Do Foreigners Facilitate Information Transmission in Emerging Markets?

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Abstract

Using the degree of accessibility of foreign investors to emerging stock markets, or *investibility*, as a proxy for the extent of foreign investments, we assess whether investibility has a significant influence on the diffusion of global market information across stocks in emerging markets. We show that greater investibility reduces price delay to global market information where the price delay is measured as the proportion of stock returns explained by the lagged world market returns in the regression of stock returns on contemporaneous and lagged world and local market returns. We also find that returns of highly investible stocks lead returns of non-investible stocks, but not vice versa. These results are consistent with the idea that financial liberalization in the form of greater investibility yields informationally more efficient stock prices in emerging markets.

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1. Introduction

Market integration is central to the international finance literature. Economists have long studied its welfare gains in terms of risk-sharing benefits (Karolyi and Stulz (2003)) and, more recently, have focused on investment and growth benefits associated with financial market integration (Bekaert, Harvey, and Lundblad (2001, 2005, 2009)). Since the opening of many emerging markets to foreign equity investors in the late 1980s and early 1990s, there has been debate about the role of foreign portfolio capital in emerging markets. On the one hand, episodes of financial crises have prompted many to question the benefits of the liberalization process. On the other hand, there has been a growing body of empirical evidence suggesting that opening a market to foreign investors is beneficial. This evidence suggests that stock market liberalizations lower cost of capital (Henry (2000a); Bekaert and Harvey (2000)), increase the real investment (Henry (2000b); Mitton (2006); Chari and Henry (2008); Bae and Goyal (2008)), and spur productivity and growth (Bekaert, Harvey, and Lundblad (2005, 2009)).

In this paper, we propose another benefit of stock market liberalizations: improved informational efficiency of local stock markets. We posit that foreign investors are likely to have an advantage in processing global information and, therefore, contribute to the incorporation of such information into stock prices. In emerging markets, not all stocks are accessible to foreign investors and the level of limits on foreign ownership varies widely across different stocks. The variation in foreign equity ownership restrictions across different stocks provides a natural setting to study the impact of liberalization on the speed of information diffusion. Specifically, by examining the relation between a stock's accessibility to foreigners, or its "investibility," and its stock return dynamics, we show that foreign investors facilitate faster diffusion of global market information among investible stocks in emerging markets.

Our motivation for this study comes from a number of theoretical models. Albuquerque, Bauer, and Schneider (2009) consider a model in which global investors have "global private" information that is valuable for trading in many countries at the same time. The key assumptions in their model are that stock returns are driven by both local and global factors, and that global investors receive signals regarding global factors about which local investors know less. In this setting, the model shows that the information asymmetry between local and foreign investors with respect to global private information can lead local investors to underreact to movements in global factors. Since local investors underreact to global news, stocks that global investors cannot trade are not likely to incorporate global information in a timely way into their prices.

Similarly, models employed by Merton (1987), Basak and Cuoco (1998), Shapiro (2002), and Hou and Moskowitz (2005), suggest a link between the speed of information diffusion and limited stock market participation. These models argue that institutional forces, information costs, or transactions costs can delay the process of information incorporation for firms with severe market frictions. We argue that the restrictions on foreign equity investments in emerging markets constitute market frictions that impede the swift processing of global market information, and we test the hypothesis that the removal of these restrictions improves the informational efficiency of stock prices in emerging markets.

We obtain data on firm characteristics and returns from the Standard & Poor's Emerging Markets Database (EMDB). Our final sample includes weekly returns from 21 emerging markets for a total of 2,434 distinct stocks over the period of 1989 to 2002. The key variable for our analysis is a variable called the degree open factor, a measure constructed by the EMDB to measure the extent to which a stock is accessible to foreigners. The degree open factor allows us to proxy for the degree of foreign investibility. Using this measure, we classify stocks into three investibility groups: non-investible (foreigners may not own any share of the stock), partially investible (foreigners may own up to 50 percent of the stock), and highly investible (foreigners may own more than 50 percent of the stock).

Our main hypothesis is that the diffusion of global market information is faster for investible stocks than it is for non-investible stocks. We design our experiment to test this hypothesis in two ways. First, we test whether price delay measures for the speed with which individual stock prices respond to global market information are related to the degree of a stock's investibility. Our main measure of price delay to global market information is the proportion of stock returns explained by the lagged world market returns in the regression of stock returns on contemporaneous and lagged world and local market returns following the approach of Hou and Moskowitz (2005). Intuitively, a larger value of this delay measure means that greater return variation is explained by lagged world market returns, and thus is indicative of sluggish response to global market information. To the extent that foreign equity investment restrictions bind and hamper the incorporation of value-relevant global information into the pricing of emerging market stocks, we should observe a negative relation between delay measures and the degree of investibility. Second, we examine whether there exists a lead-lag relation in the return dynamics between investible and non-investible stocks. If global information slowly diffuses from investible stocks to non-investible stocks, then we should expect that returns on investible stocks lead those on non-investible stocks.

The empirical evidence supports our conjecture. First, we document that the delay measures that we construct to capture the speed of price adjustment to global market information are indeed negatively associated with the degree of investibility. In contrast, we find no relationship between delay measures with respect to local market information and investibility. The absence of a relationship between delay measures with respect to local market information and investibility suggests that the degree of investibility is important only for the processing of global market information for which global investors can be especially instrumental. These findings are robust to the choice of different proxies for market information as well as to a variety of alternative regression specifications.

Second, we find that the returns on highly investible stocks lead returns on non-investible stocks, but not vice versa. The main difficulty in detecting the effect of investibility on information diffusion in this way is that investibility may be correlated with other firm characteristics that might affect the speed of information diffusion between investible and non-investible stocks. For example, it could be that investible stocks are larger and are more actively traded, with more analysts following. We find, however, that in our sample, the partially investible stocks are on average larger and more actively traded than the highly investible stocks — an observation that presents us with an interesting testing opportunity. If our results were indeed solely driven by size or liquidity instead of by investibility, we should find that returns on partially investible stocks lead those on highly investible stocks. We find no such evidence.

To further alleviate the concern that firm fundamentals are correlated with investibility, we examine a subset of sample firms for which we can identify two types of ordinary shares issued: "A" shares and "B" shares. The distinction between these shares is that "A" shares can be traded only by domestic local traders, whereas "B" shares are traded exclusively by foreign investors. This extreme form of market segmentation in a given firm's shares provides an ideal opportunity to examine the effect of foreign equity investment restrictions on the speed of adjustment to global market information. Since the fundamentals of these two share classes are exactly the same, any difference in the speed of adjustment to global market information between the "A" shares and "B" shares can only be attributed to the difference in their investibility. We find that "B" shares incorporate global market information into prices significantly faster than do the "A" shares. In contrast, we find no difference between "A" and "B" shares with respect to their respective speed of adjustment to local market information. Finally, consistent with our conjecture, portfolio returns of "B" shares lead portfolio returns of "A" shares, but not vice versa.

To the extent that the speed of price adjustment measures the degree of informational efficiency of stock prices in a market, our overall evidence indicates that removing capital barriers in the form of greater investibility in emerging markets can help improve informational efficiency of local stock markets.

Our paper is closely related to several studies that use the investibility measure to investigate the effect of stock market liberalizations. In a pioneering paper that makes use of the investibility measure as a proxy for foreign equity ownership restrictions, Bekaert (1995) examines the relationship between the degree of market integration and investment barriers in emerging markets. He measures the extent of market openness at the country level, using the ratio of market value of investible stocks to total market capitalization. Edison and Warnock (2003) and de Jong and de Roon (2005) use the same measure in their studies of capital controls on emerging stock markets. Boyer, Kumagai, and Yuan (2006) examine how stock market crises spread globally and document a greater degree of co-movement between investible stock index returns and crisis country index returns during crisis periods. While these authors measure the intensity of capital controls at the country level, several papers use an investibility measure at the individual firm level. For instance, Bae, Chan, and Ng (2004) find a positive relation between return volatility and investibility. They argue that highly investible stocks are more integrated with the world stock markets and are, therefore, more sensitive to the world market factor. Using an investible/non-investible distinction, Chari and Henry (2004) show that investible stocks realize higher risk-sharing benefits when countries liberalize their stock markets. Mitton (2006) studies how the degree of investibility affects firm performance and shows that investible firms experience increases in sales growth, profitability, and efficiency, and lower their leverage.

Our paper also contributes to a large literature that investigates the information asymmetry between local and foreign investors. Whether foreigners are more or less informed relative to locals is an important and contentious issue in the international finance literature.[1] Several studies attempt to identify whether foreign investors have an informational disadvantage. The results are, at best, mixed. Some studies show that local traders perform better than foreign traders (Hau (2001); Choe, Kho, and Stulz (2005); Dvorak (2005)). Similarly, using analysts' earnings forecast data, Bae, Stulz, and Tan (2008) show that local analysts forecast earnings more accurately than foreign analysts. However, there are also numerous studies that suggest that foreign investors are better informed (Grinblatt and Keloharju (2000); Seasholes (2000); Froot, O'Connell, and Seasholes (2001)). Our results add to the understanding of this issue by showing that foreign investors may have an advantage in processing global market information. While foreign investors may be at an informational disadvantage to domestic investors in obtaining local information, they are likely to have better resources and better access to expertise in processing global information. Depending on the relative importance of domestic and global information reflected in the stock prices, one may find that foreign investors are better informed or less informed, which may offer an explanation for the mixed evidence so far on the performance of foreign investors relative to domestic investors.

Finally, our paper is related to a long-standing literature on predictability in asset prices. Since the

[1] Information asymmetry between foreigners and locals is often used to explain home bias—the observation that investor portfolios are under-diversified internationally and are biased toward home country assets.

seminal work of Lo and MacKinlay (1990), which shows that returns of large stocks predict returns of small stocks, but not vice versa, cross-autocorrelation patterns among stock returns have received much attention in the literature. Factors that are identified as contributing to the cross-autocorrelations in stock returns include the number of analysts following (Brennan, Jegadeesh, and Swaminathan (1993)), institutional ownership (Badrinath, Kale, and Noe (1995)), and trading volume (Chordia and Swaminathan (2000)). While there is still debate about what the sources of these predictability patterns are, these studies point to the presence of market frictions in generating differences in the speed of adjustment across stocks. By showing that market frictions in the form of equity ownership restrictions impede information diffusion, our study provides additional support to the slow information diffusion hypothesis as the leading cause of lead-lag relation in returns.

The rest of the paper is organized as follows. In the next section, we present descriptive statistics of the data. Section 3 examines the impact of investibility on the speed of price adjustment, and Section 4 examines the lead-lag relation between stocks with different degrees of investibility. Section 5 examines the subset of sample firms for which both "A" and "B" shares are available. Section 6 concludes.

2. Data

2.1. Descriptive Statistics

Two sources of data are used in our analysis. The first is the Standard & Poor's (S&P) Emerging Markets Database (EMDB). We obtain weekly stock returns, market capitalization, turnover, and trading volume for each stock covered by the EMDB over the period from 1989 to 2002. We base our analysis on weekly U.S. dollar returns rather than daily returns in order to minimize the effect of potential biases associated with non-synchronous trading on our analysis.[2] The second data source is I/B/E/S International, from which we obtain information on the analyst following for our sample stocks. We merge I/B/E/S with

[2] We obtain similar results when we repeat the analyses using weekly stock returns in local currency instead of in U.S. dollars.

the firm-level data in the EMDB and obtain the number of analysts that provide earning forecasts for each firm in every year of our sample. Following the previous literature, if a firm is not covered by I/B/E/S in any given year, we assume that the number of analyst following is zero for that firm-year observation.

The EMDB includes weekly returns for 3,345 stocks from 35 emerging markets, covering more than 75 percent of the total market capitalization for each emerging market. Since our objective is to examine the role of foreign investors in emerging markets, we restrict our sample to countries where there is a reasonably large presence of foreign investors. Specifically, to include a country in the sample, we require that either the aggregate U.S. equity holdings of local stocks in that country exceed $500 million as of the year 2001, or that the ratio of the aggregate U.S. equity holdings of local stocks to the local stock market capitalization is greater than five percent. In addition to these requirements, we apply a number of filters to our sample to eliminate outliers and data errors. Following Bae, Chan, and Ng (2004) and Rouwenhorst (1999), we delete observations in which closing prices are either zero or are missing. We also check for errors and delete 45 observations for which the weekly total return exceeds 200 percent.[3] As a result of these filters and checks, our final sample consists of 2,434 stocks in 21 emerging markets over the period of 1989 to 2002.

Table 1 presents country- and firm-level descriptive statistics for our sample. In the first three columns of Table 1, we describe the aggregate presence of foreign investors in the emerging markets. We report, respectively, the aggregate dollar amount of the U.S. holdings of local stocks, its ratio to the local stock market capitalization as of 2001, and the percentage of foreign institutional ownership. We obtain the aggregate U.S. holdings of local stocks in each country from the U.S. Treasury department for the years of 1994, 1997, and 2001.[4] We obtain the aggregate foreign institutional ownership in each country from 1999

[3]We verified that these 45 observations are genuine errors by checking whether there are large discrepancies between EMDB and Datastream for these stocks. Keeping these observations does not change our results.
[4] Data on aggregate U.S. holdings of foreign equity are available every year since 2003. However, during our sample period, the data are available only for the years of 1994, 1997, and 2001.

to 2002 and report its time-series average for this period.[5]

In terms of the aggregate dollar amount invested by U.S. residents, Korea is the largest recipient of U.S. equity investment at $29.5 billion, followed by Mexico and Brazil, who both receive over $20 billion. U.S. investors also have a significant presence in markets such as Taiwan, Israel, India, and South Africa. Similarly, column 2 indicates that the U.S. investors' holdings constitute an important part of the local market capitalization in a number of these countries, but vary considerably across a range of emerging markets. The foreign institutional ownership reported in column 3 also shows a wide cross-sectional variation across these markets. The correlation between the ratio of U.S. equity holdings to local market capitalization and the average foreign institutional ownership is more than 90 percent, suggesting that the aggregate U.S. equity investment accounts for a large part of foreign institutional ownership in these markets.

In the remaining columns of Table 1, we summarize the firm-level data in our sample. The number of stocks in each country in our sample varies significantly, ranging from an average of 16 in Hungary to 196 in China.[6] The average return and volatility in each country are computed as the cross-sectional average of the time-series mean and standard deviation of weekly returns, respectively. The average weekly return ranges from −0.47 percent in Thailand to 0.53 percent in Argentina. As one would expect, emerging market stocks are highly volatile. The average weekly volatility of individual stock returns in our sample varies from 4.54 percent in Portugal to as high as 13.01 percent in Russia. Previous studies show that firm size and turnover are important determinants of the speed of stock price adjustment to information. We see that there is significant variation in both firm size and turnover across our sample. For example, firms in countries such as Indonesia, Venezuela, and the Philippines are among the smallest in our sample, while firms in Russia, Taiwan, and South Africa represent the largest. Finally, we see a significantly larger amount of trading activity in countries such as Korea and Taiwan, as compared with that in less developed markets

[5] We thank Miguel Ferreira and Pedro Matos for sharing with us their institutional ownership data at the aggregate country level.

[6] We have verified that our results are not driven by a single large country in our sample. Our main results remain qualitatively the same if we exclude China from the analysis.

such as Chile, Russia, and Venezuela, where the average turnover is only about one-thirtieth of that in Korea and Taiwan. Overall, the evidence in Table 1 indicates that the presence of foreign investors is associated, albeit not systematically, with larger market capitalization and greater trading activity in emerging markets.

2.2. Measuring investibility

The Standard & Poor's EMDB reports for each stock a variable called the *degree open factor* that takes a value between zero and one. This measure indicates the "*quantity of a company's market capitalization a foreign entity can legally own.*"[7] The EMDB states that it uses several criteria to determine the investible weight of a stock. First, it determines if the market is open to foreign institutions — in both a legal and practical sense — by investigating the mechanisms and the extent to which foreign institutions can buy or sell shares in the local stock exchange and repatriate capital. Second, it evaluates the additional limitations that can be imposed either by the government at the industry level or by the corporate charters and by-laws at the company level. The investible market capitalization is then determined, after applying foreign investment rules and after making adjustments for corporate holdings, strategic holdings, or government ownership. We use this investible weight reported by the EMDB as our measure of each stock's accessibility for foreign investors in emerging markets.

In the last two columns of Table 1, we report the mean and standard deviation of investible weights for each country. The statistics reported are measured as the cross-sectional mean and standard deviation of the average investible weights of stocks within a country. The degree to which local stocks are open to foreign investors varies greatly across countries. For example, South Africa (0.79) has the highest degree of accessibility to foreign investors, while India (0.15) allows the least access to foreign investors over our sample period.

It is worth noting some of the limitations of the EMDB data and our investibility measure. First, as

[7] S&P Emerging Markets Indices Methodology, Standard & Poor's, August 2007.

noted by Bae, Chan, and Ng (2004), it is possible that the investible weight recorded by the EMDB may sometimes fail to reflect the actual degree of investibility as a result of delays in adjusting the weights following official changes. Second, when the EMDB chooses stocks for its coverage in each country, it applies two additional criteria based on size and liquidity. This bias towards stocks with larger size and greater liquidity causes us concern, since size and liquidity are important determinants of the speed of information diffusion. To address this concern, we take care in our experiment design to separate the effect of investibility from these other factors.

Finally, it is possible that the degree of investibility may not necessarily be a good proxy for the degree of actual foreign ownership. The lack of interest in local stocks by foreign investors could be unrelated to ownership restrictions. In other words, a stock with a high degree of investibility may not necessarily be owned by a large number of foreign investors. To check for this possibility, we would ideally like to examine how firm-level investibility relates to actual foreign ownership at the firm level. Given our data limitations, however, we attempt to examine this relationship by relating firm-level investibility to the actual aggregate foreign ownership at the country level. Specifically, we compute a sample firm's investible weight in each sample year and regress it on the latest available country-level variables that proxy for the degree of foreign investors' presence in the previous year together with firm characteristic variables measured in the previous year. If our investible weight measure is related to the degree of actual foreign ownership, we should expect to observe a positive and significant relationship between these two variables. Firm characteristic variables include the firm size, analyst following, turnover and volatility. Firm size is measured as the market value of equity in millions of U.S. dollars. Turnover is the average number of shares traded in each month, scaled by the number of shares outstanding. Volatility is the standard deviation of weekly returns in a year. Analyst is a dummy variable that equals one when the number of analysts following a firm is positive, and zero otherwise.

Table 2 presents the results. To assess the statistical significance of our estimates, we use a conservative method of clustering standard errors both at the country and year level. The concern is that the country-level variables in our regressions could generate correlated errors. Clustering at the country level assumes that observations are independent across countries, but not necessarily independent within countries, and therefore addresses the concern that observations may be correlated across firms within a country. We cluster standard errors by time as well, as there is probably contemporaneous dependence in investibility. For example, after the Asian currency crisis, we find that there is a significant decrease in the investible weight for some East Asian countries in our sample. Finally, we also adjust the standard errors using a bootstrapping method when we include volatility as an explanatory variable in the regression.[8]

In column (1), we estimate a simple regression of the investible weight of each stock on the ratio of aggregate U.S. holdings of local stocks to the local stock market capitalization. We have 4,172 firm-year observations for this regression, as we have the country-level variable available for the years of 1994, 1997, and 2001. The coefficient estimate on the ratio of U.S. holdings to local stock market capitalization is significant and positive, suggesting that the variation in average degree of investibility across countries is significantly associated with the variation in aggregate U.S. ownership. This country-level variable alone explains 11.3 percent of the variation in the investible weight. In the next column, we add firm size, turnover, volatility, and analyst coverage to control for the variation in firm characteristics. Adding these additional explanatory variables increases the adjusted R^2 to 17.2 percent; however, it does not materially change the magnitude or the statistical significance of the coefficient estimate on the ratio of U.S. holdings to market capitalization. Investible weight is positively related to firm size, return volatility and analyst following. In columns (3) and (4), we replace the ratio of U.S. holdings to local market capitalization with the ratio of foreign institutional ownership to local market capitalization in each country. We have data on the aggregate amount of institutional ownership for the period of 1999 to 2002, which gives us 5,773 firm-year observations for the last two regressions. By and large, we obtain similar results.

[8] The use of generated variables in the regression models leads to a measurement error problem, thereby causing the regression error to be serially correlated and heteroscedastic (Pagan (1984) and Shanken (1992)). A standard solution to the problem of generated regressor is to estimate standard errors that are robust to heteroscedasticity and autocorrelation (Newey and West (1987)). However, this approach does not allow for cross-correlation within a cluster and may not be appropriate for our data. We use a bootstrapping approach as suggested in Cameron, Gelbach, and Miller (2008) where inference is based on cluster bootstrap-*t* procedures that provide asymptotic refinement.

While these analyses are admittedly limited on account of their aggregate nature, they suggest that our measure of the degree of investibility does not capture only firm size and liquidity effects but also proxies reasonably well for the foreign investors' actual ownership in emerging markets.

3. Investibility and speed of price adjustment

In this section, we test our main hypothesis that greater investibility facilitates the incorporation of common information into stock prices. First, we construct delay measures that proxy for the speed of stock price adjustment to market-wide information; then we test how these measures are related to the degree of a stock's investibility in the cross-section. The null hypothesis is that the degree of investibility bears no relation to how fast a firm's stock price responds to market-wide information.

3.1. Price delay measures

Our conjecture with respect to how fast stock prices adjust to market-wide information relates mainly to global market information. However, to the extent that foreigners are also better processors of local market information than local investors, we might find the degree of investibility to be important in how fast local market information gets incorporated into stock prices as well.

We take our proxy for the source of global (local) market news to be the weekly returns of the world (local) market portfolio, and we measure the delay with which stock prices respond to this information. We regress in every sample year each individual stock's weekly returns on the contemporaneous and three lagged returns on both the world and the local market portfolios,

$$R_{i,t} = \alpha + \sum_{k=0}^{3} \delta_{i,k} R_{w,t-k} + \sum_{k=0}^{3} \gamma_{i,k} R_{l,t-k} + \varepsilon_{i,t} \tag{1}$$

where $R_{i,t}$ denotes the return on stock i at week t, while $R_{w,t-k}$ and $R_{l,t-k}$ are the contemporaneous and lagged returns on the world market portfolio and the local market portfolio, respectively, for $k = 0$, 1, 2, 3. The advantage of this specification is that the relation between stock returns and world market returns is measured after controlling for local market returns, so that we measure the relation of stock returns with the component of world market returns that is orthogonal to local market returns. We obtain world market portfolio returns as well as local market portfolio returns from Datastream. We require at least 20 weekly observations to be available for each stock in each year.[9]

The intuition for price delay measures is simple: if the price of stock *i* immediately responds to global (local) market news, the coefficient on the contemporaneous world market return $R_{w,t}$ (local market return $R_{l,t}$) should be significantly different from zero, and none of the coefficients on the lagged global (local) market returns should be different from zero. In contrast, if stock *i* is delayed in responding to the global (local) market information, we should expect some of the coefficients on the lagged global (local) market returns to be significantly different from zero. Based on this insight, after estimating the regression equation (1), we construct two different versions of a price delay measure for each stock in each year of our sample.

The first delay measure we use is from Hou and Moskowitz (2005) who examine the impact of market frictions for cross-sectional return predictability. This measure is the fraction of variation of the contemporaneous individual stock returns explained by the lagged world (local) market returns in equation (1). Specifically, it is computed as one minus the ratio of the *R*-squared statistic (R_r^2) obtained from a restricted regression, in which the coefficients of the lagged world (local) market returns are set to zero, to the *R*-squared (R_{ur}^2) obtained without such restrictions:

$$delay1 = 1 - \frac{R_r^2}{R_{ur}^2} \tag{2}$$

Intuitively, larger values of $delay1$ indicate that greater return variation is captured by lagged world (local) market returns and are indicative of a greater amount of delay in the response of stock returns to global (local) market news.

Following McQueen, Pinegar, and Thorley (1996), we also consider an alternative measure constructed from the coefficient estimates in regression (1):

[9] Our main conclusions remain qualitatively the same when we include two lagged returns, and when we require at least 26 non-missing weekly returns available in a year.

$$delay2 = \frac{1}{(1+e^{-x})} \tag{3}$$

where $x = \sum_{k=1}^{3} \delta_{i,k} / (\sum_{k=0}^{3} \delta_{i,k} + \sum_{k=0}^{3} \gamma_{i,k})$ when *delay2* is computed with respect to global market information, and $x = \sum_{k=1}^{3} \gamma_{i,k} / (\sum_{k=0}^{3} \delta_{i,k} + \sum_{k=0}^{3} \gamma_{i,k})$ when *delay2* is computed with respect to local market information.

In Panel A of Table 3, we report the summary statistics for each of the price delay measures. The mean and median of *delay1* with respect to global market information are 0.147 and 0.098, respectively, while those of *delay2* are 0.533 and 0.547. The magnitude of *delay1* and *delay2* measured with respect to local market information is also quite similar.

Next, in Panel B, in each year we sort sample stocks into three investible groups using their investible weight at the end of the previous year and examine how average price delay varies across different investibility groups. Specifically, we classify stocks with a zero measure of investibility as non-investible, stocks with investible weight greater than zero but less than or equal to 0.5 as partially investible, and finally, stocks with investible weight greater than 0.5 as highly investible.[10] We see a monotonic negative relation between the degree of investibility and the average price delay with respect to global market information. Stocks in the highly investible group have the shortest delay, whereas stocks in the non-investible group show the longest average delay in incorporating global market information. The last three columns of Panel B present the *t*-test statistics adjusted for clustering at both the country and year level for the hypothesis that the mean is the same across investible groups. The results indicate that both *delay1* and *delay2* with respect to global market information are significantly larger for the non-investible group than for either the partially or the highly investible group at the conventional significance levels. In contrast, we find no such relationship between the degree of investibility and the delay with respect to local market information.

[10] The frequency distribution of investibility is skewed toward both tails. We choose not to have very fine classifications of stocks based on investibility in order to minimize the possibility that our measure of investibility does not capture fully all other factors that determine foreign participation. See Bae, Chan, and Ng (2004).

In Panel C, we report the average value of *delay1* measured with respect to global market information for each investibility group in each country. We see that, in every country, the average delay for the highly investible group is smaller than that for the non-investible group. In 12 of 21 countries, the relation between *delay1* and investibility is monotonic, with non-investible stocks realizing the largest price delay, highly investible stocks the smallest, and partially investible stocks falling in between. The *t*-test statistics adjusted for the year-level clustering indicate that the delay measure for the non-investible group is significantly larger than that for the highly investible group in 14 countries. The delay measure for the non-investible group is significantly larger than that for the partially investible group also in 14 countries. There is little difference in price delay between the partially investible and highly investible groups.

Finally, in Panel D of Table 3, we present the time series of average *delay1* with respect to global market information for each investibility group from 1990 to 2002. We lose the first sample year of 1989 since we match the investible weight of the previous year to the delay measures in the current year. There appears to be little evidence that the magnitude of the price delay has changed over time. The *t*-test statistics adjusted for the country-level clustering indicate that the delay measure for the non-investible group is significantly larger than that for the highly investible group in every year. The delay measure for the non-investible group is significantly larger than that for the partially investible group in every year except 1994. Finally, we see again little difference in *delay1* between the partially investible and highly investible groups.

A potential concern in comparing delay measures among the investible groups is the presence of contemporaneous correlation in the estimated delay measures of individual stocks, arising from the fact that individual stock returns themselves are contemporaneously correlated. While *t*-test statistics adjusted for clustering alleviate the concern of contemporaneous correlation among estimated delay measures, an alternative way to address this concern is to estimate delay measures at the portfolio level. Specifically, in each year we construct three investible portfolios by sorting stocks into three investible groups using the investible weight at the end of the previous year, and compute equal- and value-weighted weekly returns for each of these portfolios. We then regress each year the weekly returns on these investible portfolios on the contemporaneous and lagged world market returns and compute delay measures with respect to global market information.

We employ a bootstrapping approach to make inferences on the estimated delay measures and their differences. The advantage of this approach is twofold. First, it allows us to compute the statistical significance of an observed difference in the delay measures by comparing it to its empirical (bootstrap) distribution. Second, it does not require any distributional assumptions, so that we can compute statistical significance even when the distribution of the error terms is not normal. To obtain bootstrap distribution of delay measures, we first generate a simulated sample that is of the same size as the original sample of the three investible portfolio returns with replacement, and we estimate delay measures for that simulated sample. We then repeat this procedure 1,000 times and generate a simulated distribution of delay measures based on which we compute standard errors of the estimated delay measures. We follow Vanbelle and Albert (2008) in testing the differences in delay measures of investible portfolios, which essentially is a test of the mean difference on a paired sample to allow for correlation between investible portfolio returns.

The results in Table 4 corroborate our earlier findings based on delay measures of individual stock returns. First, we find that all the estimates of delay measures at the portfolio level are significant, suggesting that global market information is incorporated into stock prices with delay. Second, not surprisingly, the magnitude of delay measure is slightly smaller when value-weighted returns are used than when equal-weighted returns are used. Third, consistent with the results using delay measures of individual stocks, there is a monotonic and negative relation between investibility and price delay. Finally, the test of differences in the delay measures across investible portfolios indicates that both *delay1* and *delay2* are significantly larger for the non-investible portfolio than those for the partially or highly investible portfolios. We find no significant difference in price delay between the partially and highly investible portfolios. Overall, the portfolio-level delay measures confirm that investibility affects information diffusion of global market information.

3.2. Cross-sectional regressions of delay measures

Tables 3 and 4 provide preliminary evidence that higher investibility is associated with faster incorporation of global information into prices. However, this evidence is confined to univariate analysis. Since highly investible stocks are likely to differ from non-investible stocks on other dimensions such as size and turnover, we next turn to a multivariate analysis in which we estimate the following pooled cross-sectional ordinary least squares regression model:

$$delay_{i,j,t+1} = \alpha_0 + \beta investible_{i,j,t} + \gamma_1 size_{i,j,t} + \gamma_2 turnover_{i,j,t}$$

$$+ \gamma_3 volatility_{i,j,t} + \gamma_4\ analyst_{i,j,t} + \varepsilon_{i,j,t} \tag{4}$$

where *i* indexes stocks, *j* indexes countries, and *t* indexes the year. The dependent variable is the delay measure of stock *i* in country *j* in year *t*+1 and the test variable of our main interest is the latest investible weight for stock *i* in year *t*. We include other firm characteristics that earlier research has found to be associated with the speed of price adjustment, such as *size*, *turnover*, *volatility,* and *analyst*. *Size* is measured as the market capitalization for each stock at the end of year *t*, and *analyst* is a dummy equal to one if the stock is covered by I/B/E/S analysts in year *t*, and zero otherwise. The variables *volatility* and *turnover* are measured over the year *t.* The null hypothesis is that the degree of investibility bears no relation to how fast the stock prices adjust to global (local) market information. Alternatively, if the degree of investibility improves the process of incorporating global (local) market information into prices in a way that is not captured by these firm characteristics, then we should expect to see a negative relationship between price delay and the degree of investibility. That is, we expect $\beta < 0$.

Table 5 presents the estimation results. In Panels A and B, we use delay measures with respect to global and local market information, respectively. We cluster standard errors by both country and year. In addition, in columns (2) and (4), we adjust standard errors using a bootstrapping method to account for the fact that volatility is a generated regressor. In column (1) of Panel A, we regress *delay1* simply on the investible weight with no other control variables. The coefficient estimate on the investible weight is

−0.069, and it is highly significant; that is, we find that prices of stocks with fewer foreign ownership restrictions adjust to global market information much faster. In column (2), we add to the regression other firm characteristic variables, as well as country, industry, and year dummies to control for fixed effects. For brevity, we do not report the coefficient estimates for these dummy variables. In column (2) of Panel A, we find that firm size is negatively related to *delay1*. This evidence is consistent with the findings in earlier literature that larger firms have a higher speed of price adjustment. While including the controls reduces the coefficient estimate on the investible weight to −0.059, the estimate remains highly significant at the one percent level. The impact of investibility on the speed of price adjustment appears also to be economically significant. One standard deviation increase in the investible weight is associated with a decrease of 0.0244 (=0.059×0.413) in *delay1*. Since the mean of *delay1* is 0.147, this decrease amounts to a drop of 17 percent in the delay of price adjustment to global market information.

In columns (3) and (4) of Panel A, we re-estimate the regression equation (4), replacing *delay1* with *delay2* as the dependent variable. Again, in column (3), we regress *delay2* solely on its investible weight. The coefficient on the investible weight is estimated to be −0.037, and it is statistically significant. When we include the additional controls in column (4), the coefficient on the investible weight remains statistically significant. Taken together, the results in Panel A indicate a strong negative relation between a stock's price delay to global information and its degree of investibility for foreign investors.[11]

Next, we examine whether this relationship holds also for delay with respect to *local* market information. In columns (1) through (4) in Panel B, we repeat the same analysis, this time using the dependent variables *delay1* and *delay2* measured with respect to local market information. As in Panel A, we use *delay1* as the dependent variable in columns (1) and (2), and replace that with *delay2* in columns (3) and (4). The coefficient estimates indicate that there is no evidence of a relation between a stock's degree of investibility and its delay with respect to local market information.

[11] We find our results to be robust to replacing the continuous measure of investibility with three dummies indicating, respectively, non-, partially, and highly investible stocks.

In summary, Table 5 provides the evidence that while there is a negative relationship between a stock's degree of investibility and the rate at which its price adjusts to common information, this relationship appears to be important with regard only to global information and not to local information.

3.3 . The issue of non-trading: A different measure of liquidity

An important concern for our exercise is that in emerging markets the extent of non-trading can be very large (Bekaert, Harvey, and Lundblad (2007)). Since we use weekly returns data, non-trading should not be as serious a problem as with daily data. Nevertheless, in order to rule out the possibility that the extent of non-trading is the primary explanation for our findings, we replace the turnover measure with the zero-return measure of liquidity used in Bekaert, Harvey, and Lundblad (2007) and in Lesmond (2005). These authors argue that in emerging markets a liquidity measure based on the proportion of zero daily returns captures the extent of liquidity better than does turnover, and that the measure is more closely related to the effective transaction costs obtained from high-frequency data. Therefore, for the sample of stocks on which we have daily return data available from the EMDB, we construct the zero-return liquidity measure for each stock and repeat the analysis in Table 5 with this measure of liquidity instead of turnover. In untabulated results, our main finding that investible weight is negatively related to the speed of price delay with respect to global information remains essentially unchanged.

3.4. Cross-country variation in the effect of investibility

An interesting question may be whether the effect of investibility on the speed of stock price adjustment differs across countries. We explore this possibility by estimating our baseline regression model specified in equation (4) individually for each of the 21 sample countries. We do not tabulate the results for brevity. The results show that the coefficient estimates on the investible weight are negative in 18 out of 21 markets, and they are significant at the significance level of 10 percent or below in ten markets. These markets are Argentina, Brazil, Chile, China, Greece, Hungary, India, Russia, South Africa, and Venezuela.

We note that the results by country are somewhat statistically weaker than those reported in Table 5, possibly for two reasons. First, by restricting to individual countries, we have less variability in investibility across the stocks. Second, since the number of stocks in some countries is fairly small, we might lose the power to detect a significant effect. Nevertheless, the fact that coefficient estimates for almost all the countries are negative and none is significantly positive indicates that our conclusion that there is a negative relation between investibility and price delay with respect to global market information appears robust.

3.5. Reverse causality

We have so far presented evidence that is consistent with the idea that foreign investors' participation in emerging markets facilitates the transmission of global market information into prices of local stocks. An alternative interpretation might be that foreign traders are at an informational disadvantage relative to their local counterparts in trading local stocks and choose, therefore, to trade stocks for which information is easy to acquire (Kang and Stulz (1997)). That is, it is conceivable that what we observe as an improvement in information transmission does not in itself result from foreign investors' trading, but rather is simply an artifact of foreign investors choosing to trade in a subset of stocks with a relatively better information environment and, thereby, a faster speed of price adjustment.

We believe that this possibility of reverse causality is not very likely. First, our measure of investibility is, to some extent, an exogenous variable that is determined by government regulations and/or corporate charters. It is true that high foreign ownership can be caused by a good information environment. Leuz, Lins, and Warnock (2009) show that foreign investors tend to invest in firms with good corporate governance practices and a better information environment. However, it is less likely that stocks with a good information environment cause high investibility. Second, while it is reasonable to assume that foreign investors are disadvantaged in obtaining local information about stocks, there is little reason to believe that they are at a disadvantage over global market information. Third, we find no relation between the degree of a stock's investibility and its delay with respect to local market information. If our finding is simply a manifestation of foreign investors being attracted to stocks with good information environments, we should find evidence that investible stocks incorporate all common information more quickly, whether it is local or global. In contrast, we find strong evidence that investibility only matters for the transmission of global information, and not for local information. For these reasons, we believe that our findings are not attributable to a reverse causality whereby foreign investors are simply attracted to stocks with good information environments, but are consistent with foreign investors playing an instrumental role in facilitating the incorporation of global market information into local stock prices.

3.6. Robustness tests

The findings in Table 5 strongly reject the null hypothesis that investibility bears no relation to how fast stock prices incorporate global information. To examine the robustness of this result, in Table 6 we conduct various additional tests. We focus on *delay1* as the dependent variable in this analysis. First, we check whether the findings are robust to the choice of the source of global market information, and use different proxies for the global market return in computing the delay measures. In column (1), the delay measure is computed with respect to the S&P 500 index return and, in column (2), with respect to the EAFE index from Morgan Stanley Capital International. In both columns, the coefficient estimates are negative and significant at the one percent level. Next, we explore whether our results are sensitive to the choice of an alternative regression model. In column (3), we consider a random-effects model and find that our estimates remain largely unchanged.

One particular concern with the use of EMDB's investible weight as a proxy for foreign ownership is that the investible weight is likely to be correlated with firm characteristics. Although we add control variables to address this issue in our regression framework, one cannot exclude the possibility that the negative relation between investibility and delay is due to some omitted firm characteristics that we do not control for. In column (4), we account for this possibility by including firm-fixed effects and find that the degree of investibility has a strong negative effect on delay.

In columns (5) and (6), we examine whether the effect we identify is constant over time. We use the Asian currency crisis to partition the sample period into two subsample periods: one before the crisis (1990 to 1997) and the other after the crisis (1998-2002). The choice of this partition is motivated by the fact that many emerging markets have gone through structural changes of reforming their financial markets since the Asian crisis. The results show that the coefficient estimates on the investible weight in both pre- and post-crisis periods are negative and significant at the one percent level. Although the coefficient estimate on the investible weight in the post-crisis period is slightly more negative than that in the pre-crisis period, the difference is not significant. There seems to be little evidence that the effect of investibility on information transmission has significantly changed since the Asian currency crisis.[12]

Our conjecture is that the opening of emerging markets to foreign investment should improve the informational efficiency of these markets. So far in our analysis, we employed the investible weight as a proxy for the extent of foreign investor participation. In column (7) of Table 6, we replace the investible weight variable with a direct measure of foreign participation, namely, the ratio of U.S. investors' equity holdings to the local stock market capitalization. The obvious advantage of using this variable is that it measures the actual equity ownership by U.S. investors; the disadvantages, however, are that the variable is measured at the aggregate country level and that we have it available only for the years of 1994, 1997, and 2001, so that it may lack the statistical power to detect an effect of foreign ownership on the speed of price adjustment at the firm level. Nevertheless, we find that the ratio of U.S. equity holdings of local stocks to the local stock market capitalization is significantly negatively related to the price delay in a country. In column (8), we change the proxy for foreign investor participation from the ratio of U.S holdings to local market capitalization to the ratio of foreign institutional ownership to local market capitalization for which we have data available from 1999 to 2002. The results are by and large similar, confirming our conjecture that foreign ownership leads to a faster adjustment of stock prices to global market information.

[12] We compute average investible weight across the firms for seven East Asian countries in our sample every month during January 1990 to December 2002. These countries are China, Indonesia, Korea, Malaysia, Philippines, Taiwan, and Thailand. We find that there is a significant decrease in investibility since the Asian currency crisis of 1997-1998 for Indonesia, Malaysia, and Philippines, which are the countries that are hit hardest by the Asian currency crisis. In contrast, we see little or only modest changes in investibility for other countries, including Thailand, the country where the Asian currency crisis started. Interestingly, Korea realizes a significant increase in investibility since the crisis, which is consistent with the summary statistic on the U.S. equity holdings observed in Table 1. Overall, the effect of Asian crisis on investibility appears restricted to only a few countries.

4. Lead-lag relations of investible portfolios

In this section, we provide additional evidence of the importance of investibility for the diffusion of global market information by examining the cross-stock return dynamics in our sample. For this analysis, we build on the findings in earlier literature of significant lead-lag relations among U.S. stock returns (Lo and MacKinlay (1990); Chordia and Swaminathan (2000)). If the presence of global investors does contribute to a faster adjustment of stock prices to global market information, we should expect to see a similar lead-lag relation emerge between returns of investible and non-investible stocks. That is, while foreign investors facilitate the transmission of global market information into the prices of a subset of stocks in which they are allowed to invest — the investible stocks, this information will be slower to get incorporated into prices of those stocks in which they cannot invest — non-investible stocks. Local investors, however, can observe and infer the information in investible stocks that is relevant for the pricing of their investments, and trade the non-investible stocks on this information. As global information slowly diffuses from investible stocks to non-investible stocks in this way, we should observe a lead-lag relation between the returns of investible and non-investible stocks. We test for the presence of such cross-stock return dynamics in the following section.

4.1. Construction of investible portfolios

For this analysis, we follow a double-independent sort procedure to group stocks into portfolios. We first sort stocks in each country in each year based on their latest available investible weights in the previous year into non-, partially, and highly investible groups as defined earlier. Since the extent to which a stock is accessible to foreign investors is likely to be positively associated with its market capitalization and its trading volume, we also sort stocks in each country independently either by size or by volume to form nine size-investibility, or volume-investibility, portfolios.[13] In keeping with Chordia and Swaminathan (2000), we use stock turnover as our measure of trading volume. After partitioning stocks into nine

[13]The limited number of stocks in each country in our sample precludes conducting a three-way sort of investibility, size, and turnover.

size-investibility or turnover-investibility portfolios, we compute the equally weighted weekly returns for each portfolio. Our goal is to test whether investibility has any independent effect on the return dynamics across these portfolios.

In Panels A and B of Table 7, we present summary statistics for each size-investibility and turnover-investibility group, respectively. First, we see that our independent sorts by size and by turnover control for these effects to a large extent. For example, within each investibility group in Panel A (B), the average size (turnover) of the medium-size (turnover) group stocks is larger than that of the small-size (turnover) group stocks; similarly, the average size (turnover) of the large-size (turnover) group stocks is larger than both the small-size (turnover) and the medium-size (turnover) group stocks. When we compare the portfolios across investibility within each size and turnover group, we see that non-investible stocks tend to be smaller and less actively traded than both the partially and highly investible stocks. Surprisingly, in contrast, stocks in the partially investible group are as large as or even larger than the highly investible stocks and they are more actively traded. These characteristics of the stocks in the partially investible group provide us with an interesting opportunity to test whether the degree of investibility has an independent influence beyond that of size and liquidity on the speed of information diffusion. If firm size and liquidity are the sole determinants of the speed of information diffusion, with no independent effect of investibility, we should expect partially investible stock returns to lead highly investible stock returns. We examine this possibility later and reject such a conjecture.

Table 7 also shows that the non-investible portfolio enjoys better return performance than both partially and highly investible portfolios. For instance, in Panel A, the average weekly return of the non-investible portfolio in the medium-size group is 0.34 percent, compared to 0.13 percent for the highly investible portfolio and −0.03 percent for the partially investible portfolios in the same size group. Similarly, in Panel B, the average weekly return for the non-investible portfolio in the medium-turnover group is 0.43 percent, compared to 0.16 percent for the highly investible portfolio in the same turnover group. This finding is consistent with the view that opening local stock markets to foreign investors has the benefit of reducing the cost of capital for local companies.

Finally, in the last two columns of Table 7, we report the first-order and the sum of the first three lagged return autocorrelation coefficient estimates for each investibility portfolio within each size or turnover group. If the degree of investibility is a factor in determining how fast information gets incorporated into prices, we should observe systematic patterns across these autocorrelation coefficients. First, Table 7 shows that the first-order return autocorrelation coefficients for the non-investible stocks decline with size and turnover. This suggests that, among the stocks in the non-investible group, where the degree of investibility is zero, greater size and higher volume are the two important factors in speeding up the price adjustment process. Second, we observe that the sum of the lagged autocorrelation coefficients for the highly investible stocks is larger than that for the non-investible stocks in the medium and large size group and in the high turnover group. On first consideration, this result seems counterintuitive. After all, highly investible stocks tend to be both larger and more actively traded than non-investible stocks; therefore, to the extent that highly investible stocks incorporate information faster, we should observe a smaller sum of autocorrelation coefficients for these stocks. On the other hand, given that the degree of investibility is likely to be positively related to institutional trading, the higher autocorrelation we observe among the highly investible stocks may be a manifestation of the institutions' correlated trading patterns. This observation is consistent with that of Sias and Starks (1997), who show that the portfolio autocorrelation of NYSE stocks is an increasing function of the level of institutional ownership and attribute their finding to the institutional traders' correlated trading patterns.

While the autocorrelation patterns in Table 7 give us some preliminary understanding of the differences in return dynamics across stocks with different degrees of investibility, we recognize that the autocorrelation coefficients by themselves cannot provide unambiguous inferences about the differences in the speed of stock price adjustment to information shocks (Chordia and Swaminathan (2000)). Therefore, we next turn to cross-autocorrelations in testing our hypothesis of information diffusion across investibility groups.

4.2. Tests of lead-lag relation between portfolios of different investibility

To test whether there exists a lead-lag relation across investibility portfolios, we use a vector autoregression (VAR) model. Specifically, we estimate the following bivariate vector autoregression:

$$R_{NI,t} = a_0 + \sum_{k=1}^{3} a_k R_{NI,t-k} + \sum_{k=1}^{3} b_k R_{HI,t-k} + u_t \tag{5}$$

$$R_{HI,t} = a_2 + \sum_{k=1}^{3} c_k R_{NI,t-k} + \sum_{k=1}^{3} d_k R_{HI,t-k} + v_t \tag{6}$$

where $R_{NI,t}$ represents the return of the non-investible portfolio, and $R_{HI,t}$ represents the highly investible portfolio return at time *t*. This bivariate VAR system allows us to test formally whether the lagged returns on the highly investible portfolio in equation (5) have any significant power in predicting the current returns of the non-investible portfolio, after controlling for the lagged own returns on the latter. In addition, we examine whether there is any asymmetry in the cross-autocorrelations across the highly investible and the non-investible portfolios by testing the hypothesis that $\sum_{k=1}^{K} b_k - \sum_{k=1}^{K} c_k = 0$.

In Panels A and B of Table 8, we present the estimation results for each size and turnover group, respectively. In Panel A, the lagged returns on the highly investible portfolio predict the current returns on the non-investible portfolio in every size group. The estimated coefficients of the first lagged return on the highly investible portfolio range from 0.119 to 0.131, and all of them are significant at the one percent level. Similarly, the sum of coefficient estimates of the three lagged returns on the highly investible portfolio ranges between 0.224 and 0.302 across different size groups, and all of them are significant at the one percent level. In contrast, the lagged returns on the non-investible portfolio do not predict the current returns on the highly investible portfolio. Interestingly, the coefficient estimate of the first lagged return on the non-investible portfolio in predicting the current return on the highly investible portfolio is a significantly positive 0.036 for the medium-size group. However, its magnitude is economically smaller in comparison to that of the first lagged return on the highly investible portfolio in predicting current return on non-investible portfolio, which is 0.122. Furthermore, there is no evidence that the predictive ability of lagged non-investible portfolio returns in forecasting highly investible portfolio returns remains at longer horizons: the sum of the coefficients of the three lagged returns on the non-investible portfolio is not significant at any conventional significance level. Finally, the cross-equation tests confirm that the difference between the coefficients on the first lagged returns and the difference between the sums of the coefficients $\sum_{k=1}^{K} b_k - \sum_{k=1}^{K} c_k$ is positive and significant in every size group. We therefore conclude that, holding size constant, returns of highly investible stocks lead those of non-investible stocks, but not vice versa.

In Panel B, we present the corresponding VAR estimates for each turnover group. Overall, the results are very similar to those reported in Panel A. The lagged returns on the highly investible portfolios have strong predictability for current returns on the non-investible portfolios for each turnover group. The predictive power of past highly investible portfolio returns remains significant beyond the one-week horizon. In contrast, the ability of lagged non-investible portfolio returns to predict current highly investible portfolio returns is statistically significant only for the low- and medium-turnover group at the first lag; even then, its economic magnitude is much smaller than for that of the lagged highly investible portfolio returns in predicting current non-investible portfolio returns. Finally, the cross-equation tests confirm the asymmetry between the highly investible and non-investible portfolio returns; within each turnover group, highly investible portfolio returns lead non-investible portfolio returns, but not vice versa.

In unreported results we also look at the dynamics across the highly investible and the partially investible portfolio returns. Incidentally, this relationship presents an interesting opportunity. The reason is that the stocks in the partially investible group in our sample tend to be both larger and more actively traded than those in the highly investible group within each size and turnover group (see Table 7). Therefore, if the lead-lag relation across investible portfolios is simply a manifestation of size or turnover, we should find the larger and more liquid partially investible stock returns predicting the highly investible stock returns. However, we find no evidence suggesting that partially investible portfolio returns lead the highly investible portfolio returns.

Our results that there is an asymmetry in the lead-lag relation between the highly investible and non-investible portfolio returns are consistent with Boyer, Kumagai, and Yuan (2006). They study how stock market crises are spread globally through asset holdings of international investors and find that accessible (investible) stock index returns lead inaccessible (non-investible) stock index returns during crisis periods. While we reach the same conclusion as to the lead-lag relation between investible and non-investible stocks, our study is different from theirs at least in two respects. First, they use investible and non-investible index returns, while we use portfolio returns constructed from individual stocks with different investibility controlling for size or liquidity differences between investible portfolios. Second, their focus is on cross-correlation dynamics during a crisis period, while our framework is more general, including both crisis and non-crisis periods.

Table 8 shows that highly investible stocks lead non-investible stocks, but not vice-versa. Table 7 shows that highly investible stocks are also highly autocorrelated. Therefore, our finding that non-investible stocks incorporate global market information at a slower rate than investible stocks could simply reflect the fact that non-investible stocks are slower in incorporating information, whether it be global or local. To address this concern, we ask whether world market returns predict returns on the non-investible portfolio, after controlling for lagged returns on the highly investible portfolio of the same country and estimate the following regression.

$$R_{NI,t} = \alpha + \sum_{k=0}^{3} \delta_k R_{w,t-k} + \sum_{k=1}^{3} \gamma_k R_{HI,t-k} + \sum_{k=1}^{3} \tau_k R_{NI,t-k} + \varepsilon_t \qquad (7)$$

where $R_{NI,t}$ indicates non-investible portfolio returns for each size (or turnover) group; $R_{w,t-k}$ is contemporaneous and lagged world market return for k=0, 1, 2, 3; and $R_{HI,t-k}$ and $R_{NI,t-k}$ are lagged highly investible and non-investible portfolio returns of the same size (or turnover) group, respectively. We note that the current specification takes into account contemporaneous correlation among investible portfolio returns, as we include the contemporaneous world market returns in the explanatory variables.

In Table 9, we report the estimation results for each size and turnover group along with test statistics for the following three hypotheses: (i) the sum of coefficients on the lagged world market returns is zero; (ii) the sum of coefficients on the lagged highly investible portfolio returns is zero; and (iii) the sum of coefficients on the lagged non-investible portfolio returns is zero. Consistent with the VAR results in Table 8, in columns (1) through (3) of Table 9, we find that for each size group, the lagged returns on the highly investible portfolio predict the current returns on the non-investible portfolio, but not the lagged returns on the non-investible portfolio. More importantly, the F-test easily rejects the null hypothesis that the sum of coefficients on the lagged world market returns is zero in all size groups. This result indicates that the lead-lag relation between highly investible stocks and non-investible stocks documented in Table 8 is partly driven by the slow price adjustment of non-investible stocks to global market information. In columns (4) to (6), we present the estimation results for each turnover group. We find similar results, confirming that world market returns predict non-investible stock returns after controlling for lagged investible stock returns of the same country.

5. Is it an investibility effect, or differences in firm fundamentals?

Our results, so far, suggest that foreign investors have an advantage in processing global market information and in getting this information incorporated into prices of investible stocks in emerging markets. An alternative explanation might be that what we observe is due to differences in firm fundamentals that are correlated with investibility, although we attempt to exclude this possibility in various ways. Given the limitations of our investibility proxy, it is important that we check the validity of this alternative explanation.

To address the concern of spurious correlation, we exploit the incidence of the dual-type of shares in our sample. In some emerging markets, a listed firm can issue two types of ordinary shares, “A” and “B” shares, that differ in their ownership restrictions. Domestic traders can trade only the “A” shares, and foreign investors only the “B” shares. This segmentation may arise as a consequence of a government regulation or a company charter. Since the underlying fundamentals are exactly the same for both types of shares, the comparison of “A” and “B” shares provides us with an ideal opportunity to examine the effect of foreign equity investment restrictions on the speed of price adjustment. Given that both shares have the same fundamentals, any difference in the speed of adjustment to global market information is an outcome of the difference in their trading restrictions with respect to foreign investors.

In our sample, we identify 94 firms that have both "A" and "B" shares,[14] and we use this subsample to conduct our analysis. We re-estimate the regression in equation (4) and examine whether we can detect any effect of the dual share type structure on the delay measures. We leave out some of the firm characteristic variables from the regression this time, since the firm fundamentals are the same for both types of shares. We do keep turnover in the regression, however, since the degree of trading activity between "A" and "B" shares can be different, and this difference could generate a difference in delay measure. Finally, we replace our investibility proxy, the investible weight, with a dummy variable that equals one if the stock is "B" share, and zero otherwise. If foreign investors have an advantage in processing global market information, we should expect the coefficient on the dummy variable to be negative.

The regression results are presented in Panels A and B of Table 10. In Panel A, we first look at delay with respect to global market information. We use *delay1* as the dependent variable in columns (1) and (2) and *delay2* in columns (3) and (4). The coefficient estimate on the "B" share dummy variable in column (1) is significant and negative. The negative coefficient indicates a faster diffusion of global market information among those stocks that can be traded by foreign investors than those that are traded only by the local investors. In column (2), we add country, industry, and yearly dummy variables. The negative coefficient on the "B" share dummy remains negative. In columns (3) and (4), where the dependent variable is *delay2*, the B share dummy loses significance.[15] In Panel B of Table 10, we examine the delay measures with respect to the local market returns as the dependent variable. Consistent with the findings in Table 5, we find no difference between "A" and "B" shares in the amount of delay with respect to local information. In all regressions, the coefficient estimates on the B share dummy are never significant.

Finally, for the purpose of completeness, we repeat the VAR analyses in Section 4.2 using portfolios of

[14] They are from Brazil (21), China (30), Mexico (21), Philippines (15), South Africa (1), Taiwan (1), and Venezuela (5).

[15] In unreported results we find that the B-share dummies are significantly negative when we measure *delay1* and *delay2* with respect to the S&P 500 index returns.

"A" and "B" shares. We first construct equal-weighted portfolios of "A" and "B" shares. Then, we estimate the bivariate-VAR model using weekly returns on these two portfolios. We present this analysis in Table 11. Consistent with the earlier VAR results in Table 8, we find that the lagged returns on the portfolio of "B" shares predict the current returns on the portfolio of "A" shares, but not vice versa. The sum of the coefficient estimates on the three lagged returns of the "B" share portfolio is 0.398 in predicting current returns on the "A" share portfolio, and it is significant at the one percent level. In contrast, the corresponding sum of the coefficient estimates on the three lagged returns of the "A" share portfolio is −0.120 and it is insignificant. The cross-equation tests reported in the last column confirm the asymmetry in the predictive ability across "A" and "B" shares; the difference between the sums of the coefficients $\sum_{k=1}^{K} b_k - \sum_{k=1}^{K} c_k$ is positive and significant.

In a study related to ours, Chan, Menkveld, and Yang (2007) show that in the Chinese stock market, the "A" shares lead "B" shares in price discovery. They find that the signed volume and quote revisions of "A" shares have a predictive ability for the quote revisions for "B" shares, but not vice versa. Incidentally, in examining the period after February 19, 2001, when some domestic investors were allowed to invest in the "B" share market as well, they find that the causality reverts from the "B" share to the "A" share market. We view their findings as complementary to ours. Because the study by Chan, Menkveld, and Yang (2007) employs intraday high-frequency data, their findings are likely to capture the lead-lag relation regarding private local information, which is short-lived and possibly to the advantage of local investors. In contrast, our study focuses on a type of information that is more global in nature. Unlike private local information, the incorporation of this sort of information into prices may be better facilitated by the global investors. Thus, it is possible that "A" share investors lead the "B" share investors in discovering private local information, while "B" share investors lead "A" share investors in processing the global market information.

6. Conclusion

In this paper, we propose another benefit of stock market liberalization by investigating how greater investibility impacts the informational efficiency of emerging stock markets. We argue that foreign investors can help facilitate the diffusion of global market information into stock prices. We examine the relationship between a stock's accessibility for foreigners and its stock return dynamics, and show that greater investibility is associated with faster diffusion of global market information into stock prices.

Our findings can be summarized as follows. First, we find that greater investibility improves the speed of price adjustment to global market information. The participation of foreign investors appears instrumental only for the transmission of information that is global in nature. We find no evidence that investibility influences the speed of price adjustment to local market information. Second, returns of highly investible stocks lead those on non-investible stocks, but not vice versa. This lead-lag relation is independent of factors such as size or volume. Finally, when we exploit the incidence of "A" and "B" shares in our sample, we find that "B" shares that only foreign investors trade react faster to global information than "A" shares that only local investors trade. We also find that the returns of "B" shares can predict those of "A" shares, but not vice versa. Overall, our findings are consistent with the idea that financial liberalization in the form of greater investibility yields informationally more efficient stock prices in emerging markets.

References

Albuquerque, Rui, Gregor H. Bauer, and Martin Schneider, 2009, Global private information in international equity markets, *Journal of Financial Economics* 94, 18-46.

Badrinath, S.G., Jayant Kale, and Thomas H. Noe, 1995, Of shepherds, sheep, and the cross-autocorrelations in equity returns, *Review of Financial Studies* 8, 401-430.

Bae, Kee-Hong, Vidhan Goyal, 2008, Equity market liberalization and corporate governance, Working paper.

Bae, Kee-Hong, Kalok Chan, and Angela Ng, 2004, Investibility and return volatility, *Journal of Financial Economics* 71, 239-263.

Bae, Kee-Hong, Rene M. Stulz, and Hongping Tan, 2008, Do local analysts know more? A cross-country study of the performance of local analysts and foreign analysts, *Journal of Financial Economics* 88, 581–606.

Basak, Suleyman, and Domenico Cuoco, 1998, An equilibrium model with restricted stock market participation, *Review of Financial Studies* 11, 309-341.

Bekaert, Geert, 1995, Market integration and investment barriers in emerging equity markets, *World Bank Economic Review* 9, 75-107.

Bekaert, Geert, and Campbell R. Harvey, 2000, Foreign speculators and emerging equity markets, *Journal of Finance* 55, 565-613.

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, 2001, Emerging equity markets and economic development, *Journal of Development Economics* 66, 465-504.

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, 2005, Does financial liberalization spur growth?, *Journal of Financial Economics* 77, 3-56.

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, 2007, Liquidity and expected returns: Lessons from emerging markets, *Review of Financial Studies* 20, 1783-831.

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, 2009, Financial openness and productivity, National Bureau of Economic Research working paper No. 14843.

Brennan, Michael J., Narasimhan Jegadeesh, and Bhaskaran Swaminathan, 1993, Investment analysis and the adjustment of stock prices to common information, *Review of Financial Studies* 6, 799-824.

Boyer, H. Brian, Tomomi Kumagai, and Kathy Yuan, 2006, How do crises spread? Evidence from accessible and inaccessible stock indices, *Journal of Finance* 61, 957-1003.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas Lee Miller, 2008, Bootstrap-based improvements for inference with clustered errors, *Review of Economics and Statistics* 90, 414-427.

Chan, Kalok, Albert J. Menkveld, and Zhishu Yang, 2007, The informativeness of domestic and foreign investors' stock trades: Evidence from the perfectly segmented Chinese market, *Journal of Financial Markets* 10, 391-415.

Chari, Anusha, and Peter B. Henry, 2004, Risk sharing and asset prices: Evidence from a natural experiment, *Journal of Finance* 59, 1295-324.

Chari, Anusha, and Peter B. Henry, 2008, Firm-specific information and the efficiency of investment, *Journal of Financial Economics* 87, 636-655.

Choe, Hyuk, Bong-Chan Kho, and Rene M. Stulz, 2005, Do domestic investors have an edge? The trading experience of foreign investors in Korea, *Review of Financial Studies* 18, 795-829.

Chordia, Tarun, and Bhaskaran Swaminathan, 2000, Trading volume and cross-autocorrelations in stock returns, *Journal of Finance* 55, 913-935.

De Jong, Frank, and Frans de Roon, 2005, Time-varying market integration and expected returns in emerging markets, *Journal of Financial Economics* 78, 583-613.

Dvorak, Tomas, 2005, Do domestic investors have an information advantage? Evidence from Indonesia, *Journal of Finance* 60, 817-839.

Edison, Hali J., and Francis E. Warnock, 2003, A simple measure of the intensity of capital controls, *Journal of Empirical Finance* 10, 83-105.

Froot, Kenneth K., Paul. O'Connell, and Mark Seasholes, 2001, The portfolio flows of international investors, *Journal of Financial Economics* 59, 151-193.

Grinblatt, Mark, and Matti Keloharju, 2000, The investment behavior and performance of various investor types: A study of Finland's unique data set, *Journal of Financial Economics* 55, 43-67.

Hau, Harald, 2001, Location matters: An examination of trading profits, *Journal of Finance* 56, 1951-983.

Henry, Peter B., 2000a, Stock market liberalization, economic reform, and emerging market equity, *Journal of Finance* 55, 529-564.

Henry, Peter B., 2000b, Do stock market liberalizations cause investment booms?, *Journal of Financial Economics* 58, 301-334.

Hou, Kewei, and Tobias J. Moskowitz, 2005, Market frictions, price delay, and the cross-section of expected returns, *Review of Financial Studies* 18, 981-1020.

Kang, Jun-Koo, and Rene M. Stulz, 1997, Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan, *Journal of Financial Economics* 46, 3-28.

Karolyi, G. Andrew, and René M. Stulz, 2003, Are assets priced locally or globally?, in George Constantinides, Milton Harris, and René Stulz, eds.: *Handbook of the Economics of Finance* (North Holland, Netherlands).

Lesmond, David A., 2005, The costs of equity trading in emerging markets, *Journal of Financial Economics* 77, 411-452.

Leuz, Christian, Karl V. Lins, and Francis E. Warnock, 2009, Do foreigners invest less in poorly governed firms?, *Review of Financial Studies* 22, 3245-3285.

Lo, Andrew W., and Craig A. MacKinlay, 1990, When are contrarian profits due to stock market overreaction?, *Review of Financial Studies* 12, 609-630.

McQueen, Grant, Michael Pinegar, and Steven Thorley, 1996, Delayed reaction to good news and the cross-autocorrelation of stock returns, *Journal of Finance* 51, 889-919.

Merton, Robert C., 1987, A simple model of capital market equilibrium with incomplete information, *Journal of Finance* 42, 483-510.

Mitton, Todd, 2006, Stock market liberalization and operating performance at the firm level, *Journal of Financial Economics* 81, 625-647.

Newey, Whitney K, and Kenneth D. West, 1987, A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703–708.

Pagan, Adrian, 1984, Econometric Issues in the Analysis of Regressions with Generated Regressors, *International Economic Review* 25, 221-247.

Rouwenhorst, K. Geert, 1999, Local return factors and turnover in emerging stock markets, *Journal of Finance* 54, 1439-464.

Seasholes, Mark S., 2000, Smart foreign traders in emerging markets, Working paper, UC-Berkeley.

Shanken, Jay, 1992, On the Estimation of Beta-Pricing Models, *Review of Financial Studies* 5, 1-33.

Shapiro, Alexander, 2002, The investor recognition hypothesis in a dynamic general equilibrium: Theory and evidence, *Review of Financial Studies* 15, 97-141.

Sias, Richard W., and Laura Starks, 1997, Return autocorrelation and institutional investors, *Journal of Financial Economics* 46, 103-131.

Vanbelle, S. and A. Albert, 2008, A bootstrap method for comparing correlated kappa coefficients, *Journal of Statistical Computation and Simulation* 78, 1009-1015.

Table 1
Descriptive statistics by country
This table provides descriptive statistics by country. Firm-level data are obtained from the Emerging Market Database (EMDB) for 2,434 stocks in 21 countries over the period of 1989 to 2002. "U.S. equity holdings" are U.S. investors' holdings of local stocks as of the end of 2001; "U.S. equity holdings / market cap" is the ratio of U.S. equity holdings scaled by local stock market's total market capitalization; "Foreign ownership" is the foreign institutional equity ownership of the local stock market averaged over the period of 1999 to 2002. Firm size is measured as the market value of equity in millions of U.S. dollars. Return and volatility are the mean and standard deviation of weekly returns. Turnover is the average monthly number of shares traded over the number of shares outstanding. Investible weight is a variable that indicates the percentage of a stock that foreigners may legally own. The investible weight ranges from zero to one. A stock with zero investible weight is non-investible, and a stock with an investible weight of one is fully investible. All firm-level variables report the cross-sectional average of the time-series means for the sample stocks.

	Country-level variables			Firm-level variables						
Country	U.S. equity holdings ($millions)	U.S. equity holdings / market cap (%)	Foreign ownership (%)	No. of stocks	Firm size ($millions)	Return (%)	Volatility (%)	Turnover (%)	Investible weight	
									Mean	Std. Dev
Argentina	744	0.39	4.56	30	623	0.53	9.25	3.69	0.65	0.33
Brazil	21,801	11.71	29.69	82	1,023	0.36	11.51	3.52	0.56	0.35
Chile	1,917	3.40	5.58	42	695	0.11	5.07	0.91	0.43	0.27
China	2,370	0.45	2.44	196	916	0.15	6.61	9.39	0.22	0.37
Greece	2,810	3.25	4.42	50	669	-0.03	6.37	4.83	0.65	0.32
Hungary	1,702	16.42	24.03	16	440	0.19	6.86	7.23	0.48	0.42
India	6,897	6.25	8.26	127	561	0.04	7.45	19.37	0.15	0.11
Indonesia	1,526	6.63	0.42	60	236	-0.21	8.77	3.60	0.25	0.29
Israel	13,333	18.97	36.77	53	731	0.04	6.35	6.62	0.60	0.29
Korea	29,537	12.61	18.44	165	769	0.03	9.53	30.89	0.51	0.26
Malaysia	2,578	2.15	3.50	112	596	-0.05	7.58	4.77	0.70	0.30
Mexico	26,279	20.81	34.57	69	939	0.08	6.30	3.31	0.58	0.39
Philippines	1,344	3.24	8.77	47	341	-0.16	8.32	3.18	0.23	0.26
Poland	1,197	4.60	9.16	33	544	0.01	6.48	4.73	0.67	0.28
Portugal	3,819	8.24	5.46	30	722	0.17	4.54	4.34	0.59	0.37
Russia	4,613	6.05	9.95	29	2,129	0.01	13.01	1.10	0.34	0.33
South Africa	6,714	4.80	7.22	72	1,468	0.31	6.52	2.95	0.79	0.24
Taiwan, China	19,607	6.70	7.35	98	1,475	-0.05	6.83	33.06	0.30	0.15
Thailand	1,916	5.27	7.13	63	444	-0.47	8.16	6.75	0.25	0.16
Turkey	2,269	4.81	5.36	46	582	0.48	10.84	19.76	0.66	0.28
Venezuela	348	5.60	-	18	269	0.27	9.12	1.97	0.45	0.38

Table 2
Determinants of investible weight
This table examines the determinants of investibility. Each firm's investible weight in each sample year is regressed on the lagged firm characteristics together with lagged country-level variables that proxy for the degree of foreign investors' investments in the country. Investible weight indicates the percentage of stock that foreigners may legally own. "U.S. equity holdings / market cap" is the ratio of U.S. equity holdings scaled by the local stock market's total market capitalization for the years of 1994, 1997, and 2001. "Foreign institutional ownership" is the ratio of foreign institutional equity ownership to local stock market capitalization for the years of 1999 through 2002. Firm size is measured as the logarithm of market value of equity in millions of U.S. dollars. Turnover is the average monthly number of shares traded over the year scaled by the number of shares outstanding. Volatility is the standard deviation of weekly returns over a year. Analyst is a dummy variable equal to one if a stock is covered by analysts in the I/B/E/S database, and zero otherwise. All regression models are ordinary least squares regressions and standard errors are adjusted for two-way clustering at both country and year level. For columns (2) and (4), standard errors are also adjusted using bootstrap method to account for the fact that volatility is a generated regressor. Numbers in parentheses are *t*-statistics. N denotes the number of observations. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)
U.S. equity holdings / market cap	2.196***	2.137***		
	(4.35)	(4.06)		
Foreign institutional ownership			0.861***	0.766***
			(3.11)	(2.35)
Firm size		0.041***		0.042**
		(2.88)		(2.46)
Turnover		-0.019		0.070
		(-0.14)		(0.77)
Volatility		0.008**		0.017***
		(2.49)		(3.78)
Analyst		0.153**		0.144*
		(2.54)		(1.71)
Constant	0.325***	-0.035	0.353***	-0.089
	(5.06)	(-0.38)	(5.26)	(-1.14)
N	4,172	4,172	5,773	5,773
Adjusted R^2	0.113	0.172	0.054	0.143

Table 3
Delay measures

This table provides summary statistics of delay measures. Delay measures (*delay1* and *delay2)* are constructed for each stock in each year to proxy for the speed with which a stock's price responds to market-wide information. Delay measures are as defined in equations (2) and (3) in the text. "*delay1* to global information" and "*delay2* to global information" are delay measures with respect to the world market return, while "*delay1* to local information" and "*delay2* to local information" are delay measures with respect to the local market return. Datastream world and local market returns are used to proxy for global and local market information. "Non-investible" denotes a groups of stocks whose investible weight equals zero; "Partially investible" is a group of stocks whose investible weight is greater than zero but less than or equal to 0.5; and "Highly investible" is a group of stocks whose investible weight is greater than 0.5. The latest available investible weight in the previous year is used to sort sample stocks into three investibility groups in each sample year. Numbers in parentheses are cluster-adjusted *t*-statistics. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Summary statistics of delay measures

	Mean	Median	Standard Deviation	Q1	Q3
"*delay1* to global information"	0.147	0.098	0.146	0.042	0.201
"*delay2* to global information"	0.533	0.547	0.233	0.419	0.662
"*delay1* to local information"	0.145	0.091	0.152	0.040	0.196
"*delay2* to local information"	0.517	0.517	0.175	0.454	0.587

	Non-investible	Partially investible	Highly Investible	Test of mean difference		
	(A)	(B)	(C)	(A)-(C)	(A)-(B)	(B)-(C)
Panel B: Delay measures by investibility group						
"*delay1* to global information"	0.220	0.126	0.121	(6.16)***	(5.38)***	(0.53)
"*delay2* to global information"	0.561	0.531	0.517	(8.25)**	(2.31)**	(1.10)
"*delay1* to local information"	0.180	0.124	0.141	(1.24)	(1.90)*	(-1.59)
"*delay2* to local information"	0.514	0.516	0.520	(-1.06)	(-0.28)	(-0.63)
Panel C: "delay1 to global information" by investibility group and country						
Argentina	0.186	0.241	0.094	(5.17)***	(-3.12)***	(15.08)***
Brazil	0.205	0.126	0.150	(2.72)**	(4.65)***	(-1.59)
Chile	0.200	0.116	0.128	(3.22)***	(3.73)***	(-1.08)
China	0.258	0.124	0.121	(5.93)***	(3.78)***	(0.13)

	Non-investible	Partially investible	Highly Investible	Test of mean difference		
	(A)	(B)	(C)	(A)-(C)	(A)-(B)	(B)-(C)
Greece	0.167	0.114	0.102	(2.85)**	(1.51)	(0.44)
Hungary	0.244	0.115	0.122	(3.60)***	(2.31)**	(-0.19)
India	0.179	0.140	-	-	(3.96)***	-
Indonesia	0.206	0.165	0.126	(2.46)**	(1.48)	(1.25)
Israel	0.169	0.114	0.138	(0.48)	(0.85)	(-1.46)
Korea	0.167	0.136	0.108	(2.34)**	(2.10)*	(1.20)
Malaysia	0.175	0.100	0.104	(1.65)	(2.23)**	(-0.32)
Mexico	0.262	0.170	0.148	(6.43)***	(4.56)***	(0.93)
Philippines	0.195	0.122	0.147	(2.50)**	(3.03)**	(-1.47)
Poland	0.155	0.107	0.105	(1.33)	(0.76)	(0.06)
Portugal	0.217	0.161	0.165	(3.32)**	(2.15)*	(-0.19)
Russia	0.236	0.120	0.112	(2.30)*	(2.13)*	(0.55)
South Africa	0.312	0.204	0.155	(3.90)***	(1.89)*	(1.54)
Taiwan	0.118	0.109	0.072	(1.61)	(0.27)	(3.18)***
Thailand	0.176	0.110	0.103	(1.68)	(2.65)**	(0.24)
Turkey	0.114	0.043	0.076	(1.09)	(1.84)*	(-3.99)***
Venezuela	0.274	-	0.113	(4.43)***	-	-
	Panel D: "delay1 to global information" by investibility group and year					
1990	0.160	0.043	0.101	(3.29)***	(4.06)***	(-1.68)
1991	0.231	0.094	0.125	(4.18)***	(7.13)***	(-1.30)
1992	0.221	0.118	0.137	(4.01)***	(4.87)***	(-0.78)
1993	0.218	0.100	0.143	(2.46)**	(3.41)***	(-1.88)*
1994	0.200	0.178	0.119	(4.23)***	(0.89)	(2.46)**
1995	0.231	0.128	0.106	(7.65)***	(3.51)***	(0.87)
1996	0.269	0.132	0.167	(2.69)**	(3.79)***	(-2.09)*
1997	0.253	0.126	0.118	(4.34)***	(3.70)***	(0.42)
1998	0.227	0.126	0.107	(2.49)**	(2.36)**	(1.17)
1999	0.193	0.123	0.116	(4.17)***	(4.51)***	(0.55)
2000	0.277	0.125	0.122	(6.75)***	(4.03)***	(0.11)
2001	0.204	0.101	0.117	(3.91)***	(5.06)***	(-1.25)
2002	0.186	0.128	0.121	(3.53)***	(4.64)***	(0.44)

Table 4
Delay measures: portfolio approach

This table presents delay measures of investible portfolio returns. Using the latest available investible weight in the previous year, sample stocks are sorted into three investibility groups in each year where "Non-investible" denotes a groups of stocks whose investible weight equals zero; "Partially investible" is a group of stocks whose investible weight is greater than zero but less than or equal to 0.5; and "Highly investible" is a group of stocks whose investible weight is greater than 0.5. Equal- and value-weighted weekly returns for each of the three investible groups are computed and then delay measures with respect to world market returns are computed for each investible portfolio. A simulated sample of the same size as the original sample of three investible portfolio returns is generated with replacement and then delay measures with respect to world market returns are computed for the simulated sample. This procedure is repeated 1,000 times to generate simulated distribution of delay measures. Test of difference is based on these paired samples to adjust for correlation among investible portfolios. Numbers in parentheses are *t*-statistics based on the bootstrap method. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	Non-investible	Partially investible	Highly investible	Test of difference		
	(A)	(B)	(C)	(A)-(C)	(A)-(B)	(B)-(C)
			Panel A: Equal-weighted investible portfolio returns			
delay1	0.331***	0.160***	0.106***	0.224**	0.171*	0.054
	(2.87)	(2.61)	(3.00)	(2.13)	(1.65)	(1.06)
delay2	0.628***	0.598***	0.584***	0.043***	0.030*	0.013
	(35.74)	(34.57)	(45.37)	(2.60)	(1.72)	(0.88)
			Panel B: Value-weighted investible portfolio returns			
delay1	0.281***	0.092**	0.066**	0.216**	0.189*	0.026
	(2.40)	(2.34)	(2.46)	(1.99)	(1.77)	(0.84)
delay2	0.619***	0.573***	0.568***	0.050**	0.046**	0.004
	(27.87)	(33.90)	(44.31)	(2.57)	(2.18)	(0.30)

Table 5
Speed of price adjustment to common information
This table presents the estimation results of the regression models where the dependent variable is a delay measure (*delay1* or *delay2)* constructed for each stock in each year to proxy for the speed with which a stock's price responds to market-wide information. Delay measures are as defined in equations (2) and (3) in the text. All other variables are as defined in Table 2 and explanatory variables are for the previous year relative to the dependent variable. All regression models are ordinary least squares regressions and standard errors are adjusted for two-way clustering at both country and year level. For columns (2) and (4), standard errors are also adjusted using the bootstrap method to account for the fact that volatility is a generated regressor. Numbers in parentheses are *t*-statistics. N denotes the number of observations. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	delay1		*delay2*	
	(1)	(2)	(3)	(4)
Panel A: Delay measures with respect to global market information				
Investible weight	-0.069***	-0.059***	-0.037***	-0.024***
	(-3.30)	(-3.61)	(-4.37)	(-4.24)
Firm size		-0.020***		-0.010***
		(-4.94)		(-4.34)
Turnover		0.001		0.019
		(0.07)		(1.37)
Volatility		-0.002***		-0.001
		(-2.72)		(-1.15)
Analyst		-0.003		-0.005
		(-0.28)		(-0.72)
Constant	0.181***	0.242***	0.551***	0.613***
	(9.95)	(5.62)	(49.45)	(15.22)
Country dummy	No	Yes	No	Yes
Industry dummy	No	Yes	No	Yes
Year dummy	No	Yes	No	Yes
N	14,075	14,075	14,070	14,070
Adjusted R^2	0.038	0.143	0.004	0.035
Panel B: Delay measures with respect to local market information				
Investible weight	-0.017	-0.020	0.007	-0.001
	(-0.88)	(-1.63)	(1.33)	(-0.14)
Firm size		-0.029***		-0.007***
		(-9.05)		(-3.87)
Turnover		-0.005		-0.018
		(-0.40)		(-1.53)
Volatility		-0.003**		-0.001***
		(-2.53)		(-2.61)

	delay1		*delay2*	
	(1)	(2)	(3)	(4)
Analyst		0.017**		0.000
		(2.11)		(0.01)
Constant	0.153***	0.324***	0.514***	0.529***
	(9.07)	(8.22)	(58.98)	(30.59)
Country dummy	No	Yes	No	Yes
Industry dummy	No	Yes	No	Yes
Year dummy	No	Yes	No	Yes
N	14,075	14,075	14,074	14,074
Adjusted R^2	0.002	0.149	0.000	0.017

Table 6

Speed of price adjustment to global market information: Robustness tests

This table presents the robustness tests of the speed of price adjustment to global market information. The dependent variable is *delay1* computed with respect to global market information for each stock in each year. All variables are as defined in Table 2 and explanatory variables are for the previous year relative to the dependent variable. Columns (1) and (2) use S&P 500 and EAFE index returns to proxy for global market information, respectively. Column (3) uses a random effects model, and column (4) uses a firm-fixed effect model. Columns (5) and (6) use the sample period of 1990–1997 and 1998–2002, respectively. Columns (7) and (8) replace investible weight with country-level variables that proxy for foreign investment in local stock markets. All models are ordinary least squares regressions except models (3) and (4). Standard errors of all OLS regressions are adjusted for two-way clustering at both country and year level. Standard errors are also adjusted using the bootstrapping method to account for the fact that volatility is a generated regressor. Numbers in parentheses are *t*-statistics. N denotes the number of observations. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Investible weight	-0.061***	-0.054***	-0.056**	-0.057***	-0.059***	-0.068***		
	(-3.42)	(-6.00)	(-2.54)	(-3.36)	(-3.48)	(-4.78)		
U.S. equity holdings/ market cap							-0.620***	
							(-3.91)	
Foreign institutional ownership								-0.479**
								(-2.15)
Firm size	-0.020***	-0.011**	-0.019***	-0.020***	-0.023***	-0.015***	-0.022***	-0.015***
	(-5.09)	(-2.28)	(-5.20)	(-5.47)	(-5.14)	(-4.41)	(-4.33)	(-3.51)
Turnover	0.007	-0.010	0.017	0.001	0.002	-0.008	-0.005	-0.013
	(0.36)	(-0.78)	(-1.04)	(0.07)	(0.09)	(-0.61)	(-0.40)	(-0.95)
Volatility	-0.003***	0.000	-0.003**	-0.003***	-0.003***	-0.001*	0.000	-0.001
	(-3.13)	(0.39)	(-2.47)	(-3.21)	(-2.89)	(-1.72)	(0.02)	(-0.94)
Analyst	-0.005	-0.009***	-0.013	-0.001	0.009	-0.016**	-0.006	-0.028**
	(-0.55)	(-8.31)	(-1.05)	(-0.06)	(0.99)	(-2.18)	(-0.48)	(-2.05)
Constant	0.262***	0.292***	0.256***	0.311***	0.237***	0.302***	0.356***	0.288***
	(6.73)	(4.14)	(6.54)	(15.14)	(3.45)	(14.50)	(7.17)	(4.10)
Country dummy	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	No	Yes	Yes	No	No
N	14,075	2,942	14,075	14,075	8,130	5,945	4,151	4,376
Adjusted R^2	0.149	0.187	0.143	0.074	0.160	0.157	0.159	0.155

Table 7
Summary statistics and auto-correlations by investibility groups
For each stock in each year, using the latest available investible weight in the previous year, sample stocks are sorted into three investibility groups where "Non-investible" denotes a group of stocks whose investible weight equals zero; "Partially investible" is a group of stocks whose investible weight is greater than zero but less than or equal to 0.5; and "Highly investible" is a group of stocks whose investible weight is greater than 0.5. In addition, for each country in each year, sample stocks are independently sorted into three size or three turnover groups based on their latest available market capitalization or average monthly turnover over the previous year, respectively. Panels A and B present summary statistics and autocorrelations associated with each of the nine size/investibility and turnover/investibility portfolios, respectively. ρ_1 denotes the first order autocorrelation, and $\sum\rho_{t-k}$ is the sum of the first three lagged autocorrelations. For each portfolio, we report equally weighted size, investible weight, weekly return, volatility, and turnover.

Size/turnover group	Investibility group	Firm size ($ millions)	Turnover (%)	Investible weight	Return (%)	Volatility (%)	ρ_1	$\sum_{k=1}^{3}\rho_{t-k}$
		Panel A: Groups sorted by size and investible weight						
Small	Non-investible	59	8.07	0.00	0.40	9.28	0.21	0.57
	Partially investible	136	17.68	0.32	-0.17	7.98	0.06	0.25
	Highly investible	137	11.20	0.97	0.15	8.01	0.07	0.32
Medium	Non-investible	214	6.87	0.00	0.34	7.70	0.10	0.21
	Partially investible	352	13.23	0.30	-0.03	7.80	0.12	0.38
	Highly investible	360	8.15	0.95	0.13	7.77	0.11	0.35
Large	Non-investible	1,009	4.45	0.00	0.29	7.47	0.05	0.12
	Partially investible	2,141	8.30	0.30	0.05	7.00	0.09	0.33
	Highly investible	1,854	6.03	0.94	0.21	7.16	0.08	0.33
		Panel B: Groups sorted by turnover and investible weight						
Low	Non-investible	443	1.09	0.00	0.31	7.75	0.18	0.48
	Partially investible	1,675	2.70	0.29	-0.08	6.49	0.03	0.32
	Highly investible	870	1.79	0.94	0.13	6.69	0.11	0.32
Medium	Non-investible	275	4.16	0.00	0.43	8.44	0.13	0.34
	Partially investible	1,056	6.34	0.31	-0.01	7.30	0.11	0.36
	Highly investible	920	4.46	0.95	0.16	7.35	0.08	0.34
High	Non-investible	182	18.16	0.00	0.33	9.19	0.08	0.18
	Partially investible	759	26.41	0.30	-0.06	8.17	0.10	0.32
	Highly investible	709	15.60	0.95	0.17	8.44	0.10	0.33

Table 8
Lead-lag relations of investible portfolios

This table presents the estimation results of Vector Autoregression (VAR) model using the equal-weighted weekly returns on the size/investibility and turnover/investibility portfolios. For each of the sample countries, sample stocks are partitioned into three investibility groups of non-investible, partially investible, and highly investible stocks. In addition, in each country sample stocks are independently sorted into three size or three turnover groups based on their latest available market capitalization or average monthly turnover over the previous year, respectively. Then, equal-weighted returns of non-investible portfolio ($R_{NI,t}$) and highly investible portfolio ($R_{HI,t}$) are computed within each size or turnover groups. Finally, the following VAR is estimated jointly across all sample countries:

$$R_{NI,t} = a_0 + \sum_{k=1}^{k=3} a_k R_{NI,t-k} + \sum_{k=1}^{k=3} b_k R_{HI,t-k} + u_t$$

$$R_{HI,t} = a_2 + \sum_{k=1}^{k=3} c_k R_{NI,t-k} + \sum_{k=1}^{k=3} d_k R_{HI,t-k} + v_t$$

where $R_{NI,t}$ and $R_{HI,t}$ are the week t return on the non-investible and highly investible portfolio, respectively. Panels A and B report the VAR estimation for non-investible and highly investible portfolio returns controlling for size and turnover, respectively. The cross-equation test of null hypotheses are $b_1 - c_1 = 0$ and $\sum_{k=1}^{3} b_k - \sum_{k=1}^{3} c_k = 0$. The p-values are in parentheses. N is the number of observations.

Group	Dependent variable	Independent variables				Cross-equation test		Adjusted R^2	N
		$R_{NI,t-1}$	$\sum_{k=1}^{3} R_{NI,t-k}$	$R_{HI,t-1}$	$\sum_{k=1}^{3} R_{HI,t-k}$	$b_1 - c_1$	$\sum_{k=1}^{3} b_k - \sum_{k=1}^{3} c_k$		
Panel A: Lead-lag relation of non-investible and highly investible portfolio returns controlling for size									
Small	$R_{NI,t}$	-0.089	-0.113	0.131	0.302	0.115	0.263	0.024	6,542
		(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)		
	$R_{HI,t}$	0.016	0.039	0.015	0.113			0.010	
		(0.27)	(0.32)	(0.32)	(0.01)				
Medium	$R_{NI,t}$	0.001	-0.026	0.122	0.224	0.086	0.172	0.020	5,918
		(0.93)	(0.53)	(0.00)	(0.00)	(0.00)	(0.00)		
	$R_{HI,t}$	0.036	0.052	0.058	0.109			0.009	
		(0.02)	(0.12)	(0.00)	(0.01)				
Large	$R_{NI,t}$	0.000	-0.009	0.119	0.227	0.117	0.193	0.016	4,321
		(1.00)	(0.88)	(0.00)	(0.00)	(0.00)	(0.00)		
	$R_{HI,t}$	0.002	0.034	0.037	0.084			0.006	
		(0.92)	(0.45)	(0.04)	(0.06)				
Panel B: Lead-lag relation of non-investible and highly investible portfolio returns controlling for turnover									
Low	$R_{NI,t}$	-0.014	0.035	0.074	0.139	0.040	0.084	0.010	6,380
		(0.33)	(0.42)	(0.00)	(0.00)	(0.04)	(0.02)		
	$R_{HI,t}$	0.034	0.055	0.016	0.078			0.005	
		(0.02)	(0.17)	(0.27)	(0.09)				
Medium	$R_{NI,t}$	-0.105	-0.125	0.150	0.328	0.170	0.348	0.020	6,576
		(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)		
	$R_{HI,t}$	-0.020	-0.020	0.047	0.153			0.007	
		(0.09)	(0.52)	(0.00)	(0.00)				
High	$R_{NI,t}$	-0.023	0.010	0.120	0.234	0.105	0.227	0.017	6,173
		(0.12)	(0.82)	(0.00)	(0.00)	(0.00)	(0.00)		
	$R_{HI,t}$	0.015	0.007	0.049	0.159			0.011	
		(0.22)	(0.80)	(0.00)	(0.00)				

Table 9
Do world market returns predict non-investible portfolio returns?

This table presents the test results regarding whether world market returns predict non-investible stock returns after controlling for lagged investible returns of the same country. For each of the sample countries, sample stocks are partitioned into three investibility groups of non-investible, partially investible, and highly investible stocks. In addition, in each country sample stocks are independently sorted into three size or three turnover groups based on their latest available market capitalization or average monthly turnover over the previous year, respectively. Then, equal-weighted returns of non-investible portfolio ($R_{NI,t}$) and highly investible portfolio ($R_{HI,t}$) are computed within each size or turnover groups. Finally, the following OLS regression is estimated:

$$R_{NI,t} = \alpha + \sum_{k=0}^{3} \delta_k R_{w,t-k} + \sum_{k=1}^{3} \gamma_k R_{HI,t-k} + \sum_{k=1}^{3} \tau_k R_{NI,t-k} + \varepsilon_t$$

where $R_{NI,t}$ indicates returns of non-investible portfolio for each size (turnover) group; $R_{w,t-k}$ is contemporaneous and lagged world market returns for k = 0, 1, 2, and 3; and $R_{HI,t-k}$ and $R_{NI,t-k}$ are lagged highly investible returns and lagged non-investible returns of the same size (turnover) group for k = 1, 2, and 3. Numbers in parentheses and brackets are *t*-statistics and F-statistics, respectively. N denotes the number of observations. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	By size group			By turnover group		
	Small (1)	Medium (2)	Large (3)	Low (4)	Medium (5)	High (6)
$R_{w,t}$	0.577***	0.382***	0.518***	0.462***	0.510***	0.543***
	(9.47)	(7.57)	(5.17)	(6.26)	(7.41)	(6.95)
$R_{w,t-1}$	0.156**	0.107***	0.060	0.136***	0.128**	0.144**
	(2.39)	(3.64)	(0.91)	(3.93)	(2.34)	(2.22)
$R_{w,t-2}$	0.106*	0.109**	0.212***	0.114**	0.176***	0.093*
	(2.10)	(2.39)	(2.97)	(2.42)	(3.60)	(1.86)
$R_{w,t-3}$	0.031	0.007	0.049	0.049	0.015	0.048
	(0.99)	(0.22)	(0.76)	(1.57)	(0.37)	(1.33)
$R_{HI,t-1}$	0.119***	0.113***	0.115***	0.061**	0.138***	0.108***
	(6.62)	(5.64)	(3.44)	(2.79)	(9.48)	(4.30)
$R_{HI,t-2}$	0.104***	0.030*	0.040*	0.027	0.110***	0.084***
	(4.08)	(1.84)	(1.94)	(1.16)	(3.15)	(3.18)
$R_{HI,t-3}$	0.058***	0.068***	0.052	0.029	0.054***	0.014
	(5.34)	(3.22)	(1.62)	(1.65)	(3.05)	(0.69)

	By size group			By turnover group		
	Small (1)	Medium (2)	Large (3)	Low (4)	Medium (5)	High (6)
$R_{NI,t-1}$	-0.093**	0.002	-0.003	-0.015	-0.105***	-0.025
	(-2.65)	(0.12)	(-0.11)	(-0.56)	(-3.10)	(-0.82)
$R_{NI,t-2}$	0.003	-0.010	0.001	0.009	-0.011	0.021
	(0.14)	(-0.38)	(0.04)	(0.32)	(-0.56)	(1.24)
$R_{NI,t-3}$	-0.022*	-0.015	-0.017	0.039**	-0.010	0.018
	(-1.74)	(-0.99)	(-0.82)	(2.13)	(-0.41)	(1.05)
Constant	0.178*	0.183**	0.150	0.158**	0.185*	0.090
	(2.04)	(2.40)	(1.34)	(2.70)	(1.88)	(0.83)
Test of hypotheses that						
$\sum_{k=1}^{3} \delta_k = 0$	[6.61]***	[5.32]***	[3.96]**	[9.35]***	[6.78]***	[5.87]***
$\sum_{k=1}^{3} \gamma_k = 0$	[27.03]***	[10.83]***	[10.40]***	[5.98]***	[32.89]***	[15.58]***
$\sum_{k=1}^{3} \tau_k = 0$	[4.88]**	[0.39]	[0.32]	[3.95]**	[3.53]**	[1.80]
N	6,542	5,918	4,321	6,380	6,576	6,173
Adjusted R^2	0.054	0.039	0.047	0.040	0.042	0.040

Table 10

Speed of price adjustment to common information using a subsample of A and B shares

This table presents the estimation results of the regression models where the dependent variable is a delay measure (*delay1* or *delay2)* constructed for each stock in each year to proxy for the delay with which a stock's price responds to market-wide information. Delay measures are as defined in equations (2) and (3) in the text. The regression models use a sample of 835 observations for 94 firms for which both A and B shares are available. A shares' trading is restricted to local investors only, while B shares' trading is open to foreign investors. Dummy for B share equals one if a stock is B-share stock, and zero otherwise. Turnover is the average monthly number of shares traded over the year scaled by the number of shares outstanding. All regression models are ordinary least squares regressions and standard errors are adjusted for two-way clustering at both country and year level. Numbers in parentheses are *t*-statistics. N denotes the number of observations. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	delay1		*delay2*	
	(1)	(2)	(3)	(4)
Panel A: Delay measures with respect to global market information				
Dummy for B share	-0.073***	-0.073***	-0.031	-0.031
	(-3.12)	(-3.08)	(-1.48)	(-1.46)
Turnover	0.067	-0.085	0.042	-0.012
	(0.55)	(-0.61)	(0.42)	(-0.05)
Constant	0.220***	0.202***	0.563***	0.613***
	(11.19)	(10.07)	(43.66)	(9.31)
Country dummy	No	Yes	No	Yes
Industry dummy	No	Yes	No	Yes
Year dummy	No	Yes	No	Yes
Adjusted R^2	0.050	0.152	0.004	0.058
Panel B: Delay measures with respect to local market information				
Dummy for B share	0.047	0.047	-0.002	-0.002
	(0.73)	(0.71)	(-0.14)	(-0.14)
Turnover	0.070	0.337***	0.048	0.086
	(0.69)	(3.08)	(1.49)	(1.01)
Constant	0.150***	0.056	0.521***	0.524***
	(3.94)	(1.46)	(43.14)	(108.42)
Country dummy	No	Yes	No	Yes
Industry dummy	No	Yes	No	Yes
Year dummy	No	Yes	No	Yes
N	835	835	835	835
Adjusted R^2	0.017	0.106	0.000	0.037

Table 11
Lead-lag relation of A and B shares

This table presents the estimation results of Vector Autoregression (VAR) model using the equally weighted weekly returns of the A and B share portfolios. For a sample of 94 firms that have both A and B shares, equal-weighted returns of A-share portfolio and B-share portfolio are computed. Then, the following Vector Autoregression (VAR) model is estimated:

$$R_{A,t} = a_0 + \sum_{k=1}^{3} a_k R_{A,t-k} + \sum_{k=1}^{3} b_k R_{B,t-k} + u_t$$
$$R_{B,t} = a_2 + \sum_{k=1}^{3} c_k R_{A,t-k} + \sum_{k=1}^{3} d_k R_{B,t-k} + v_t$$

where $R_{A,t}$ and $R_{B,t}$ are the week t return on the A-share portfolio and the B-share portfolio, respectively. The cross-equation tests of null hypotheses are $b_1 - c_1 = 0$ and $\sum_{k=1}^{3} b_k - \sum_{k=1}^{3} c_k = 0$. The p-values are in parentheses.

Dependent	$R_{A,t-1}$	$\sum_{k=1}^{3} R_{A,t-k}$	$R_{B,t-1}$	$\sum_{k=1}^{3} R_{B,t-k}$	$b_1 - c_1$	$\sum_{k=1}^{3} b_k - \sum_{k=1}^{3} c_k$
$R_{A,t}$	-0.040	-0.097	0.142	0.398	0.179	0.518
	(0.39)	(0.34)	(0.00)	(0.00)	(0.01)	(0.00)
$R_{B,t}$	-0.036	-0.120	0.112	0.320		
	(0.49)	(0.26)	(0.02)	(0.05)		