependent variables are stock liquidity and volatility measures. I use three measures of stock liquidity: 1) proportional bid-ask spread that reflects the difference between ask and bid home market prices relative to the midpoint, i.e. the average of the ask and bid prices; monthly average bid-ask spread is the average of the daily bid-ask spreads 2) turnover ratio that is the monthly average of the daily turnover ratios calculated as a ratio of the trading volume by value, i.e. the product of the number of shares traded and the stock price, to the stock's market capitalization and 3) total turnover ratio[3] that is the monthly average of the

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[2] Relatively small number of domestic stocks from the UK can be explained by the fact that majority of the UK stocks are listed or admitted to trading on other European exchanges. Out of the 1,928 UK stocks available in Datasream, only 546 stocks were identified as domestic, while 1,138 stocks were identified as stocks with foreign presence. The majority of stocks with foreign presence are admitted to trading on Berlin exchange, Frankfurt exchange and XETRA

[3] When a stock is traded in more than one market, as in case of cross-listed stocks, analysis of home market liquidity might not provide a complete picture if a significant portion of the stock trading takes place in a foreign market(s). Accordingly, it is beneficial for an understanding of the stock's overall liquidity to additionally examine the changes after cross-listing/

daily total turnover ratios calculated as a ratio of the total trading volume in GBP to the stock's market capitalization in GBP. Total trading volume in GBP is the sum of the trading volumes in GBP on each exchange in the sample where the stock is traded, calculated as the product of the number of shares traded and the stock price converted to GBP. Also I use three measures of stock price volatility to quantify stock risk[4]: 1) stock return volatility defined as the monthly standard deviation of the stock's daily return including dividend income 2) volatility ratio that additionally accounts for market-level volatility and is calculated as the ratio of monthly standard deviation of the stock daily total return to monthly standard deviation of the home market index daily total return and 3) high-low ratio (Parkinson, 1980) that is the average of the daily high-low ratios calculated as the natural logarithm of the ratio of the highest stock price achieved on the day to the lowest price achieved on the day.

Panel A of Table 4 reports summary statistics of the liquidity and volatility measures[5] for the full sample and for sub-samples by listing/ trading status. Table 3 also reports the difference in variable means and medians between two groups of stocks: 1) stocks with a particular foreign listing/ trading status (with foreign presence, and individually for cross-traded only, cross-listed only and cross-listed and traded simultaneously), and 2) domestic stocks. Based on a t-test and a Wilcoxon test, I find that mean and median *liquidity* measures of the stocks with foreign presence are significantly different from those of the domestic stocks. As expected, compared to those of domestic stocks, stocks with foreign presence and, particularly, stocks that are cross-listed and cross-traded at the same time, enjoy significantly lower bid-ask spread and significantly higher home market turnover ratio and total turnover ratio. Further, Panel A of Table 4 reports that, in line with expectations, mean and median *volatility* measures of the stocks with foreign presence, including cross-listed and cross-traded stocks, are significantly lower than those of the domestic stocks based on a t-test and a Wilcoxon test accordingly.

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trading in total turnover ratio. Total turnover ratio takes into account trading volumes in all markets where the stock is listed and traded.

[4] The focus of this study is on the total stock risk. A number of studies link the quality of the information environment to stock's idiosyncratic risk (e.g. Ferreire and Laux, 2007; Fernandes and Ferreira, 2008). I acknowledge that stock idiosyncratic risk would be an appropriate measure; however, I do not use it due to data limitation. In order to obtain reliable estimates of the idiosyncratic risk using a market model a relatively long time series of daily stock returns are required (Draper and Paudyal, 1995). In this study I evaluate and compare stock risk over periods of time when the stock had different listing statuses and in many cases the length of such time periods is not sufficient to estimate parameters of a market model.

[5] To avoid drawing spurious inferences from extreme values, the observations of all liquidity and volatility measures distributions over the whole sample period are trimmed 1% at each end.

Explanatory variables: cross-listing/ trading status

Definition, measurement and data sources for the explanatory variables are presented in Table 3. The main explanatory variable is the *listing/ trading status* variable that reflects one of the following listing and/or trading statuses:

- domestic, i.e. not listed or trade outside of the home market

- cross-traded, i.e. traded abroad without stock exchange listing in addition to the home market listing

- cross-listed, i.e. listed on a foreign exchange in addition to the home market listing

- with foreign presence, i.e. cross-listed and/or cross-traded inclusive

- cross-listed and cross-traded, i.e. cross-listed and cross-traded simultaneously

Listing/ trading status of a cross-listed company in the sample changes over time: from domestic to listed and/or traded on one or more foreign exchanges/ trading venues. The listing/ trading classification is based on the sample data.

Control variables

Main control variables are chose that have a direct impact on the change in stock liquidity and volatility after cross-listing/ trading, as discussed in the Hypotheses development section, namely, Company size, International accounting standards used, Analysts coverage, and Total trading volume. Additionally, I control for such firm characteristics as the level of the stock ownership concentration, sales growth, leverage and intangibles. Finally, I control for the home country characteristics in the stock-level liquidity and volatility analysis, specifically, per capita GDP, Capital market size, market-level liquidity, legal environment, and country-level quality of accounting information. Definition, measurement and data sources for all explanatory and control variables are presented in Table 3.

Panel B of Table 4 provides descriptive statistics of firm characteristics[6] used as control variables in multivariate analysis. Based on a t-test and a Wilcoxon test, companies with foreign presence, and, particularly, stocks simultaneously listed and traded abroad, are significantly larger than domestic companies. As expected, stocks with foreign presence and, particularly, stocks simultaneously listed and traded abroad, enjoy significantly higher analyst coverage than domestic stocks and have significantly lower ownership concentration, measured by the percentage of closely held shares, than domestic stocks. Furthermore, companies with a foreign presence exhibit significantly lower sales

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[6] To avoid drawing spurious inferences from extreme values, the observations of company size, sales growth, leverage, and intangibles variables are also trimmed 1% at each end. The Closely held shares variable, proxy for ownership concentration, is discarded if it is more than 100 percent.

growth, are significantly more leveraged, and have a significantly higher ratio of the intangible assets to the total assets.

4.2 Cross-sectional analysis

In cross-sectional analysis the liquidity and volatility of cross-listed and cross-traded stocks is compared against those of pure domestic stocks. A cross-listing decision, however, is a matter of choice for a company and largely determined by company-specific factors (Pagano et al, 2002). Therefore, it is essential to control for self-selection bias in the estimation of the relationship between cross-listing/ trading and stock liquidity and volatility. I use Heckman's (1979) two-stage estimation method to control for potential endogeneity, firstly, estimating with probit model[7] the likelihood of a company to cross-list and cross-trade given company and home country characteristics, and then use maximum likelihood coefficient estimates from the probit model to calculate Inverse mills ratio[8] that will be employed in the cross-sectional regression analysis.

Probability of foreign presence: cross-listing and cross-trading

The probability of foreign presence, cross-listing and cross-trading is estimated using the full sample of cross-listed/ traded and domestic stocks as a function of company and home country- specific characteristics. Table 5 reports the output from three probit regressions of a dummy variable representing the listing/ trading status (foreign presence, cross-listing and cross-trading accordingly) on the company size and a number of the home country characteristics, including per capita GDP, market size, legal index and accounting opacity index. All variables have the predictable sign and are significant. Companies that are larger, come from countries with higher per capita GDP, but smaller capital markets, weaker investor protection and higher accounting opacity are more likely to cross-list and cross-trade outside of the home country.

Multivariate analysis

A multivariate framework is used to test the main hypothesis that a stock's availability for trading on a foreign exchange enhances the stock's information environment proxied by various measures of stock liquidity and volatility, controlling for other factors that are likely to affect the cross-section of stock-

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[7] Following Doidge et al (2004, 2009), I estimate a probit model that includes company size and a number of country characteristics, such as economic development, financial development, legal environment and accounting opacity, as potential determinants of a cross-listing and cross-trading status

[8] Inverse mills ratio is the ratio of the probability density function over the cumulative distribution function of a distribution, for each observation in the sample: $\lambda_{i,t} = \varphi(\omega F_{i,t})/ \Phi(\omega F_{i,t})$, where φ is the normal probability distribution function and Φ is the normal cumulative distribution function. Inverse mills ratio is the estimate of the non-selection hazard that discounts the probability of a stock with characteristics $F_{i,t}$ being listed/ traded on a foreign exchange.

level liquidity and volatility. Furthermore, it is used to test whether the impact of an international cross-listing differs from that resulting from admission to trade on a foreign exchange.

Panel data regressions reported in Tables 6 and 7 are estimated using OLS procedure[9] with heteroskedasticity consistent (White, 1980) standard errors that are adjusted to account for the possible correlation within a cluster[10]. Additionally, all model specifications include industry-fixed effects to account for potential cross-sectional dependence within an industry and year-fixed effects to account for potential dependence across time. Finally, I control for country- level differences by including country-level control variables – per capita GDP, capital market size, legal index and accounting opacity index.

Regression specifications in Table 6 aim to evaluate the power of the stock foreign presence in explaining stock liquidity and volatility. They include a foreign presence variable (lambda), i.e. the inverse Mills ratios, in order to account for the probability of a stock having a foreign presence. Regression specifications in Table 7 focus on the difference in the impact of cross-listing and cross-trading on stock liquidity and include, instead of a foreign presence variable, cross-listing and cross-trading variables (lambdas), i.e. the inverse Mills ratios, derived to account for the probability of a stock being cross-listed and cross-traded accordingly. Additionally, model specifications (2) of Table 6 and Table 7 include interactive variables of the foreign presence dummy variable with the main control variables – company size, international accounting standards and residual analyst coverage, in order to account for the impact of the changes in the firm characteristics named above after cross-listing/ trading. The interaction variables measure the incremental contribution to the change in stock liquidity due to the change in the company size, company-level accounting practices and analyst coverage.

Stock liquidity: Bid-ask spread

The hypothesis to test is that a foreign listing and, to a lesser degree, foreign trading positively affect the stock's information environment and, thus, should result in lower bid-ask spread of the stock. In model specifications that do not control for the change in firm characteristics after a foreign listing/admission to trade (bid-ask spread models (1), Tables 6 and 7), the coefficient estimates of the foreign presence variable and the cross-listed variables are positive and significant at 1%. However,

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[9] As a robustness test, two alternative panel data methods were additionally used to estimate the relationship between stock liquidity and volatility and the stock foreign presence controlling for other firm-level and country-level determinants of stock liquidity and volatility: 1) firm fixed effects that control for all unobserved heterogeneity across stocks and 2) random effects. The estimation results (not reported) are in line with the estimation results from OLS procedure.

[10] This estimation method is chosen based on the findings of Peterson (2008) that it produces unbiased standard errors when there is a possibility that residuals are correlated cross-sectionally.

after introducing interactive variables to reflect the changes in firm characteristics after the change in the listing status, the foreign presence, cross-listed and cross-traded variables have coefficient estimates that are negative (-0.01) and statistically significant at least at 5% (bid-ask spread models (2), Tables 6 and 7).

Theoretically, stocks of larger companies that use higher quality accounting standards provide lower trading costs to investors due to lower information costs. Empirically, I find that indeed company size and international accounting standards are negative and statistically significant determinants of the bid-ask spread (bid-ask spread models, Tables 6 and 7). However, I find that the impact of cross-listing/trading on the bid-ask spread is asymmetric based on company size and accounting standards used. It is smaller companies that experience more considerable incremental reduction in the bid-ask spread following cross-listing/trading, as suggested by the positive and highly significant coefficient estimates on the interaction variables of company size with foreign presence, cross-listed and cross-traded dummy variables accordingly (bid-ask spread models (2), Tables 6 and 7). Similarly, companies with international accounting standards experience an increase in the bid-ask spread after becoming present on a foreign exchange, suggested by the coefficient of 0.01 significant at 1% on the IAS*Foreign presence variable. The bid-ask spread model (2) of Table 7 reveals that the latter result is driven by cross-traded stocks rather than by cross-listed stocks.

The greater analyst coverage results in lower information costs for investors and, accordingly, in lower bid-ask spread. Empirically, the coefficient estimate on the residual analysts' coverage is negative in all the bid-ask spread model specifications. However, the impact of the change in the intensity of analysts' coverage after the change in listing status varies between cross-listing and cross-trading. While cross-trading further reduces the bid-ask spread, cross-listing actually reduces the bid-ask spread for companies with a smaller increase in analyst coverage after cross-listing, as suggested by the positive and significant at 5% coefficient estimate on the Analysts*Cross-listed variable) (bid-ask spread model (2), Table 7). Also, empirical findings confirm theoretical expectations that the bid-ask spread is lower for stocks that are more actively traded and higher for stocks that exhibit higher return volatility and a higher concentration of stock ownership (bid-ask spread models, Tables 6 and 7).

To summarize, the findings provide empirical support to the hypothesis H1.1 that cross-listed and cross-traded stocks have lower trading costs as a result of the enhanced information environment. I find that, foreign presence overall, and cross-listing and cross-trading individually, significantly reduce the bid-ask spread, controlling for stock-specific and country-level determinants of the bid-ask spread and controlling for asymmetric impact of company size and company accounting practices on

the bid-ask spread following cross-listing/trading. However, the expectation that cross-listing has a more profound impact than cross-trading due to additional disclosure requirements (hypothesis H1.2) are not confirmed empirically. I find that the impact of cross-listing on the bid-ask spread is similar to that of cross-trading – the difference in coefficient estimates, while significant, is very small in magnitude.

Stock liquidity: Turnover ratios

Based on the regression output reported (Table 6), stocks with foreign presence do have higher home market and total turnover ratios, controlling for other stock-level and market-level factors. However, based on the output of the regressions that include variables reflecting the incremental impact of the change in company size, accounting practices and analyst coverage after cross-listing/ trading on the stock liquidity (model (2)), it is the increase in company size and the increase in analyst coverage (in case of the home market turnover) that drive the improvement in the turnover ratios rather the change in listing status per se. There is evidence that cross-listing has a positive and significant impact on stock liquidity measured by the total turnover ratio, controlling for other factors including the change in company size, accounting practices and analyst coverage after cross-listing/ trading. Moreover, based on the Wald test statistics, a foreign exchange listing improves stock turnover more significantly in comparison to an admission to trade on a foreign exchange (Table 7). In other words, cross-listing enhances stock liquidity due to an increase in trading on foreign exchanges but not on the home market, whereas admission to trade has no positive impact on stock liquidity measured by stock turnover ratio.

To sum up, the findings on the change in stock liquidity after cross-listing/ trading partly support the hypothesis H1.1 that stock that can be traded abroad are more liquid due to the enhanced information environment. More specifically, it is found that listing as well as admission to trade on a foreign exchange significantly reduces the stock's transaction costs measured by the bid-ask spread, possibly, due to facilitated inter-market competition among market makers rather than to the increase in the level of information disclosure. Furthermore, it is found that more active trading of cross-listed and cross-traded stocks on the home market can essentially be explained by the change in company size and by the change in the level of analyst coverage rather than by the change in listing status. The level of trading activity on foreign exchange(s), however, is positively affected by the cross-listing status but not by the cross-trading status, which is in line with the findings of Dodd (2010) that regulated stock exchanges have superior ability to attract the active trading of cross-listed stocks compared to

OTC markets and trading platforms. Thus, there is a partial confirmation of the hypothesis H1.1 that cross-listing results in more significant improvement in stock liquidity compared to cross-trading.

Stock price volatility

Table 6 and Table 7 report that the coefficient estimates on the foreign presence, cross-listed and cross-traded variables are negative and statistically significant in all model specifications, except for high-low ratio models (1). In other words, there is strong empirical evidence that a stock presence on a foreign exchange, including exchange listing and admission to trade, results in significant reduction in stock price volatility, controlling for other stock-specific and market-level determinants of stock volatility. Furthermore, after controlling for the changes in firm characteristics after foreign listing/ admission to trade (models (2), Tables 6 and 7), I find that coefficient estimates become even more negative and statistically significant with the exception of cross-traded variable in the volatility ratio model (2) of Table 7. The high-low ratio that is not affected by foreign listing/ trading in models (1), becomes negative and significant after controlling for the change in company size and in stock trading volume (models (2)), implying that intra-day price volatility is also reduced by listing and trading outside of the home market.

As predicted, company size is a highly significant negative determinant of all measures of stock volatility. However, the impact of cross-listing/trading on stock volatility is asymmetric based on company size, meaning smaller companies experience larger marginal reductions in volatility following cross-listing/trading, as suggested by the positive coefficient estimates on the interaction variables of company size with foreign presence, cross-listed and cross-traded dummy variables accordingly. In contrast to expectations, the coefficient estimate on the international accounting standards variable is positive and significant in all model specifications (Table 6 and 7); however, for cross-listed/ traded stocks the adoption of international accounting standards is rewarded with lower stock price volatility. Furthermore, no consistent evidence is found that residual analyst coverage has an impact on stock price volatility. In line with extensive empirical evidence in the literature, higher trading volumes are found to be associated with higher stock price volatility. Furthermore, the interactive variables of trading volume and the listing status variables capture the additional increase in stock price volatility due to the increase in trading activity of cross-listed/ traded stocks. The results also reveal that stocks with higher rates of sales growth, higher leverage, with higher intangibles to total assets ratios and with more concentrated stock ownership have significantly higher stock price volatility.

Overall, there is compelling empirical evidence in support of hypothesis H2.1 that a foreign listing and trading significantly reduces stock price volatility, measured by stock return volatility, market-adjusted return volatility and intra-day price variation. In contrast, there is no evidence found to support hypothesis H2.2 that cross-listing results in greater reduction of stock price volatility compared to cross-trading due to additional mandatory information disclosure requirements. The impact of cross-listing is found to be similar to that of cross-trading for return volatility and high-low ratio as the coefficient estimates are similar in magnitude and statistical significance, and only in case of market-adjusted stock volatility does cross-listing reduce stock volatility ratio more significantly than cross-trading. The fact that cross-trading reduces stock price volatility almost as much as cross-listing implies that the improvement in the stock's information environment comes not from the imposed cross-listing disclosure requirements but mostly from the increased production of stock-specific information that occurs because after cross-listing/ trading as a larger number of investors have access to the stock.

4.3 Evolution of stock liquidity and volatility around cross-listing/ trading

Cross-sectional analysis provided evidence that cross-listing/ trading has a significant impact on stock liquidity and volatility. The next empirical question is: what are the dynamics of stock liquidity and stock price volatility before and after cross-listing and cross-trading event? In order to reveal the dynamics, the year of the initial foreign presence/ cross-listing/ cross-trading is assigned as the year 0, and the years around the year 0 are assigned accordingly as the years $\leq$ -4, -3, …, 0, +1, …, +3, $\geq$ +4 relative to the year 0. Initially, stock liquidity and stock price volatility of cross-listed stocks individually in each of the years $\leq$ -4, -3, …, 0, +1, …, +3, $\geq$ +4 are compared against the stock liquidity and volatility in the year 0 and against liquidity and volatility of domestic stocks. Then, the evolution of stock liquidity and volatility is evaluated using a multivariate regression analysis framework. In cross-sectional regressions variables representing foreign presence, cross-listing and cross-trading listing statuses are replaced with a series of dummy variables representing years around foreign presence/ cross-listing/ cross-trading from beyond year -4 to beyond year +4. Coefficient estimates on these year dummies relative to the year of cross-listing/ trading would, thus, indicate the evolution of stock liquidity and volatility before, during the year of and after cross-listing and cross-trading, controlling for other relevant factors.

Panels A.1 and A.2 of Figure 1 plot the results of univariate analysis of the evolution of stock liquidity and volatility respectively around foreign presence, cross-listing, and cross-trading. To construct the

plotted relative measures of stock liquidity and volatility, mean liquidity and volatility measures are first calculated for companies with foreign presence in year $\leq$ -4, -3, …, 0, +1, …, +3, $\geq$+4 relative to the year 0 of foreign presence/ cross-listing/ cross-trading accordingly, then the calculated means are divided by the mean of the corresponding measure of stock liquidity/ volatility of the companies with domestic listing status. Panels B.1 and B.2 of Figure 1 plot coefficient estimates on the dummy variables that represent the year relative to the change in listing status reported in Table 8. More specifically, Table 8 reports coefficient estimates of the dummy variables representing years around the year of the change in listing status from regressions that control for other factors.

Bid-ask spread. A relative bid-ask spread of 0.54 and below (Figure 1 Panel A.1) indicates that the bid-ask spread of companies with foreign presence is almost half of that of domestic companies even before foreign listing/ admission to trade, as long as it is four or more years before cross-listing/ cross-trading. The plot reveals that there is a significant downward trend in the bid-ask spread following both cross-listing and cross-trading, suggesting that the reduction in bid-ask spread after foreign listing/ trading endures over time. After controlling for other factors that affect the stock's bid-ask spread, the impact of foreign presence is profoundly negative (Panel A of Table 8 and Panel B.1 of Figure 1). Specifically, coefficient estimates on the dummy variable representing years relative to foreign presence/ cross-listing/ cross-trading are positive for the years before the change in listing/ trading status and both negative and statistically significant in the year of foreign listing/ trading and thereafter. Coefficient estimates on the dummy variables for cross-listing and cross-trading are similar by magnitude and statistical significance; in other words the impact of cross-listing and that of cross-trading are comparable. Overall, there is evidence that listing/trading on foreign exchanges is associated with a significant decrease in the bid-ask spread that is sustainable over time.

Turnover ratio. The next proxy of stock liquidity, turnover ratio, takes into account the number of shares outstanding. Turnover ratio and total turnover ratios of cross-listed stocks three or more years before the year of the cross-listing/ trading event are no different from those of domestic stocks. In the year of cross-listing/trading, mean turnover ratios of cross-listing/ cross-trading stocks are above the level of those of domestic stocks, in other words, relative mean turnover ratio is more than one, and is steadily increasing following the cross-listing/trading event (Panel A.2 of Figure 1). After controlling for other factors in regression analysis, a foreign exchange listing is associated with a positive contribution to the stock's turnover ratio and, particularly, total turnover ratio, while admission to trade is associated with a negative contribution to the stock's turnover ratio (Panel A of Table 8 and Panel B.2 of Figure 1). This finding empirically supports hypothesis H1.2 that cross-listing has a more profound positive impact on stock liquidity than cross-trading.

Volatility. Panel A.2 of Figure 1 shows that stock volatility, measured by stock return volatility, volatility ratio, and high–low ratio, of cross-listed stocks is less than that of domestic stocks, as relative volatility measures are below one for any year relative to a cross-listing/ trading event. There is an increase in the mean stock return volatility and high-low ratio during (-1; +1) years around the cross-listing/ trading event, followed by a downward trend during and after the second year relative to the change in listing status. After controlling for other factors that potentially affect stock volatility in regression analysis, foreign trading is associated with a negative and statistically significant contribution to the stock's return volatility and high-low ratio, while a foreign exchange listing is associated with a negative but insignificant contribution to the stock volatility (Panel B of Table 8 and Panel B.2 of Figure 1). Overall, the decrease in volatility as a result of the change in listing is persistent over time.

To sum up, the findings of the analysis of the evolution of stock liquidity and volatility confirm and further extend the results from cross-sectional analysis. Supportive of the hypothesis H1.1, trading on a foreign exchange is found to be associated with reduced transaction costs. Supportive of the hypothesis H1.2 that cross-listing has greater positive impact on stock liquidity than cross-trading, cross-listing is found to be associated with a significant increase in trading activity, whereas cross-trading is not. Furthermore, the findings support hypothesis H2.1 that stock price of cross-listed/ traded stocks is less volatile and do not support hypothesis H2.2 that cross-listing is associated with greater reduction in stock price volatility than cross-trading. More importantly, the improvements in stock liquidity and stock price volatility due to listing and/or trading on a foreign exchange are found to be sustainable beyond up to four years after the change in listing status.

5. Conclusions

A company's commitment to the higher levels of information disclosure and scrutiny by market participants after a foreign listing should lower the information asymmetry between the managers and the investors and between different groups of the investors. This study tests this proposition empirically by examining the changes in stock's liquidity and price volatility after the stock becomes available for trading on a foreign stock exchange for the sample of European cross-listed companies that have their shares listed and/or traded on a various foreign exchanges. Since the presence on a foreign stock exchange enhances the stock's information environment via additional information disclosure by the company and via production of stock- specific information by the increased number of investors, stocks that can be traded on a foreign exchange(s) are expected to be more liquid and

exhibit lesser price volatility. Further, this study distinguishes between a foreign exchange listing and a foreign trading that differ by the level of mandatory information disclosure and test the hypothesis that a cross-listing more significantly enhances the stock's information environment and, accordingly, more significantly improves stock liquidity and reduces stock price volatility.

Firstly, stock liquidity and volatility of cross-listed and cross-traded stocks is compared against those of domestic stocks controlling for other determinants of the stock liquidity and stock price volatility in the cross-sectional univariate and multivariate analysis. Secondly, the evolution of stock liquidity and stock price volatility measures is tracked in the years around the year of cross-listing and/or cross-trading using the sample of cross-listed and/or cross-traded stocks as well as domestic stocks.

The empirical evidence confirms that the added disclosure and information production after a foreign listing results in significant benefits for a cross-listed company. Stocks that can be traded on an exchange(s) outside of the home country have lower transaction costs, have higher trading activity, and have less volatile stock price compared to pure domestic stocks. After controlling for potential self-selection bias and other factors that potentially affect stock liquidity and stock price volatility, a presence on a foreign exchange is associated with a significant reduction in transaction costs measured by bid-ask spread and a significant reduction in stock price volatility. The evidence of considerably higher trading activity of cross-traded stocks is mainly explained by the increase in company size following a foreign listing/ trading. Cross-listing status only results in significant improvements of the total turnover ratio driven by active trading on a foreign exchange(s) following the cross-listing.

The next important finding is that the impact of cross-listing and cross-trading on stock liquidity and stock price volatility is sustained over time. More specifically, the observed decrease in bid-ask spread, the increase in total turnover ratio, and decrease in volatility are sustained for four or more years after cross-listing/ admission to trading.

Another major finding of this study is that the impact of a foreign exchange listing on the stocks' information environment measured by stock's liquidity and price volatility is not significantly different from that of an admission to trading on a foreign exchange. There are two possible explanations for the similar impact of cross-listing and cross-trading. First, it is possible that information environment improved by added mandatory disclosure requirements of cross-listed stocks is not substantially higher than that of the stocks that are admitted to trade. The sample contains of European stocks cross-listed on various exchanges, including European exchanges. The level of addition information disclosed from cross-listing within European Union is not expected to be significant due to the presence of the mutual recognition principle in regards to stock exchange

listings, according to which EU-complied companies are not subject to any additional legal and disclosure requirements when cross-listing within the European Union. Comparing the impact of cross-listing on various markets, particularly, the US and continental Europe due the substantially different legal frameworks, on the stock's information environment is one of the directions for future research on cross-listing. Second, the similar impact of cross-listing and cross-trading can be explained by the fact that along with added mandatory disclosure there are other important factors that equally affect information environment of cross-listed and cross-traded stocks, such as improved stock accessibility to foreign investors, intensified competition among market makers, and increased production of stock-specific information by a larger number of market participants that have an economic interest in the stock after cross-listing/ admission to trading. The finding that the difference between the implications of cross-listing and cross-trading is not significant triggers new questions for future research regarding the motivations and justification of cross-listing vs. cross-trading.

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Figure 1. The evolution of stock liquidity and volatility around cross-listing and/or cross-trading

Panel A.1 The evolution of relative stock liquidity. Panel A plots the relative measures of stock liquidity in each year around the year of cross-listing and/or cross-trading (year 0). Foreign presence is inclusive of cross-listing and cross-trading statuses. The relative measures of stock liquidity are defined as the mean measure of stock liquidity of the sub-sample of stocks with a particular listing status over the mean measure of stock liquidity of domestic stocks.
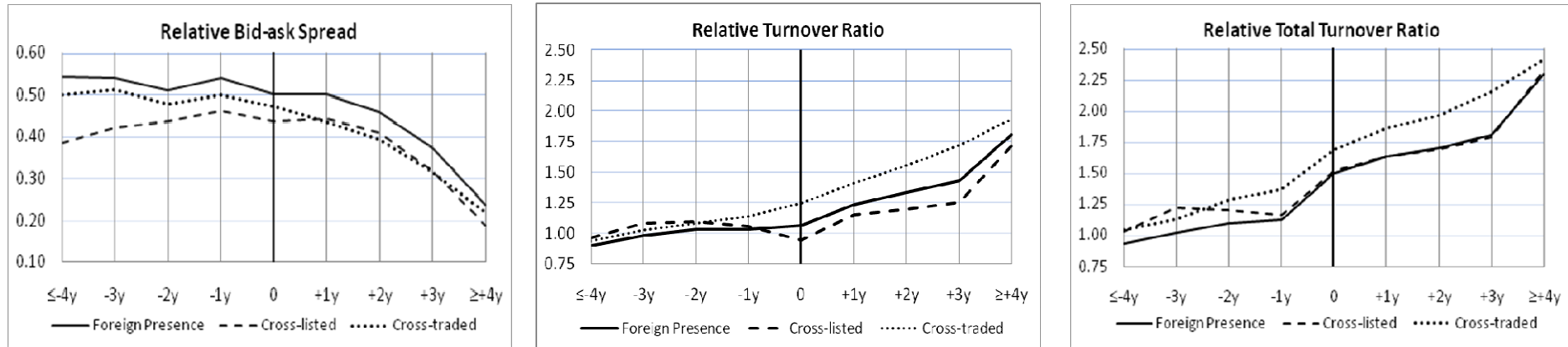
Panel B.1 The evolution of stock liquidity: regression analysis. Panel B plots the coefficient estimates of the year-specific dummy variables relative to the year of cross-listing and/or cross-trading (year 0) from regressions reported in Table 10. Foreign presence is inclusive of cross-listing and cross-trading status.
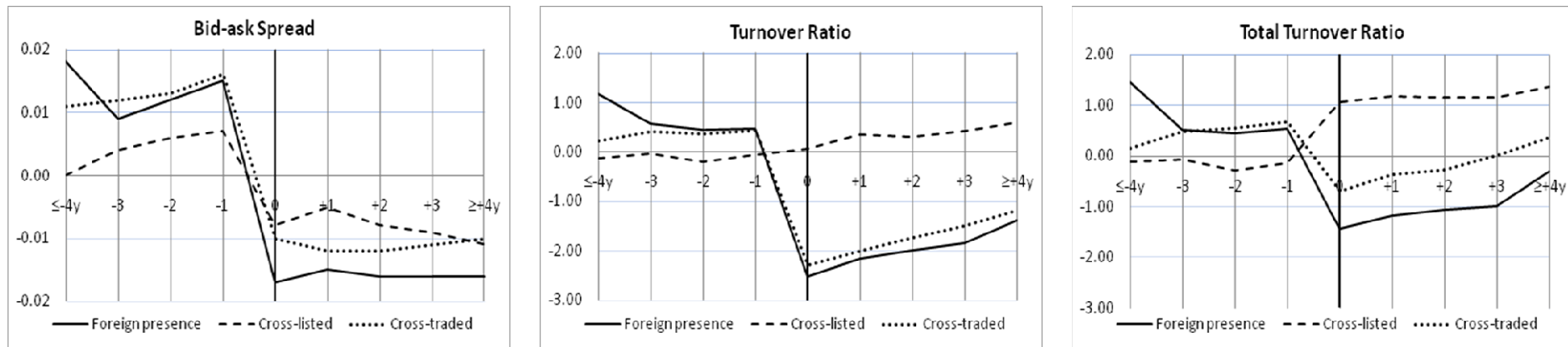
Panel A.2 The evolution of relative stock volatility. Panel A plots the relative measures of stock volatility in each year around the year of cross-listing and/or cross-trading (year 0). Foreign presence is inclusive of cross-listing and cross-trading statuses. The relative measures of stock volatility are defined as the mean measure of stock volatility of the sub-sample of stocks with a particular listing status over the mean measure of stock volatility of domestic stocks.
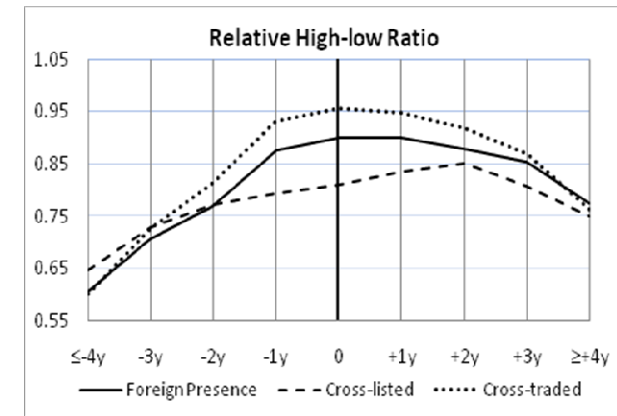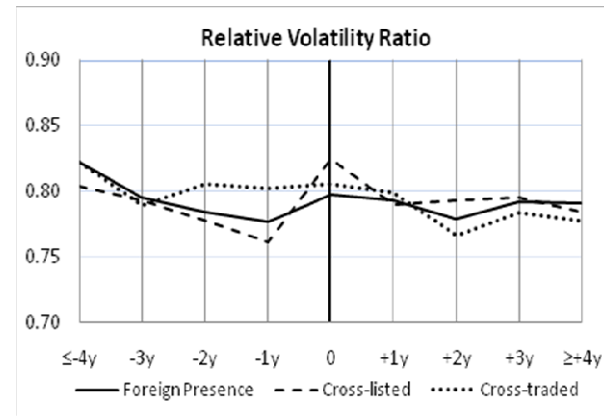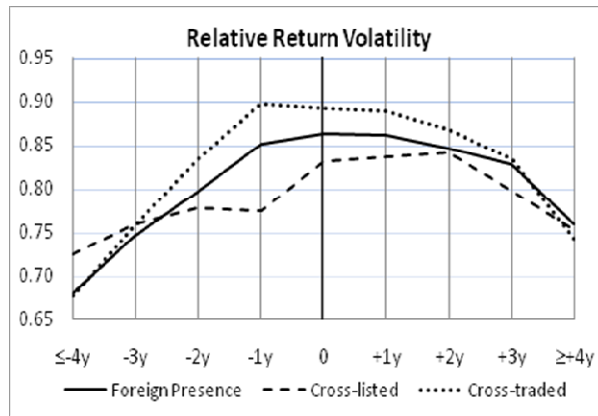
Panel B.2 The evolution of stock volatility: regression analysis. Panel B plots the coefficient estimates of the year-specific dummy variables relative to the year of cross-listing and/or cross-trading (year 0) from regressions reported in Table 10. Foreign presence is inclusive of cross-listing and cross-trading status.
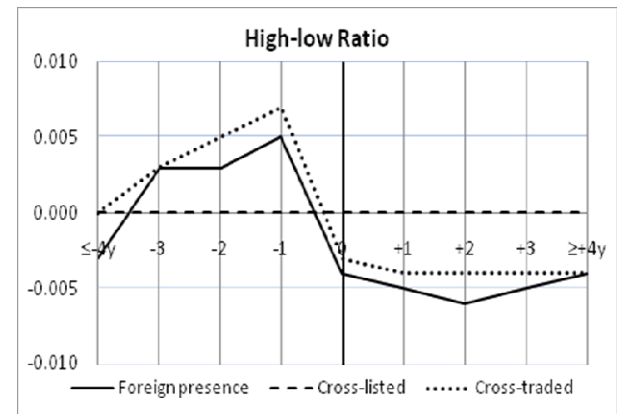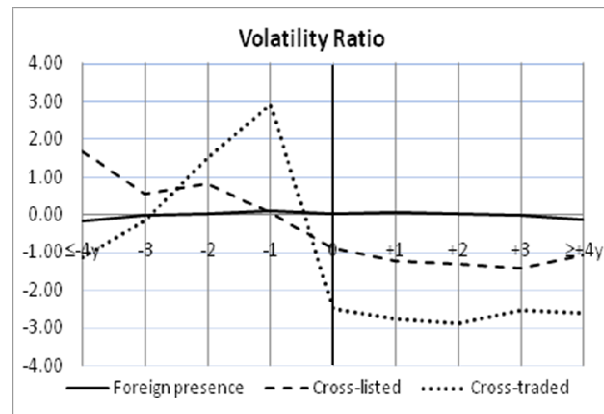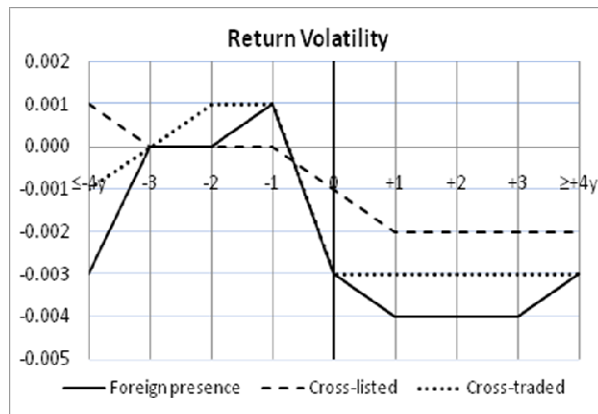
Table 1. Sample description

The table reports the sample description by the home country. It displays the number of companies with foreign presence, i.e. listed and/or traded on a foreign exchange(s), the number of domestic companies, i.e. listed and traded in the home country exclusively, and the total number of companies, which is the sum of the two previous categories, for each home country in the sample and for the sample total. Columns (2) – (4) report description of the sample that includes stocks with data available for all liquidity and volatility measures defined in Table 1. Columns (5) – (7) report description of the sample that includes stocks with data available for all liquidity and volatility measures defined in Table 1 as well as with data available for all explanatory and control variables defined in Table 2. Accordingly, the former sample is used in univariate analysis, while the latter sample is effectively used in multivariate regression analysis that incorporates the explanatory and control variables. Noticeably, stocks from Belgium, Luxemburg and Norway are excluded from multivariate regression analysis due to unavailability of data on the control variables.

	Sample with data available for liquidity and volatility measures			Sample with data available for all variables		
Home Country	Number of companies with foreign presence	Number of domestic companies	Total number of companies	Number of companies with foreign presence	Number of domestic companies	Total number of companies
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Austria	11	6	17	10	2	12
Belgium	13	80	93	0	0	0
Denmark	12	115	127	12	68	80
Finland	9	42	51	8	32	40
France	57	442	499	55	245	300
Germany	55	1559	1614	51	685	736
Hungary	11	13	24	11	2	13
Ireland	42	6	48	33	4	37
Italy	20	64	84	18	38	56
Luxemburg	7	9	16	0	0	0
Netherlands	22	26	48	20	22	42
Norway	12	77	89	0	0	0
Poland	9	199	208	9	50	59
Portugal	2	29	31	2	15	17
Russia	34	122	156	23	26	49
Spain	10	26	36	10	17	27
Sweden	17	110	127	15	27	42
Switzerland	22	74	96	20	63	83
Turkey	12	250	262	11	162	173
United Kingdom	132	453	585	117	297	414
Total	509	3702	4211	425	1755	2180

Table 2. Stock liquidity and price volatility measures

The table presents the list of stock liquidity and price volatility measures, used to proxy the quality of the stock's information environment and provides definition and data sources for each of the variables.

Variable	Definition/ Measurement	Data source
Liquidity		
Proportional Bid-ask spread	Monthly average bid-ask spread is the average of the daily bid-ask spreads. Daily bid-ask spread is the ratio of the difference between ask and bid home market prices to the average of ask and bid prices	DataStream
Turnover ratio	the average of the daily turnover ratios calculated as the product of the number of shares traded and the stock price divided by the stock market capitalization	DataStream
Total turnover ratio	the average of the daily total turnover ratios calculated as the total trading volume in GBP divided by the stock market capitalization in GBP. Total trading volume in GBP is the sum of the trading volumes in GBP on each exchange in the sample, calculated as the product of the number of shares traded and the stock price converted to GBP	DataStream
Volatility		
Return volatility	the monthly standard deviation of the stock daily total return (including dividend income)	DataStream
Volatility ratio	the ratio of the monthly standard deviation of the stock daily total return to monthly standard deviation of the home market index daily total return	DataStream
High-low ratio	the average of the daily high-low ratios calculated as the natural logarithm of the ratio of the highest stock to the lowest price achieved on the day	DataStream

Table 3. Explanatory and control variables

The table presents the list of the explanatory and control variables and the abbreviation used in the forthcoming tables, and provides definition and data sources for each of the variables.

Variable	Abbreviation	Definition/ Measurement	Data source
Stock-level variables			
Foreign presence	Foreign presence; FP	dummy variable =1 if stock is listed and/or traded on a foreign exchange, =0 otherwise	the sample
Lambda foreign presence	Lambda ForeignPresence	the Mills inverse ratio derived using probit model estimation of probability for a stock to have a foreign presence	estimated
Cross-listed	Cross-listed; CL	dummy variable =1 if stock is listed on a foreign exchange, =0 otherwise	the sample
Lambda Cross-listed	Lambda Cross-listed	the Mills inverse ratio derived using probit model estimation of probability to cross-list	estimated
Cross-traded	Cross-traded; CT	dummy variable =1 if stock is admitted to trading on a foreign exchange, =0 otherwise	the sample
Lambda Cross-traded	Lambda Cross-traded	the Mills inverse ratio derived using probit model estimation of probability to trade on a foreign exchange	estimated
Company size	Company size	stock market capitalization, daily and monthly at the end of the month	DataStream
Total trading volume	Total trading volume	the average of the total daily trading volume for each month. Daily trading volume is the sum of the number of shares traded on all exchanges in the sample	DataStream
International accounting standards	Int accounting standards; IAS	dummy variable =1 if company used IAS, IFRS or US GAAP at the end of the proceeding year, =0 otherwise	DataStream
Analysts coverage	Analysts coverage	the total number of EPS one year estimates on the company	I/B/E/S, DataStream
Analysts coverage residual	Analysts; Analysts Residual	the error term from the regression of the analysts coverage on the company size	I/B/E/S, DataStream
Ownership concentration	Own. concentration	closely held shares – the percentage of shares held by insiders of the total common shares outstanding at the end of the preceding year	DataStream
Sales growth	Sales growth	the percentage increase in sales over the preceding three years	DataStream
Leverage	Leverage	the ratio of the total liabilities to total assets at the end of the preceding year	DataStream
Intangibles to Total assets ratio	Intangibles	the ratio of total value of intangible assets to total assets at the end of the preceding year	DataStream
Market-level variables			
GDP per capita	GDP per capita	the natural logarithm of the 3-year moving-average GDP per capita in USD	UN Statistics Division
Capital market size	Market size	the natural logarithm of total market capitalization of the DS Total Market index converted from local currency to GBP	DataStream
Market liquidty	Market turnover	the average daily ratio of the aggregate trading volume by value to the aggregate market capitalization of the DS Total market index calculated for each month	DataStream
Legal index	Legal index	the anti-director rights index multiplied by the rule-of-law index	Djiankov et al (2007), Kaufmann et al
Accounting opacity	Accounting opacity	accounting opacity index	Kurtzman et al (2004)

Table 4. Summary statistics

Panel A of the table reports the summary statistics of the stock liquidity and stock price volatility measures by different listing/ trading status. Liquidity and stock price volatility measures are defined in Table 1.

Panel B of the table reports the summary statistics of firm characteristics by different listing/ trading status. Company- specific variables (characteristics) are defined in Table 2. All stocks are inclusive of domestic stocks and stocks with foreign presence, i.e. listed and/or traded on a foreign exchange(s). Stocks with foreign presence include traded only stocks, i.e. traded abroad without stock exchange listing in addition to the home market listing, cross-listed only stocks, i.e. listed on a foreign exchange in addition to the home market listing, and cross-listed and cross-traded stocks (CL and CT), i.e. cross-listed and cross-traded simultaneously. Number (N) of observations is the number of stock-months observations of available data. Mean-difference with domestic is the difference between the mean of the sub-sample with a particular listing status and the mean of domestic stocks. Median-difference with domestic is the difference between the median of the sub-sample with a particular listing status and the mean of domestic stocks.

Variable	Listing/ trading status	N observations	Mean	Mean - difference with Domestic (1)	Median	Median - difference with Domestic (2)	Min	Max	St Dev
Panel A: Dependent Variables									
Liquidity									
Bid-ask spread	All	293,978	0.035		0.020		0.000	1.08	0.05
	Domestic	253,644	0.039		0.023		0.000	1.08	0.05
	Foreign Presence	40,334	0.013	-0.026***	0.005	-0.017***	0.000	0.40	0.02
	Traded only	21,602	0.015	-0.024***	0.006	-0.017***	0.000	0.40	0.03
	Cross-listed only	8,142	0.017	-0.022	0.009	-0.013***	0.000	0.32	0.03
	CL and CT	10,590	0.006	-0.033***	0.003	-0.020***	0.000	0.40	0.01
Turnover ratio	All	293,978	2.40		1.01		0.000	57.29	4.21
	Domestic	253,644	2.23		0.86		0.000	57.29	4.34
	Foreign Presence	40,334	3.52	1.30***	2.83	1.98***	0.000	23.20	3.03
	Traded only	21,602	3.73	1.51***	3.06	2.20***	0.000	23.20	3.14
	Cross-listed only	8,142	2.25	0.02**	1.86	1.00***	0.001	17.67	2.00
	CL and CT	10,590	4.06	1.84***	3.58	2.73***	0.001	22.82	3.17
Total turnover ratio	All	293,978	2.57		1.08		0.000	57.29	4.35
	Domestic	253,644	2.25		0.87		0.000	57.29	4.36
	Foreign Presence	40,334	4.56	2.31***	3.68	2.82***	0.000	34.13	3.71
	Traded only	21,602	4.53	2.29***	3.65	2.78***	0.000	30.41	3.76
	Cross-listed only	8,142	3.15	0.91***	2.44	1.57***	0.006	28.09	2.97
	CL and CT	10,590	5.70	3.45***	4.90	4.03***	0.009	34.13	3.74

Table 4 continued

Variable	Listing/ trading status	N observations	Mean	Mean - difference with Domestic (1)	Median	Median - difference with Domestic (2)	Min	Max	St Dev
Panel A: Dependent Variables									
Volatility									
Return volatility	All	293,978	0.022		0.020		0.000	0.10	0.01
	Domestic	253,644	0.022		0.020		0.000	0.10	0.01
	Foreign Presence	40,334	0.018	-0.004***	0.017	-0.004***	0.000	0.06	0.01
	Traded only	21,602	0.018	-0.004***	0.017	-0.004***	0.000	0.06	0.01
	Cross-listed only	8,142	0.017	-0.005*	0.016	-0.004***	0.000	0.05	0.01
	CL and CT	10,590	0.017	-0.005***	0.016	-0.004***	0.001	0.05	0.01
Volatility ratio	All	293,978	2.410		2.022		0.000	20.01	1.59
	Domestic	253,644	2.482		2.087		0.000	20.01	1.66
	Foreign Presence	40,334	1.961	-0.52***	1.772	-0.314***	0.000	10.36	0.95
	Traded only	21,602	1.960	-0.521***	1.764	-0.323***	0.000	10.36	0.98
	Cross-listed only	8,142	2.041	-0.441**	1.850	-0.237***	0.020	9.94	1.01
	CL and CT	10,590	1.902	-0.58***	1.737	-0.350***	0.091	8.82	0.82
High- low ratio	All	293,978	0.033		0.027		0.000	0.19	0.02
	Domestic	253,644	0.034		0.028		0.000	0.19	0.02
	Foreign Presence	40,334	0.028	-0.006***	0.024	-0.004***	0.001	0.13	0.01
	Traded only	21,602	0.029	-0.005***	0.025	-0.003***	0.001	0.13	0.02
	Cross-listed only	8,142	0.026	-0.008***	0.022	-0.006***	0.001	0.12	0.01
	CL and CT	10,590	0.027	-0.007***	0.024	-0.004***	0.001	0.12	0.01

(1) statistical significance reported is based on t-test

(2) statistical significance reported is based on Wilcoxon rank sum test

'***' indicates significance at 1%, '**' indicates significance at 5% and '*' indicates significance at 10%

Table 4 continued

Variable	Listing/ trading status	N observations	Mean	Mean - difference with Domestic (1)	Median	Median - difference with Domestic (2)	Min	Max	St Dev
Panel B: Firm Characteristics									
Company size	All	280,816	923		53		0	49,349	3,585
	Domestic	241,366	210		38		0	49,310	885
	Foreign Presence	39,450	5,286	5,075***	2,060	2,023***	2	49,349	8,034
	Traded only	21,249	3,852	3,642***	1,546	1,509***	2	49,349	6,250
	Cross-listed only	8,105	3,448	3,237***	862	824***	2	48,681	6,195
	CL and CT	10,096	9,780	9,569***	5,970	5,932***	4	49,280	10,582
Int. accounting standards	All	248,387	0.35		0.0		0.00	1.00	0.48
	Domestic	209,693	0.35		0.0		0.00	1.00	0.48
	Foreign Presence	38,694	0.34	-0.01***	0.0	0***	0.00	1.00	0.47
	Traded only	20,944	0.35	0.01	0.0	0	0.00	1.00	0.48
	Cross-listed only	7,582	0.20	-0.15***	0.0	0***	0.00	1.00	0.40
	CL and CT	10,168	0.41	0.06***	0.0	0***	0.00	1.00	0.49
Analysts coverage	All	273,594	4.5		1.0		0.0	54.0	7.1
	Domestic	233,788	2.9		1.0		0.0	41.0	5.1
	Foreign Presence	39,806	13.8	10.9***	13.0	12.0***	0.0	54.0	9.8
	Traded only	21,439	12.1	9.2***	11.0	10.0***	0.0	48.0	8.8
	Cross-listed only	7,959	12.9	10.0***	11.0	10.0***	0.0	50.0	10.5
	CL and CT	10,408	17.9	15.0***	18.0	17.0***	0.0	54.0	10.0
Ownership concentration	All	186,234	43.46		45.98		0.00	100.0	27.0
	Domestic	151,429	47.15		50.57		0.00	100.0	26.2
	Foreign Presence	34,805	27.39	-19.76***	22.97	-27.60***	0.00	100.0	24.1
	Traded only	19,016	29.84	-17.31***	25.72	-24.85***	0.00	100.0	24.7
	Cross-listed only	6,827	26.29	-20.86***	23.23	-27.34***	0.00	97.9	22.9
	CL and CT	8,962	23.04	-24.11***	16.39	-34.18***	0.00	100.0	23.0
Sales growth	All	240,962	0.48		0.16		-0.95	22.7	1.50
	Domestic	203,788	0.51		0.16		-0.95	22.7	1.60
	Foreign Presence	37,174	0.31	-0.20***	0.15	-0.01***	-0.78	7.9	0.70
	Traded only	20,227	0.31	-0.20***	0.15	-0.01***	-0.76	7.9	0.68
	Cross-listed only	7,207	0.33	-0.18***	0.17	0.01	-0.78	7.7	0.78
	CL and CT	9,740	0.29	-0.22***	0.14	-0.03***	-0.76	7.3	0.69
Leverage	All	262,944	0.57		0.58		0.01	1.38	0.24
	Domestic	224,652	0.56		0.57		0.01	1.38	0.25
	Foreign Presence	38,292	0.62	0.06***	0.62	0.05***	0.05	1.21	0.22
	Traded only	20,628	0.60	0.04***	0.60	0.04***	0.05	1.21	0.22
	Cross-listed only	7,556	0.62	0.06***	0.63	0.06***	0.05	1.19	0.22
	CL and CT	10,108	0.65	0.09***	0.64	0.07***	0.05	1.00	0.22
Intangibles	All	258,522	0.09		0.02		0.00	0.67	0.13
	Domestic	221,028	0.09		0.02		0.00	0.66	0.13
	Foreign Presence	37,494	0.12	0.03***	0.06	0.04***	0.00	0.67	0.14
	Traded only	20,290	0.12	0.03***	0.07	0.05***	0.00	0.65	0.14
	Cross-listed only	7,339	0.10	0.02***	0.03	0.01*	0.00	0.66	0.14
	CL and CT	9,865	0.13	0.04***	0.06	0.04***	0.00	0.67	0.15

(1) statistical significance reported is based on t-test
(2) statistical significance reported is based on Wilcoxon rank sum test
'***' indicates significance at 1%, '**' indicates significance at 5% and '*' indicates significance at 10%

Table 5. Probability of cross-listing and/or cross-trading

The table reports the output from binary probit model regressions of the dependent variable, foreign presence, cross-listing or cross-trading dummy variables accordingly, on the company size and market-level variables: *Probability (foreign listing/trading status) = f ($\omega F_{i,t}$)*, where $F_{i,t}$ - determinants of cross-listing and/or cross-trading status. Foreign presence dummy variable equals one if the stock is listed and/or traded on a foreign exchange and equal zero otherwise. Cross-listing dummy variable equals one if the stock is listed on a foreign exchange and equals zero otherwise. Cross-trading dummy variable equals one if the stock is admitted to trading on a foreign exchange and equals zero otherwise. The explanatory variables are defined in Table 2. The number (N) of observations is the number of stock-months observations of available data. The coefficients are estimated using maximum-likelihood procedures, standard errors are adjusted for clustering on the stock level.

Varible	Foreign presence			Cross-listing			Cross-trading		
	Estimate	z-stat	Pr > |z|	Estimate	z-stat	Pr > |z|	Estimate	z-stat	Pr > |z|
Intercept	-9.60	-9.77	<.0001	-9.21	-5.64	<.0001	-9.54	-8.82	<.0001
Company size	0.59	31.06	<.0001	0.45	18.29	<.0001	0.53	27.68	<.0001
GDP per capita	0.86	7.56	<.0001	0.87	4.73	<.0001	0.73	6.12	<.0001
Market size	-0.28	-8.15	<.0001	-0.27	-6.55	<.0001	-0.20	-5.28	<.0001
Legal index	-0.21	-6.75	<.0001	-0.24	-5.09	<.0001	-0.11	-3.45	0.00
Accounting opacity	1.88	5.86	<.0001	0.48	1.02	0.31	2.19	7.01	<.0001
Pseudo R-Sq	0.513			0.412			0.472		
N observations	266,942			266,942			266,942		
N stocks	3,967			3,967			3,967		

Table 6. Impact of foreign presence on stock liquidity and price volatility

The table reports the estimates from the OLS regressions of the dependant variables – measures of stock liquidity and price volatility, defined in Table 1. Model (1) specification is: *Liquidity/Volatility Measure*$_{i,t}$ = α + $\gamma \lambda_{i,t}$ + $\Sigma\theta F_{i,t}$ + $\varepsilon_{i,t}$, and Model (2) specification is: *Liquidity/Volatility Measure*$_{i,t}$ = α + $\gamma \lambda_{i,t}$ + $\Sigma\beta D_{i,t}V_{i,t}$ + $\Sigma\theta F_{i,t}$ + $\varepsilon_{i,t}$, where $\lambda_{i,t}$ - Inverse mills ratio calculated using the estimated probability of foreign presence; $D_{i,t}$ - foreign presence dummy variable, V_i - the main stock- specific control variables; $F_{i,t}$ - control variables. The explanatory and control variables are defined in Table 2. Number (N) of observations is the number of stock-months observations of available data. Reported in parentheses *t*-value is heteroskedasticity consistent (White, 1980) and adjusted for clustering at stock level. '***' indicates significance at 1%, '**' indicates significance at 5% and '*' indicates significance at 10%.

	Bid-ask spread		Turnover ratio		Total turnover ratio		Return volatility		Volatility ratio		High-low ratio	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lambda ForPresence	**0.01***	**-0.01***	**0.20***	**-0.79***	**0.82***	**-0.37**	**-0.001***	**-0.003***	**-0.08***	**-0.16***	**0.0**	**-0.01***
	(6.43)	(-4.68)	(2.73)	(-7.66)	(7.91)	(-2.11)	(-4.37)	(-9.13)	(-4.14)	(-4.54)	(0.22)	(-6.93)
Company size*FP		0.004***		0.32***		0.33***		0.0003**		0.02		0.001***
		(9.76)		(11.78)		(10.92)		(2.35)		(1.61)		(4.21)
IAS*ForeignPresence		0.01***		-0.31*		0.64***		-0.002***		-0.32***		-0.01***
		(8.63)		(-1.67)		(3.11)		(-6.87)		(-7.1)		(-6.55)
Analysts*FP		-0.002		0.45***		0.31		0.0		-0.004		0.0
		(-1.51)		(3.88)		(1.6)		(-0.33)		(-0.12)		(-0.17)
Total trading volume*FP								0.0005***		0.02		0.001***
								(3.83)		(1.36)		(2.66)
Company size	-0.01***	-0.01***	0.18***	-0.12***	0.30***	-0.05	-0.002***	-0.002***	-0.25***	-0.28***	-0.004***	-0.01***
	(-28.43)	(-22.43)	(7.97)	(-3.60)	(12.34)	(-1.33)	(-27.6)	(-25.95)	(-29.2)	(-24.16)	(-27.19)	(-27.48)
Stock turnover ratio	-0.001***	-0.001***										
	(-14.45)	(-15.72)										
Return volatility	0.42***	0.38***	80.93***	75.20***	84.84***	79.59***						
	(15.36)	(13.62)	(26.44)	(25.03)	(26.42)	(25.13)						
Total trading volume							0.001***	0.001***	0.15***	0.14***	0.003***	0.002***
							(21.08)	(18.16)	(21.2)	(19.49)	(23.96)	(21.02)
Sales growth							0.001***	0.001***	0.03***	0.03***	0.001***	0.001***
							(8.67)	(9.24)	(3.55)	(3.68)	(7.49)	(8.1)
Leverage							0.002***	0.002***	0.27***	0.25***	0.004***	0.003***
							(3.99)	(3.35)	(4.69)	(4.43)	(4.46)	(3.76)
Intangibles							0.01***	0.01***	0.52***	0.51***	0.009***	0.01***
							(7.24)	(7.36)	(5.15)	(5.05)	(6.15)	(6.36)

Table 6 continued

	Bid-ask spread		Turnover ratio		Total turnover ratio		Return volatility		Volatility ratio		High-low ratio	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Int accounting stnds	-0.01***	-0.01***	-0.38***	-0.25**	-0.22**	-0.31***	0.002***	0.003***	0.28***	0.36***	0.004***	0.01***
	(-7.66)	(-9.81)	(-3.97)	(-2.57)	(-2.14)	(-3.07)	(10.81)	(12.48)	(9.78)	(11.44)	(8.35)	(10.73)
Own. concentration	0.10***	0.10***	-30***	-30***	-40***	-30***	0.04***	0.05***	4.0***	4.0***	1.0***	1.0***
(x 10^{-3})	(2.76)	(4.07)	(-17.52)	(-16.79)	(-18.05)	(-17.15)	(10.64)	(11.51)	(7.74)	(8.08)	(10.04)	(11.1)
Analysts following	-0.001	-0.001*	0.35***	0.20***	0.31***	0.18***	0.0	0.0	-0.09***	-0.1***	0.001***	0.001***
	(-0.96)	(-1.88)	(7.68)	(4.34)	(5.35)	(3.75)	(1.31)	(1.01)	(-5.86)	(-5.76)	(3.55)	(2.97)
Market turnover	0.0004***	0.0003**	0.20***	0.20***	0.19***	0.19***						
	(2.95)	(2.42)	(12.04)	(12.52)	(11.01)	(11.09)						
GDP per capita	0.01***	0.004**	-3.78***	-4.10***	-3.97***	-4.35***	-0.003***	-0.004***	0.66***	0.63***	-0.01***	-0.01***
	(5.15)	(2.17)	(-11.73)	(-12.63)	(-12.28)	(-13.38)	(-8.21)	(-10.52)	(15.28)	(14.2)	(-7.96)	(-10.1)
Market size	0.004***	0.005***	-0.12**	-0.03	-0.10**	0.02	0.0	0.0	0.08***	0.08***	-0.001***	0.0
	(6.17)	(8.67)	(-2.48)	(-0.66)	(-2.06)	(0.45)	(-0.74)	(0.49)	(5.47)	(5.44)	(-3.17)	(-1.55)
Legal index	-0.004***	-0.003***	-0.41***	-0.35***	-0.42***	-0.34***	0.001***	0.001***	0.18***	0.18***	0.001***	0.001***
	(-6.91)	(-5.4)	(-8.65)	(-7.54)	(-8.66)	(-7.06)	(10.72)	(11.15)	(12.12)	(11.9)	(6.15)	(6.7)
Accounting opacity	0.01**	0.001	0.74	-0.16	0.36	-0.64	-0.01***	-0.01***	-0.78***	-0.82***	-0.02***	-0.02***
	(2.25)	(0.17)	(1.54)	(-0.34)	(0.74)	(-1.36)	(-9.93)	(-11.23)	(-5.47)	(-5.78)	(-8.80)	(-10.44)
Intercept	-0.06***	-0.01	37.47***	40.93***	38.86***	42.67***	0.05***	0.06***	-4.91***	-4.53***	0.10***	0.12***
	(-3.79)	(-0.36)	(11.71)	(12.70)	(12.05)	(13.15)	(16.69)	(19.71)	(-13.99)	(-12.46)	(13.92)	(16.41)
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-sq	*0.331*	*0.355*	*0.351*	*0.364*	*0.358*	*0.373*	*0.276*	*0.285*	*0.251*	*0.254*	*0.309*	*0.323*
N observations	*167,542*	*167,542*	*167,542*	*167,542*	*167,542*	*167,542*	*149,788*	*149,788*	*149,788*	*149,788*	*149,788*	*149,788*
N stocks	*2,347*	*2,347*	*2,347*	*2,347*	*2,347*	*2,347*	*2,180*	*2,180*	*2,180*	*2,180*	*2,180*	*2,180*

Table 7. Impact of cross-listing and cross-trading status on stock liquidity and price volatility

The table reports the estimates from the OLS regressions of the dependant variables – measures of stock liquidity and price volatility, defined in Table 1. Model (1) specification: *Liquidity/Volatility Measure$_{i,t}$ = α + γ λ$_{i,t}$ + ΣθF$_{i,t}$ + ε$_{i,t}$*, and Model (2) specification is: *Liquidity/Volatility Measure$_{i,t}$ = α + γ λ$_{i,t}$ +ΣβD$_{i,t}$V$_{i,t}$ + ΣθF$_{i,t}$ + ε$_{i,t}$*, where λ$_{i,t}$ - Inverse mills ratio calculated using the estimated probability of foreign presence; D$_{i,t}$ - dummy variable representing cross-listing or cross-trading status accordingly, V$_i$ - the main stock- specific control variables; F$_{i,t}$ - control variables. The explanatory and control variables are defined in Table 2. Number (N) of observations is the number of stock-months observations of available data. Reported in parentheses *t*-value is heteroskedasticity consistent (White, 1980) and adjusted for clustering at stock level. '***' indicates significance at 1%, '**' indicates significance at 5% and '*' indicates significance at 10%.

	Bid-ask spread		Turnover ratio		Total turnover ratio		Return volatility		Volatility ratio		High-low ratio	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lambda Cross-listed	**0.001***	**-0.006****	**-0.005**	**-0.07**	**0.57****	**0.35****	**-0.0004****	**-0.002****	**-0.05****	**-0.15****	**-0.001**	**-0.003****
	(1.68)	(-2.4)	(-0.05)	(-0.50)	(5.78)	(2.04)	(-2.17)	(-3.57)	(-2.11)	(-2.78)	(-1.22)	(-2.48)
Company size*CL		0.002***		0.03		0.03		0.0		0.01		0.001
		(3.62)		(0.90)		(0.78)		(-0.06)		(0.62)		(1.23)
IAS*Cross-listed		-0.001		-0.42		0.51*		-0.001		-0.18***		-0.003**
		(-0.49)		(-1.45)		(1.75)		(-1.55)		(-2.61)		(-2.21)
Analysts *Cross-listed		0.003**		0.32**		0.35		-0.001*		-0.12**		0.0
		(2.29)		(2.18)		(1.63)		(-1.79)		(-2.24)		(-0.59)
Total trading volume*CL								0.0005**		0.03		0.0
								(1.99)		(1.35)		(0.53)
Lambda Cross-traded	**0.01****	**-0.007****	**0.31****	**-0.77****	**0.87****	**-0.33**	**-0.0005****	**-0.002****	**-0.07****	**-0.06**	**0.0**	**-0.004****
	(6.35)	(-2.7)	(3.72)	(-6.13)	(7.30)	(-1.36)	(-3.12)	(-5.18)	(-3.57)	(-1.43)	(0.86)	(-4.31)
Company size*CT		0.003***		0.34***		0.33***		0.0		0.01		0.001***
		(5.58)		(10.79)		(8.61)		(1.27)		(0.43)		(2.81)
IAS*Cross-traded		0.01***		-0.40**		0.28		-0.002***		-0.24***		-0.004***
		(8.16)		(-1.99)		(1.04)		(-5.69)		(-4.68)		(-5.72)
Analysts*Cross-traded		-0.002**		0.45***		0.21		0.0		0.04		0.0
		(-2.08)		(3.39)		(0.86)		(1.26)		(0.95)		(0.72)
Total trading volume*CT								0.0004***		0.003		0.001**
								(2.82)		(0.21)		(2.13)
Company size	-0.01***	-0.01***	0.18***	-0.11***	0.29***	-0.02	-0.002***	-0.002***	-0.25***	-0.27***	-0.004***	-0.01***
	(-28.52)	(-24.04)	(7.93)	(-3.20)	(12.47)	(-0.53)	(-27.52)	(-26.28)	(-29.23)	(-24.5)	(-27.24)	(-28.16)
Stock turnover ratio	-0.001***	-0.001***										
	(-14.51)	(-15.72)										
Return volatility	0.42***	0.38***	80.92***	75.04***	84.68***	79.52***						
	(15.34)	(13.79)	(26.41)	(25.10)	(26.55)	(25.17)						
Total trading volume							0.001***	0.001***	0.15***	0.15***	0.003***	0.002***
							(20.98)	(18.58)	(21.19)	(19.93)	(23.96)	(21.56)

Table 7 continued

	Bid-ask spread		Turnover ratio		Total turnover ratio		Return volatility		Volatility ratio		High-low ratio	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Sales growth							0.0005***	0.0005***	0.03***	0.03***	0.001***	0.001***
							(8.67)	(9.14)	(3.54)	(3.61)	(7.49)	(8.02)
Leverage							0.002***	0.002***	0.27***	0.26***	0.004***	0.003***
							(3.97)	(3.44)	(4.66)	(4.55)	(4.48)	(3.86)
Intangibles							0.006***	0.01***	0.52***	0.5***	0.01***	0.01***
							(7.2)	(7.17)	(5.12)	(4.94)	(6.17)	(6.22)
Int accounting standards	-0.01***	-0.01***	-0.39***	-0.20**	-0.23**	-0.27***	0.002***	0.003***	0.28***	0.35***	0.004***	0.01***
	(-7.76)	(-9.78)	(-4.02)	(-2.13)	(-2.30)	(-2.78)	(10.81)	(12.49)	(9.81)	(11.23)	(8.35)	(10.85)
Ownership concentration	0.00004***	0.0001***	-0.03***	-0.03***	-0.04***	-0.03***	0.0001***	0.00005***	0.004***	0.004***	0.0001***	0.0001***
	(2.65)	(3.84)	(-17.49)	(-16.79)	(-18.05)	(-17.11)	(10.67)	(11.61)	(7.75)	(8.13)	(10.04)	(11.15)
Analysts following	-0.001	-0.001*	0.34***	0.19***	0.30***	0.18***	0	0	-0.09***	-0.09***	0.001***	0.001***
	(-0.93)	(-1.85)	(7.60)	(4.19)	(5.27)	(3.69)	(1.3)	(0.98)	(-5.82)	(-5.59)	(3.55)	(2.88)
Market turnover	0.0003***	0.0003**	0.20***	0.20***	0.19***	0.18***						
	(2.78)	(2.41)	(11.90)	(12.47)	(10.94)	(11.1)						
GDP per capita	0.01***	0.004**	-3.78***	-4.08***	-3.96***	-4.31***	-0.003***	-0.004***	0.66***	0.63***	-0.01***	-0.01***
	(5.22)	(2.35)	(-11.69)	(-12.62)	(-12.26)	(-13.26)	(-8.3)	(-10.6)	(15.24)	(14.1)	(-7.94)	(-10.15)
Market size	0.004***	0.01***	-0.12**	-0.05	-0.10**	-0.005	0	0	0.08***	0.09***	-0.001***	-0.0004*
	(6.17)	(8.47)	(-2.44)	(-1.05)	(-2.04)	(-0.10)	(-0.69)	(0.5)	(5.5)	(5.67)	(-3.15)	(-1.74)
Legal index	-0.004***	-0.003***	-0.41***	-0.38***	-0.42***	-0.38***	0.001***	0.001***	0.18***	0.18***	0.001***	0.001***
	(-6.91)	(-5.73)	(-8.61)	(-8.28)	(-8.75)	(-7.85)	(10.68)	(11.12)	(12.14)	(12.18)	(6.21)	(6.52)
Accounting opacity	0.01**	0.002	0.74	-0.32	0.32	-0.73	-0.01***	-0.01***	-0.78***	-0.78***	-0.02***	-0.02***
	(2.28)	(0.33)	(1.54)	(-0.71)	(0.68)	(-1.55)	(-9.9)	(-11.08)	(-5.45)	(-5.44)	(-8.76)	(-10.36)
Intercept	-0.06***	-0.01	37.52***	41.42***	38.93***	42.93***	0.05***	0.06***	-4.9***	-4.58***	0.1***	0.12***
	(-3.78)	(-0.31)	(11.73)	(12.86)	(12.09)	(13.25)	(16.82)	(19.73)	(-14.02)	(-12.54)	(13.97)	(17.01)
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adj. R-sq	0.330	0.355	0.352	0.367	0.362	0.377	0.275	0.285	0.251	0.254	0.309	0.323
N observations	167,542	167,542	167,542	167,542	167,542	167,542	149,788	149,788	149,788	149,788	149,788	149,788
N stocks	2,347	2,347	2,347	2,347	2,347	2,347	2,180	2,180	2,180	2,180	2,180	2,180
Coefficient Estimates Difference:												
Crosslisted - Traded	**-0.004**	**0.001**	**-0.310**	**0.700**	**-0.298**	**0.675**	**0.0009**	**0.0002**	**0.028**	**-0.086**	**-0.0002**	**0.001**
Wald test (Pr > F stats)	<.0001	0.015	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

Table 8. Cross-listing and/or cross-trading and the evolution of stock liquidity and price volatility

The table reports the estimates from the OLS regressions of the dependant variables – measures of stock liquidity and price volatility, defined in Table 1. In the regressions, foreign presence/ cross-listing/ cross-trading variables are replaced by a series of the year-specific dummy variables relative to the year of foreign presence/ cross-listing/ cross-trading accordingly (year 0). Model specification is:

Liquidity/Volatility Measure$_{i,t}$ = α + $\Sigma\gamma Y_n$ + $\Sigma\beta D_{i,t} V_{i,t}$ + $\Sigma\theta F_{i,t}$ + $\varepsilon_{i,t}$, where Y_n - variable representing a year relative to the year of foreign presence/ cross-listing/ cross-trading accordingly (from year -4 and earlier to year +4 and later); $D_{i,t}$ - dummy variable representing foreign presence/ cross-listing/ cross-trading accordingly, V_i - the main stock- specific control variables; $F_{i,t}$ - control variables. The explanatory and control variables are defined in Table 2. Only the coefficient estimates on the year-specific dummies around foreign presence/ cross-listing/ cross-trading are reported in the Table but the regressions include the full set of control variables as in model (2) of Table 6 for foreign presence and model (2) of Table 7 for cross-listing and cross-trading. Reported in parentheses *t*-value is heteroskedasticity consistent (White, 1980) and adjusted for clustering at stock level. '***' indicates significance at 1%, '**' indicates significance at 5% and '*' indicates significance at 10%.

		Years relative to foreign presence/ cross-listing/ cross-trading								
		≤-4y	-3	-2	-1	0	+1	+2	+3	≥+4y
Panel A: Liquidity										
Bid-ask spread										
	Foreign presence	0.018	0.009***	0.012***	0.015***	-0.017***	-0.015***	-0.016***	-0.016***	-0.016***
		(1.42)	(4.65)	(6.51)	(8.59)	(-3.21)	(-2.93)	(-3)	(-3.03)	(-2.73)
	Cross-listed	0	0.004*	0.006**	0.007***	-0.008	-0.005	-0.008	-0.009	-0.011*
		(0.12)	(1.83)	(2.55)	(2.94)	(-1.64)	(-0.85)	(-1.44)	(-1.58)	(-1.91)
	Cross-traded	0.011***	0.012***	0.013***	0.016***	-0.01	-0.012*	-0.012*	-0.011*	-0.01
		(3.63)	(6.14)	(8.18)	(9.8)	(-1.54)	(-1.88)	(-1.86)	(-1.79)	(-1.45)
Turnover ratio										
	Foreign presence	1.186	0.559***	0.453***	0.473***	-2.517***	-2.169***	-1.98***	-1.845***	-1.389***
		(1.11)	(3.74)	(3.16)	(3.74)	(-7)	(-6.08)	(-5.52)	(-4.98)	(-3.55)
	Cross-listed	-0.133	-0.024	-0.199	-0.046	0.054	0.345	0.317	0.415	0.596
		(-0.42)	(-0.09)	(-0.99)	(-0.24)	(0.11)	(0.75)	(0.67)	(0.86)	(1.18)
	Cross-traded	0.218	0.421***	0.365**	0.426***	-2.295***	-1.999***	-1.733***	-1.49***	-1.19**
		(0.72)	(2.82)	(2.56)	(3.2)	(-5.44)	(-4.66)	(-4.09)	(-3.43)	(-2.55)
Total turnover ratio										
	Foreign presence	1.468	0.514***	0.456***	0.553***	-1.435**	-1.166**	-1.046*	-0.978*	-0.293
		(1.07)	(3.19)	(2.99)	(3.85)	(-2.57)	(-2.03)	(-1.87)	(-1.73)	(-0.45)
	Cross-listed	-0.122	-0.068	-0.273	-0.128	1.07*	1.173**	1.167**	1.152**	1.358**
		(-0.31)	(-0.27)	(-1.21)	(-0.58)	(1.91)	(2.24)	(2.3)	(2.29)	(2.52)
	Cross-traded	0.144	0.48***	0.546***	0.684***	-0.689	-0.354	-0.267	0.023	0.363
		(0.38)	(3.02)	(3.38)	(4.67)	(-0.95)	(-0.47)	(-0.36)	(0.03)	(0.42)

Table 8 continued

	≤-4y	-3	-2	-1	0	+1	+2	+3	≥+4y
	Years relative to foreign presence/ cross-listing/ cross-trading								
Panel B: Volatility									
Return volatility									
Foreign presence	-0.003**	0	0	0.001	-0.003***	-0.004***	-0.004***	-0.004***	-0.003***
	(-2.02)	(0.83)	(0.36)	(1.56)	(-3.77)	(-4.25)	(-4.72)	(-4.07)	(-3.73)
Cross-listed	0.001*	0	0	0	-0.001	-0.002	-0.002	-0.002	-0.002
	(1.68)	(0.54)	(0.82)	(0.07)	(-0.87)	(-1.21)	(-1.3)	(-1.4)	(-1.07)
Cross-traded	-0.001	0	0.001	0.001***	-0.003**	-0.003***	-0.003***	-0.003**	-0.003***
	(-1.12)	(-0.14)	(1.51)	(2.9)	(-2.49)	(-2.74)	(-2.88)	(-2.53)	(-2.59)
Volatility ratio									
Foreign presence	-0.174	-0.01	0.028	0.091	0.017	0.049	0.019	-0.02	-0.141
	(-1.03)	(-0.14)	(0.46)	(1.6)	(0.15)	(0.44)	(0.16)	(-0.18)	(-1.23)
Cross-listed	1.680	0.540	0.820	0.070	-0.870	-1.210	-1.300	-1.400	-1.070
	(0.01)	(-0.61)	(0.03)	(-0.93)	(-0.69)	(-0.99)	(-0.78)	(-0.84)	(-1.21)
Cross-traded	-1.120	-0.140	1.510	2.900	-2.490	-2.740	-2.880	-2.530	-2.590
	(-0.08)	(0.13)	(1.86)	(3.54)	(0.95)	(1.15)	(1.09)	(0.47)	(-0.46)
High- low ratio									
Foreign presence	-0.003	0.003***	0.003***	0.005***	-0.004**	-0.005***	-0.006***	-0.005**	-0.004**
	(-0.94)	(2.6)	(3.06)	(5.47)	(-1.99)	(-2.62)	(-3.09)	(-2.48)	(-2.21)
Cross-listed	0.001	0	0.002	0.002	0	0	-0.001	0	0
	(0.55)	(-0.03)	(1.14)	(1.53)	(-0.06)	(-0.09)	(-0.2)	(0.01)	(0.03)
Cross-traded	0	0.003**	0.005***	0.007***	-0.003	-0.004*	-0.004*	-0.004*	-0.004*
	(-0.26)	(2.36)	(4.57)	(6.88)	(-1.28)	(-1.76)	(-1.95)	(-1.77)	(-1.82)