INVESTIBILITY AND RETURN VOLATILITY

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Abstract

This paper investigates the impact of investibility, the degree to which a stock is accessible to foreigners, on emerging market volatility. Unlike previous studies that examine how emerging market volatility changes subsequent to liberalization, we study how investibility affects the cross-sectional variations of stock return volatility. Results show that there is a positive relationship between return volatility and the investibility of individual stocks, even after controlling for the country, industry, firm size, and turnover factors. We also find that the highly investible emerging market portfolio is subject to larger world market exposure than the non-investible portfolio, suggesting that the highly investible stocks are more integrated with the world and therefore subject to greater world market risk.

Introduction

There has been an increase in net portfolio flows into emerging markets in recent years due to the liberalization of these markets. On the one hand, the net portfolio flows into emerging markets should lower the cost of capital for the economies and help finance their growth. On the other hand, the experience from the 1997 Asian financial crisis shows that foreign portfolio flows are not stable, but come and go quickly.[1] This ebb and flow of foreign portfolios prompts the worry that "large inflows leave a country exposed to the latest mood of Wall Street traders" [Sachs, Tornell and Velasco (1996)] and that "developing countries are more vulnerable to vacillations in the international flows than ever before" [Stiglitz (1998)]. It also triggers debate about the role of foreign portfolio capital in the emerging market economies.

Many academic studies have investigated how stock market liberalization affects the variability of emerging market returns and their linkages with the world market. One approach is to investigate the relationship between capital flows and equity returns and to detect the existence of positive-feedback trading (buy when prices have increased and sell when prices have declined) and herding (buy or sell at the same time) by foreign investors. Although several studies (for example, Choe, Kho and Stulz (1999), Froot, O' Connell, and Seasholes (2001), Karolyi (2003), show that foreign investors pursue both positive-feedback trading and herding strategies, they do not find that foreign investors have destabilizing impact on stock prices. Another approach is to examine the behavior of emerging markets subsequent to liberalizations. A few studies find that stock market liberalizations lower the cost of capital (Bekaert and Harvey (2000) and Henry (2000)) and slightly increase the correlation between emerging market and world market returns (Bekaert and Harvey (1997)), but they do not drive up the emerging market volatility (Bekaert and Harvey (1997 and 2000), Kim and Singal (2000)).

In this paper, we propose a cross-sectional approach to study the potential impact of foreign investors on emerging market securities, by examining the relationship between a stock's investibility

[1] Krugman (1998) states that "in 1996 capital was flowing into emerging Asia at the rate of about $100 billion a

and its return volatility. The Standard & Poor's Emerging Markets Database (EMDB) contains a variable called the "degree open factor," which indicates the degree to which a stock is accessible to foreigners. One of the elements in determining the degree open factor is the foreign ownership limit, which may vary substantially across different securities. For instance, a tighter foreign ownership limit might be imposed in the banking, energy, utility, and broadcasting industries. Furthermore, some companies may impose their own restrictions on foreign ownership and these limits could be tighter than the national limits. Also, in some markets such as China and Philippines, there are distinct classes of shares for locals (A-shares) and for foreigners (B-shares).[2] Such variation in investibility across stocks naturally gives us an ideal setting in evaluating the impact of foreign investment restrictions using cross-sectional data.

Previous studies typically identify the dates of financial liberalizations and treat them as one-time events or structural breaks. However, as Bekaert, Harvey, and Lumsdaine (2002) argue, liberalization is often not a discrete event. Our study addresses the gradual nature of liberalization by incorporating the degree open factor. In addition, we focus on the cross-sectional relation between investibility and return volatility. We admit that our investibility measure has some drawbacks. First, the degree of investibility is not necessarily a good proxy for the degree of foreign ownership - a stock with a low foreign ownership limit is not necessarily owned by a lot of foreigner investors. If this is the case, there will be a bias against finding any systematic pattern between the investibility factor and stock return variability. Second, the investibility factor may be correlated with other factors. For example, companies with greater foreign ownership restrictions tend to be smaller firms and tend to come from particular economic sectors. Therefore, it is possible that other characteristics of the firms, rather than the investibility factor, affect their stock return volatility. To circumvent this problem, we need to separate the effect of investibility factor from these factors.

The investibility measure used in this paper is closely related to the capital control measure used

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year; by the second half of 1997 it was flowing out at about the same rate."

in De Jong and De Roon (2001) and Edison and Warnock (2002). Also based on the EMDB, they construct a measure of the intensity of capital controls for each country, as the ratio of the market value of the investible stocks to the total market capitalization. The distinction is that while the above studies construct the capital control measure at the country level and examine how the intensity of capital controls varies over time, we develop our measure at the individual firm level and examine how the investibility measure could explain cross-sectional variations of individual firm volatility and correlation with the world market.

Based on the investibility measure, we classify the stocks into three groups: non-investible stocks (investible weight equal to 0%), partially investible stocks (investible weight less than or equal to 50%) and highly investible stocks (investible weight greater than 50%). We find that highly investible stocks exhibit higher return volatility than the non-investible stocks, even after controlling for the country, industry, firm size, and turnover factors. However, the idiosyncratic risk does not increase with the degree of investibility. Our explanation for the highly investible stocks to be more volatile is that they become more integrated with the world so that they experience increased world market risk. Consistent with Chari and Henry (2001) who show that there is a difference in the world market betas between investible and non-investible firms, we also find that the highly investible emerging market portfolio is subject to greater world market exposure than the non-investible portfolio.

The remainder of this paper is organized as follows. Section 1 provides a brief review of previous studies on liberalization and emerging market volatility. Section 2 presents the data and preliminary statistics. Section 3 offers the empirical analysis. Section 4 summarizes the main results and presents conclusions.

1. Emerging Market Liberalization and Volatility

Although there is empirical evidence that the cost of capital in emerging markets could be

[2] See Domowitz, Glen and Madhavan (1997) and Bailey, Chung and Kang (1999) for further discussion.

lowered upon liberalization (Kim and Singal (2000), Henry (2000), and Bekaert and Harvey (2000)), there is concern that foreign participation will increase emerging market volatility. Indeed, foreign investors have often been blamed for excessive volatility, particularly in the collapse of Asian stock markets during the 1997 financial crisis. The argument against foreign portfolio flows is that they are "hot money" and come and go quickly. If foreign investors trade very frequently in emerging markets, and because emerging markets are not very liquid, the portfolio adjustment by large foreign institutional investors will result in large price fluctuations.

Nevertheless, the linkage between liberalization and increased volatility is not strongly supported by empirical evidence. Richards (1996) estimates the volatility of emerging markets and concludes that the volatility during the period of 1992-1995 when foreign institutional investors played a significant role in emerging markets is not much different from that during the period of 1972-1992. In a study of 20 emerging markets, Bekaert and Harvey (1997 and 2000) find that on average liberalization does not increase volatility by much. Kim and Singal (2000) consider changes in volatility around liberalizations for a sample of 16 emerging markets and find that after the first 12 months following liberalization, volatility falls significantly on average.

However, it should be noted that all of the above studies are based on dating financial liberalizations and treating them as one-time events or structural breaks, which presupposes that all liberalizations are similar in their intensity and speed. In a recent study, Edison and Warnock (2002) show that although the experience of each country is different, liberalizations in Latin American countries are in general much faster and much more complete than those in Asia. As a result, relying on dummy indicators for liberalizations fails to provide additional information about the degree of changes in capital controls. Edison and Warnock propose a monthly measure that is based on the ratio of market capitalizations underlying a country's investible and global indices as computed by the International Finance Corporation (IFC). The difference between the two indices is that the global index (IFCG) is designed to represent the whole market while the investible index (IFCI) is designed to represent the portion of the market available to foreign investors. Hence, the ratio of the market capitalizations of a country's IFCI and IFCG indices is a quantitative measure of the availability of the country's equities to foreigners. Interestingly, Edison and Warnock find that their measure corresponds quite well with the liberalization dates of Bekaert and Harvey (2000).

One reason why emerging market volatility is affected upon liberalization is through the link between market integration and the influence of world factors on emerging markets. If an emerging market is completely segmented from the rest of the world before liberalization, market volatility will be induced only by local factors. However, once the emerging market becomes integrated with the world after liberalization, the expected returns of the emerging market and developed market will be affected by the global risk premium. Consequently, the beta relative to the world factors will go up so that the market volatility will be driven by world factors as well.

There is evidence of significant, albeit modest, increases in correlation after liberalization. Bekaert and Harvey (1997) estimate a model that allows correlations between emerging markets and the world market to change over time. They then estimate correlations before and after liberalization but find that only nine out of 17 emerging markets show higher correlations with the world market. Bekaert and Harvey (2000) also find that the correlation of the emerging market portfolio with the world market portfolio increases from 0.7% to 4.9% following capital market liberalization. In another study, based on a composite index of emerging markets, De Jong and De Roon (2001) find a slight increase in beta after the markets become more integrated. Chari and Henry (2001) examine the individual firm data from the IFC emerging market database, and calculate the difference in covariance of the individual firm returns with the local and world markets (DIFCOV) for every firm. They find that the average value of DIFCOV is 0.018 for investible firms and 0.0096 for non-investible firms, suggesting that there is a considerable difference in either the local or world market betas between the firms that are accessible to foreigners and those that are not.

Except for Chari and Henry, previous studies of the impact of liberalization on emerging markets typically make use of aggregate market data and employ time-series analysis. Our paper represents one of the few studies that examine individual firm data. We obtain the investibility measure for individual firms, as reported by the EMDB. Similar to the capital control measure proposed by De Jong and De Roon (2001) and Edison and Warnock (2002), our investibility measure provides important information on the degree of foreign investment restrictions. Based on this measure, we examine how investibility affects the return volatility of a stock and its exposure to the world market. Since we also obtain the information on other characteristics of individual firms, such as firm size, turnover and industry classification, we are able to control for their influences on stock return volatility in order to isolate the impact of investibility. An advantage of our study is that because we investigate the cross-sectional relationship between the stock's investibility and return volatility, we avoid the somewhat arbitrary process of dating financial liberalizations. Given that previous studies find only scant evidence on changes of emerging market volatility and correlation with the world subsequent to liberalization, our cross-sectional approach could be more powerful in detecting the impact of relaxing foreign investment restrictions on the stock return dynamics.

2. Data and Preliminary Statistics

The data are from Standard & Poor's (formerly the International Finance Corporation or IFC) Emerging Markets Database (EMDB), which covers more than 2,000 stocks from 45 emerging markets. The database compiles monthly closing stock prices, dividends, shares outstanding, market capitalization, trading volume, and other financial statement information such as earnings and book value.

The EMDB determines the investible weight of a stock based on several criteria. It first determines if the market is open to foreign institutions. It shows the extent to which and the mechanisms foreign institutions can use to buy and sell shares in the local stock exchange and repatriate capital. It also determines if there are any corporate by-laws, corporate charters, or industry limitations on foreign ownership of the stock. The database then lists a variable called the "degree open factor" that indicates the amount of the security accessible to foreigners, with zero for non-investible stocks and one for fully-investible stocks.

It should be noted that the investible weight recorded by the EMDB might sometimes fail to reflect the actual degree of investibility. Edison and Warnock (2002) note that the IFC would delay adjusting the IFCI index even after an official change was made. For example, in May 1997 the Korean government increased the foreign ownership limit from 20 to 23 percent and announced that another 3 percent increase would take place later in the year. In response to the government's announcement, the IFC announced that it would wait until its annual rebalancing of the indices in November to adjust Korea's investible index. Another example is when Malaysia implemented the capital controls in late 1998. However, the IFC announced that it would continue to track Malaysia's IFCI index, but that Malaysia's weight in the worldwide investible index would be zero. In the EMDB dataset, we find that the investible weights for the Malaysia companies do not drop to zero in late 1998. We, therefore, follow Edison and Warnock (2002) and make adjustments to the data based on additional information on capital controls.[3] As discussed by Rouwenhorst (1999), there are some other problems associated with the EMDB. First, there is survivorship bias in the data as the IFC selects stocks based on firm size and liquidity, which are probably correlated with the past performance of the companies. Second, there appear to be data errors, such as zero entries for missing observations and some unreasonable figures. We are not worried about the survivorship bias as this study is not seeking to explain the performance of the companies over time. However, we are quite concerned about the data errors as even a few return outlier observations could significantly bias the volatility upward. Since the emerging market is known for high stock price volatility, it is difficult to decide whether the return figures are unreasonable or not based on the convention.

The following describes how we detect dubious return and volume observations. First, since it

[3] We find that the results are not sensitive to the adjustments and, therefore, only report the results based on the

is well documented that stock return volatility is positively related to trading volume, it will be unusual if a large stock price change is not accompanied by a surge in trading volume. Therefore, for those observations that have the absolute returns in the top 0.1% tail of the distributions of all firm-month return observations in a country, they will be flagged if monthly turnover for the stock in that month is not in the top 10% tail of the distributions of all firm-month turnover observations in a country. We then cross check these return outliners with the Datastream. If the return outliers deviate from the figures from Datastream by more than 5% or if data are not available from Datastream, they will be discarded. We also filter the volume outliers in a similar way. In the first step, we screen out those volume outliers that are in the top 0.1% tail of the distributions but the absolute return for the corresponding stock in that month is not in the top 10% of the distributions. We then cross check the volume outliers with the volume figures from Datastream and discard those outliers if the differences are more than 5% or if we cannot get volume data from Datastream for verification. In addition, we also compare the monthly turnover in terms of both number of shares and dollar value, and discard those observations if the difference between two monthly turnover measures is larger than 100%. Altogether we delete 79 extreme return observations and 80 extreme turnover observations, another 108 observations whose turnovers in terms of number of shares and dollar value differ substantially. This represents 267 out of 196,864 observations or 0.13% of the sample.[4]

The sample period is from January 1989 to September 2000. A country will be included in a sample year if it has a sufficient number of stock observations throughout the year. Table 1 provides summary statistics of the sample. There are 33 countries included in various sample years and more than a half of them are included from the beginning of the sample period. A few countries (Egypt, Israel, Morocco, Russia, Saudi Arabia, and Slovakia) are included in the sample after 1996. Except for Portugal, which drops out in 1993, all countries have stock observations until the end of the sample.

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unadjusted data.

[4] Tables containing all the discarded return and volume observations are available on the internet at http://home.ust.hk/~kachan/research/index.html.

The number of stocks in each country ranges from 18 for Morocco to 259 for China. It should be noted that some of the stocks might not be included for some sample years, so that the average number of stocks per year varies. The average monthly U.S. dollar returns range from -1.60% for Egypt and Thailand to 5.33% for Russia.[5] The monthly return volatility ranges from 6.69% for Saudi Arabia to 49.39% for Russia. Except for three countries (Jordan, Morocco and Saudi Arabia), the average monthly volatility of individual stocks exceeds 10%. The average market capitalization ranges from US$17.96 million for Slovakia to US$1,161 million for South Africa. Therefore, some of the emerging market companies are quite large.

Before we classify the stocks into different groups according to their investibility, we first tabulate the frequency distribution of the investible weights of all the stocks in our sample. In Panel A of Table 2, we calculate the percentage of stocks in 10 investible weight categories, with an increment of 10% across each category. There are 196,597 firm-month observations in the sample. The frequency distribution is skewed toward both tails, as about 38% of the observations are completely non-investible (investible weight = 0%) and about 27% are fully investible (investible weight = 100%). Most of the remaining observations have investible weights in the range of 0.1% to 50%, and less than 10% of the total observations have investible weights of between 50.1% and 99.9%. It should be noted that investibility is not necessarily a good indicator of the percentage of foreign ownership. Even though a stock is highly accessible to foreign investors, there are many other factors that determine whether it will be included by foreign institutions in an emerging market portfolio. For this reason, we choose not to have a very fine classification of the stocks based on investibility. We partition the stocks only into three investibility groups: non-investible (weight = 0%), partially investible (weight = 0.1% - 50%), and highly investible (weight = 50.1% - 100%). Although our grouping method seems ad hoc, the coarse classification ensures that there are a reasonable percentage of observations within each investibility group. Furthermore, we try alternative classifications and do not find that the results change

[5] Since the sample period for each country is not the same - for example, Thailand starts in 1989 while Russia starts

substantially.[6]

Based on this classification scheme, Panel B of Table 2 presents the frequency distribution in each investibility group, with a breakdown by country, region, industry, size, and year. It is apparent that the investibility weight varies quite a lot across countries. The stock markets that are highly accessible to foreign investors are Argentina, Malaysia, Poland, South Africa, and Turkey with more than 75% of the stock observations in the highly investible category. The stock markets that are least accessible to foreign investors are Nigeria and Saudi Arabia, as none of their stocks are investible. The stock markets in China, the Czech Republic, Jordan, Slovakia, Sri Lanka, and Zimbabwe are also not very accessible, as close to 80% of their stocks are in the non-investible category. Looking at the region as a whole, Latin America has the lowest percentage of stocks in the zero-investibility group (35%), followed by Asia (41%) and Europe/Middle East/Africa (48%). There is, however, not a pronounced variation in the investibility across industries. The three investibility groups are well represented in each industry.

The frequency distribution of the investibility groups is quite different across the five size quintiles. The size quintiles are country-neutral, as we rank the stocks into quintiles based on their market capitalization relative to the stocks from the same market. This avoids loading too many stocks from the same country into a particular size category. Looking at the frequency distribution in each size quintile, there is a strong and negative relationship between the firm size and the degree of investibility. The percentage of observations in the non-investible group declines monotonically as we move to the larger size quintile, while the percentage of observations in the highly-investible group increases monotonically.

Finally, there is a clear time trend of stock market liberalization during the sample period, as evidenced by the gradual decrease (increase) in the percentage of stocks in the non-(highly) investible

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in 1996 - the average returns are not strictly comparable across countries group over time. In 1989, 68% of the stocks were non-investible and 20% were highly investible, whereas in 2000, 31% were non-investible and 46% were highly investible.

3. Empirical Analysis

A. Regression Analysis

A.1 The relationship between investibility and return volatility

In this section, we investigate if return volatility is related to the investibility of a stock, after controlling for the stock characteristics. We estimate the following times-series and cross-sectional regression:

$$\ln(r_{i,t}^2) = \alpha + \sum_{k=1}^{3} \rho_k INVEST_{k,t} + \sum_{k=1}^{33} \beta_k COUNTRY_{k,t} + \sum_{k=1}^{10} \gamma_k INDUSTRY_{k,t} + \sum_{k=1}^{5} \delta_k SIZE_{i,t} + \sum_{k=1}^{141} \tau_k MONTH_{k,t} + \varepsilon_{i,t}, \quad (1)$$

subject to $\sum_{k=1}^{3} \rho_k = 0,\ \sum_{k=1}^{33} \beta_k = 0,\ \sum_{k=1}^{10} \gamma_k = 0,\ \sum_{k=1}^{5} \delta_k = 0,\ and\ \sum_{k=1}^{141} \tau_k = 0$,

where $r_{i,t}$ is the U.S. dollar return on stock *i* in month *t*, $COUNTRY_{k,t}$, $INDUSTRY_{k,t}$, $SIZE_{k,t}$, and $MONTH_{k,t}$ are dummy variables for country, industry, size quintile, and month, whereas $INVEST_{1,t}$, $INVEST_{2,t}$, and $INVEST_{3,t}$ are dummy variables for the non-investible, partially investible, and highly investible groups. The dummy variables are set to 1 if the observation of the dependent variable belongs to the relevant category, and 0 otherwise. By imposing the restrictions that all within-group dummy variable coefficients sum to zero, we avoid linear dependency among the dummy variables within a group. With such restrictions, the estimate of α reflects the average return volatility of an emerging market security and the dummy variable coefficients measure the deviation of return volatility of a portfolio of stocks in a particular category from a portfolio of all stocks. We stack all the observations

[6] For instance, we sort the stocks also into three investibility groups. While the non-investbile group remains the same, the second group comprises stocks with investible weights of 0.1%~99.9%, and the last group is the fully-investible one, comprising stocks with investible weights of 100%. The major results still hold.

and estimate the regression based on generalized least squares method that corrects for both group-wise heteroskedasticity and serial correlation as well as firm-specific serial correlation.[7]

Table 3 presents parameter estimates of the regression. To examine the robustness of the results, we try three different empirical specifications. The first specification includes all dummy variables except the size and time dummies; the second specification omits the country and industry dummies; and the third specification includes all dummy variables. Overall, there is pervasive evidence that the stock return volatility is positively related to the degree of investibility. For example, in the third empirical specification when we include all dummy variables, the highly investible stocks are more volatile than are the non-investible stocks. The coefficient estimates of $INVEST_{1,t}$, $INVEST_{2,t}$, and $INVEST_{3,t}$ are -0.0803, -0.0555 and 0.1358, respectively, and are significantly different from zero. Tests of the equality of the dummy coefficients ($\rho_1 = \rho_3$ and $\rho_1 = \rho_2 = \rho_3$) are rejected at 0.1% level of significance.[8]

It is noteworthy that the coefficients of the size dummies decrease monotonically from large to small capitalization categories. This indicates that return volatility is negatively related to the firm size and is consistent with the conjecture that small firms are more volatile than large firms. This result is interesting because while the firm size is positively correlated with the degree of investibility, it is negatively correlated with stock return volatility. As a result, even if we cannot disentangle the effect of investibility and firm size completely, we feel confident that the positive association between the degree of investibility and return volatility is not a manifestation of the firm size effect.

We also omit the country dummy variables in equation (1) and estimate the regression on a country-by-country basis. The results are not reported here but can be furnished upon request. There are five countries that do not have firms represented in all three investibility groups so that we cannot obtain

[7] The GLS estimation is a 3-step FGLS procedure. First, we estimate the regression based on OLS and based on the estimated residuals, we compute the first-order autocorrelation for each firm in each country. Second, we estimate the regression based on GLS, taking into account the first-order autocorrelation. Given the estimated residuals from GLS, we estimate the variance for each firm. Third, we run the FGLS to accommodate group-wise heteroskedasticity correction.

[8] We have also estimated the empirical specifications using squared demeaned returns (i.e., subtracting the average returns from the raw returns before taking square). Results are robust.

the estimation results. Out of the remaining 28 countries, 25 have coefficient of $INVEST_{3,t}$ being larger than that of $INVEST_{1,t}$, and 16 have the difference being significant at 5% level. Therefore, the result that there is a positive association between the degree of investibility and return volatility holds in most of the countries.

A.2. The relationship between investibility and return volatility after controlling for turnover and size

Given that stock return volatility is positively related to trading volume, one might wonder whether the results in Table 3 could be explained by turnover activity. In particular, if foreign investors trade more often than domestic residents, such speculative trading activity may cause excessive stock price volatility and this may explain why investible stocks are more volatile than non-investible stocks. In a regression analysis that is not reported here but furnished upon request, we investigate how turnover is related to investibility, using the regression model similar to equation (1). We find that there is a strong association between the degree of investibility and the turnover ratio after controlling for the characteristics of country, industry and size.

To separate the influence of turnover from investibility, we sort the stocks within each country into three groups based on the average turnover of the previous year and then estimate equation (1) for the three turnover groups (low / medium / high) separately. We examine whether the investibility can still explain stock price volatility once turnover is controlled. Table 4 presents the results. It is interesting to note that the coefficient α increases monotonically from low to high turnover groups, suggesting that high turnover stocks are more volatile than low turnover stocks. Furthermore, in all three turnover groups, highly investible stocks are still more volatile than non-investible stocks. For example, in the low turnover group, the coefficients of $INVEST_{1,t}$, $INVEST_{2,t}$, and $INVEST_{3,t}$ are -0.0813, -0.0605, and 0.1418, respectively, and are significantly different from zero. In the medium and high turnover groups, the coefficients of $INVEST_{3,,t}$ are also higher than those of $INVEST_{1,t}$ and $INVEST_{2,t}$.

We also omit the country dummy variables in equation (1) and estimate the regression on a country-by-country basis. We only briefly mention the major findings here and the results are available on request. The percentages of the country that has coefficient of $INVEST_{3,,t}$ being significantly larger than that of $INVEST_{1,t}$ are 78%, 69% and 54% for the low, medium, and high turnover groups. Overall, even after controlling for turnover, there remains a positive relationship between investibility and stock price volatility.

We also perform similar kind of analysis to separate the influence of size from investibility. We first sort the stocks within each country into three groups based on market capitalization of the previous year and then estimate equation (1) for the three size groups. Our results confirm that investibility can still explain stock price volatility after controlling for size effect.

B. The decomposition of returns into the systematic and idiosyncratic factors

The results established so far show that return variability of a stock is positively correlated with its accessibility to foreign investors. One possible reason is that the systematic risk is affected by the investibility (Chari and Henry (2001) . In this section, we decompose the stock return into systematic and idiosyncratic components and examine their relationships with the degree of investibility.

We assume that systematic variations of stock returns are driven by the country, industry, firm size and investibility characteristics. For a particular month *t*, the return on individual stock *i* is assumed to follow a return-generating process as:

$$r_i = \alpha + \sum_{k=1}^{3} \rho_k INVEST_k + \sum_{k=1}^{33} \beta_k COUNTRY_k , + \sum_{k=1}^{10} \gamma_k INDUSTRY_k + \sum_{k=1}^{5} \delta_k SIZE_k + e_i \ , \tag{2}$$

where e_i is the idiosyncratic return with a zero mean and uncorrelated with each other, and the other variables are dummy variables as defined in equation (1).[9] Equation (2) allows us to estimate the "pure" returns to a portfolio of stocks that fall into the same category. Once we estimate the coefficients in the

[9] Heston and Rouwenhorst (1994) have a similar structure for decomposing returns, although they consider only country and industry effects.

regression model (α, ρ_k, β_k, γ_k,δ_k) and given the investibility category, country, and industry and size classification, we can calculate the "expected return" of any stock with particular characteristics.

Equation (2) is similar to equation (1) except in a few ways. First, we use the raw returns, instead of return volatility, as the dependent variable, since we are trying to explain the cross-sectional variation in stock returns. Second, there are no time subscripts and no time dummy variables in equation (2). This equation is purely a cross-sectional regression so that there is no need to have time notation and to control for the time effect.

An alternative approach of estimating the idiosyncratic returns is to use a traditional factor model in which individual stock returns are regressed against returns on the country, industry, investibility, and size portfolios. A limitation of using the traditional factor model is that an individual stock is assumed to have constant beta sensitivities, requiring the stock to remain in the same investibility or size category throughout the entire sample period. The return-generating process in equation (2), on the other hand, does not make such an assumption. In each month, the stock is assigned to the corresponding investibility and size categories, so that its "expected returns" could be calculated based on the stock's characteristics.

It is not possible to estimate equation (2) directly because of perfect multicollinearity between the regressors. Similar to equation (1), we force the sum of the coefficients in each category to be equal to zero. With these constraints, the least squares estimate of α reflects the return on an equally weighted emerging market portfolio. The estimate of $\alpha+\rho_q$ measures the "pure" return on investibility group *q*, a portfolio that loads stocks from investibility group *q* in such a way that it has the same country, industry and size composition as the equally weighted emerging market portfolio.

In estimating equation (2) for every month, we obtain a time series of the idiosyncratic returns for stock *i* ($e_{i,t}$). By regressing $ln(e_{i,t}^2)$ against the investibility dummy variables and other dummy variables as in equation (1), we examine whether the idiosyncratic risk is related to the investibility measure. Results are presented in Table 5. It is interesting to note that unlike the raw return volatility, the idiosyncratic return volatility does not increase with the degree of investibility. For example, in the last empirical specification when we include all dummy variables, the coefficient estimates of $INVEST_{1,t}$, $INVEST_{2,t}$, and $INVEST_{3,t}$ are 0.0662, -0.1022 and 0.0361.[10] Therefore, our results suggest that the reason for highly investible stocks to be more volatile is that they are subject to greater systematic risk. If we examine the idiosyncratic returns alone, its fluctuation is no longer related to investibility.

We could also investigate the effect of investibility on return volatility by comparing ρ_q for the three investibility groups. Panel A of Table 6 presents summary statistics of the parameter estimates in equation (2). The mean estimate of α is 1.156%, indicating a positive average return to the equally weighted emerging market portfolio during the sample period. The pure returns on the three investibility groups (i.e., $\alpha+\rho_q$) are 1.776% for the non-investible portfolio, 0.647% for the partially investible portfolio, and 1.143% for the highly investible portfolio. The evidence that the non-investible portfolio has a higher average return than the non-investible portfolio is consistent with the cost of capital declining with the liberalization. There is also evidence that the portfolio volatility increases with the degree of investibility. The standard deviations are 5.448%, 6.145% and 6.572% for the three portfolios and using the Bartlett test, the null hypothesis of equal variance for the three portfolios is rejected with a *p*-value of 10%. This finding is consistent with the earlier results in Table 3 where we find that the stock return volatility is positively related to the degree of investibility, although the interpretations are slightly different. While Table 3 is based on the volatility of individual stocks, Table 6 examines three investible portfolios. Thus, the evidence that the highly investible portfolio exhibits higher volatility than the non-investible portfolio suggests that investibility affects the systematic risks that cannot be diversified away.

Bekaert and Harvey (1997) argue that after liberalization emerging market volatility could either rise or fall. The most obvious source of increased volatility is that stocks in emerging markets are more subject to world risk factors after liberalization, that is, if betas go up with the world factors, the volatility

[10] It should be noted that although the investibility dummy variables are used as explanatory variables in both equations (1) and (2) – first in explaining stock returns (equation (2)) and then in explaining idiosyncratic return volatility (equation (1)) – there is no guarantee that the investibility will not affect idiosyncratic return volatility. For example, the size dummy variables, which appear in both equations (1) and (2), remain negatively related to the idiosyncratic return volatility.

induced by the world market will also increase. However, one may argue that before liberalization, these stocks are purely exposed to local factors which may well be much more volatile than the world factors. If they become less subject to local market risk after liberalization, then volatility may decrease. Our finding that the non-investible emerging market portfolio offers lower volatility than the highly investible portfolio suggests that the increase in return volatility after liberalization is due to greater exposure to the world risk factors.

Panel B of Table 6 presents correlations among the parameter estimates and the MSCI world market return. There is a positive correlation between the MSCI world market return and the return on the equally weighted emerging market portfolio (α), suggesting that the emerging markets co-vary positively with the world market during the sample period. Instead of examining the correlations of pure returns of the investible portfolios ($\alpha+\rho_q$) with world market returns, we examine the correlations of the pure factor return (ρ_q) with both the emerging market returns (α) and world market returns. In this case, we can also see how stocks of different degree of investibility co-vary with an average emerging market stock portfolio. At first glance, it may seem surprising that the non-investible factor return (ρ_1) is negatively correlated with the equally weighted emerging market return and the MSCI world market return. Recall that ρ_1 measures the return differential between the non-investible portfolio and the equally weighted emerging market portfolio. Suppose non-investible stocks are less integrated with the world market, so that they are less influenced by global market shocks than are the more investible stocks. Non-investible stocks will underperform the average stocks (negative ρ_1) when the global market shocks are positive (positive α), and they will outperform the average stocks (positive ρ_1) when the global market shocks are negative (negative α). Therefore, the negative relationship between ρ_1 and α (or MSCI world market return) supports the conjecture that non-investible stocks are less sensitive to global market shocks. Using similar reasoning, the positive relationship between ρ_3 and α (or MSCI world market return) suggests that highly investible stocks are more sensitive to global market shocks. Overall, the results show that the correlation of emerging markets with the MSCI world market will increase if the stocks become more accessible to foreign investors. As discussed earlier, although previous studies (Bekaert and Harvey (1997, 2000), De Jong and De Roon (2001)) present evidence that the correlation between emerging markets and developed markets increases after stock market liberalizations, the magnitude of the increase seems small. Here we document much stronger evidence that the degree of investibility affects the correlation of emerging market securities with the world market. An interpretation is that stocks that are more accessible to foreign investors become more integrated with the world.

C. A world factor model of conditional variances of investible portfolios

Our analysis in the previous sections shows that highly investible stocks are more volatile, and that investible portfolios are more volatile and more correlated with the world market. In this section, we link these results together and provide indirect evidence that the increased volatility of investible stocks is due to their exposure to world market factor. We apply the world factor model of Bekaert and Harvey (1997) on the three investibility groups constructed from equation (2). Let $r_{q,t}$ denote the excess return on investible portfolio *q*, that is, $r_{q,t} = \alpha_t + \rho_{q,t} - r_{f,t}$, where $r_{f,t}$ is the 1-month Treasury bill rate. The world factor model has the following general form:

$$r_{q,t} = \delta_q ' \mathbf{X}_{t-1} + \varepsilon_{q,t} , \tag{3}$$

$$\varepsilon_{q,t} = \nu_q \varepsilon_{w,t} + e_{q,t} , \tag{4}$$

$$\left(\sigma^l_{q,t}\right)^2 = E\left[e^2_{q,t} \middle| \mathbf{I}_{t-1}\right] = a_q + b_q \left(\sigma^l_{q,t-1}\right)^2 + c_q e^2_{q,t-1} , \tag{5}$$

$$e_{q,t} = \sigma^l_{q,t} z_{q,t} , \tag{6}$$

$$z_{q,t} \mid \mathbf{I}_{t-1} \sim N(0,1) ,$$

where $\mathbf{I}_{t-1}$ is the information available at time t-1, and $\mathbf{X}_{t-1}$ represents a set of information variables, including a constant, the lagged excess return on portfolio q, the world market dividend yield in excess of the 30-day Eurodollar rate, the default spread (Moody's Baa minus Aaa bond yields), the change in the term structure spread (U.S. 10-year bond yield minus 3-month T-bill yield), and the change in the 30-day Eurodollar rate. The above model is a simplified version of the one in Bekaert and Harvey (1997). The unexpected portion of portfolio q's return, $\varepsilon_{q,t}$, is driven in part by world shocks, $\varepsilon_{w,t}$, as well as an idiosyncratic shock, $e_{q,t}$. The dependence of local shock on the world factor is determined by v_q which is assumed to be time-invariant.[11] The local idiosyncratic standard deviation is $\sigma^{l}_{i,t}$ and $z_{i,t}$ is a standardized residual with zero mean and unit variance.

The model is estimated based on a two-stage procedure. In the first stage, we estimate the model in (3)-(6) for the MSCI world market index, with v_q equal to zero and without the lagged excess portfolio return in $\mathbf{X}_{t-1}$. In the second stage, we estimate the model based on individual portfolio returns, conditioning on the world market model estimates. In the empirical exercise, we focus not only on the factor loading parameter v_q but also on two statistics implied by the model. The first one is the correlation of the investible portfolio return with the world market return, as given by

$$Corr_{q,t} = v_q \sigma_{w,t} / \sigma_{q,t} . \tag{7}$$

The other statistic that we are interested is the proportion of variance accounted for by the world factors, that is,

$$VR_{q,t} = v_q^2 \sigma^2_{w,t} / \sigma^2_{q,t} . \tag{8}$$

[11] Bekaert and Harvey (1997) allow the factor loading to change over time as a function of some local variables that contain information regarding the degree of market integration with the world market. Unfortunately, we do not have such local information variables regarding the investible portfolios and thus assume v_q to be constant.

Results are reported in Table 7. The factor loading parameter v_q is significantly positive for all investible portfolios, being the highest for the highly investible portfolio and the lowest for the non-investible portfolio. Based on the full-sample period, the estimates of v_q are 0.499, 0.634 and 0.750 for the three investible portfolios. To investigate how the behaviors of the investible portfolios change over time, we divide the sample into two sub-periods, with the first sub-period from January 1989 to December 1994 and the second from January 1995 to September 2000, and re-estimate the world factor model over the two sub-samples. For all three investible portfolios, the parameter v_q increases dramatically from the first to the second sub-period. For example, the v_q estimate increases from 0.228 in the first sub-period to 0.744 in the second sub-sample for the non-investible portfolio. This is consistent with the conjecture that emerging markets have become more integrated with the world. Notice also that there are still noticeable differences of world market influence among the three investible portfolios during both sub-sample periods.

Table 7 also presents the average conditional correlation with the world market ($\overline{Corr}_{q,t}$) and the mean proportion of variance due to world factors ($\overline{VR}_{q,t}$), over the entire sample and for the two sub-periods. Throughout the sample period, the highly investible portfolio has higher variance ratio and correlation measure than the non-investible portfolio. The average correlations for the non-investible and highly investible portfolios are 0.403 and 0.523, respectively, while the average variance ratios for the two portfolios are 16.5% and 28.1%. As a result of the increased impact of the world factor on the investible portfolios, both the correlation measures and the variance ratios are much higher in the second sub-period.[12] For example, the average correlation for the highly investible portfolio increases from 0.471 to 0.654 between the two sub-periods while the average variance ratio increases from 22.4% to

[12] Our first half sample is similar to the sample in Bekaert and Harvey (1997) who find that only 3 out of 19 emerging markets have the average variance proportion of greater than 10% and there are 5 countries with average correlations larger than 20%.

43.7%. Therefore, the results confirm that highly investible stocks are subject to larger world market risk.

D. Robustness Checks

D.1 Sample Selection Problem

A problem with the EMDB data is that some of the stocks with a zero value in the "degree open factor" might in fact be accessible to foreigners. For stocks to be included in the investible series, not only must they be legally held by foreigners, but also they have to meet the size/liquidity screening criteria. The size criterion requires a stock to have a minimum investible market capitalization of $50 million or more over the 12 months prior to the addition of the stock to the investible index. The investible market capitalization is determined after applying the foreign investment rules and after any adjustments due to cross-holdings or government ownership. The size criteria require that the stock must have at least $20 million in trades over the prior year, and it must be traded on at least half the local exchange's trading days. Therefore, even when a stock can be legally held by foreigners, it will still be classified as non-investible according to the EMDB if it fails either the size or liquidity criterion.

Some might argue that given these stocks are small or illiquid, they may in fact fail to generate interest from foreign investors. Therefore, it is not a bad assumption to treat these stocks as non-investible. However, we note that there are some stocks that are definitely traded by foreign investors (e.g., B-shares in China) but yet classified as non-investible because of low liquidity. To examine the robustness of the results, we screen out those stocks that are potentially misclassified as non-investible. Stocks with a value of zero for the "degree open factor" will be discarded from the sample if their investible market capitalization or liquidity over the last 12 months fails to satisfy the investibility criteria specified by the EMDB. We then re-estimate regression equation (1) using the sub-sample. We do not report the results here, but in general they are qualitatively similar to the previous results that stock return volatility is positively related to the degree of investibility.

D.2 Regional analysis

To check whether our results are robust to different regions, we partition the stocks into three regions: Asia, Latin America, and Europe/Middle East/Africa. We modify regression equation (1) by allowing each region to have its own investibility dummy variables. To conserve space, results are not reported but available upon request. The impact of the investibility factor on stock return volatility is most pronounced for Asia, while the results for Latin America and Europe/Middle East/Africa are weaker. But overall, there is evidence that return volatility of highly investible stocks is higher.

We also perform a return decomposition (Equation (2)) for the three regions separately and obtain a time series of the parameter estimates of ρ_1, ρ_2, and ρ_3 for each region. Results, which are not reported here, are generally robust. In all three regions, the highly investible portfolio (ρ_3) has higher volatility and is also more correlated with the world market than is the non-investible portfolio.

4. Conclusion

This paper employs a cross-sectional approach to study the impact of foreign investors on emerging market securities by examining the relationship between a stock's investibility and its return volatility. Unlike most previous studies that examine changes in emerging market volatility subsequent to stock market liberalizations, we do not have to identify the liberalization dates. Given that stock market liberalization is not a one-time event but a gradual process, it is somewhat arbitrary to pinpoint the date after which foreign investors enter the markets.

Results show that stock return volatility is positively related to the degree of investibility of individual stocks even after controlling for the country, industry, firm size, and turnover factors. Investible stocks are more volatile because of the increased exposure to world market risk. We show that the highly investible portfolio is subject to larger world market exposure than the non-investible portfolio. As a result, the percentage of the variance attributed to world market risk is higher for the investible stocks than for the non-investible stocks. Overall, this paper documents solid evidence on the impact of market integration on emerging market volatility. We also show that stock investibility is a good measure of the degree of integration with the world market.

To summarize, this paper documents interesting results that the degree of stock investibility affects return variability of emerging market securities. Also, emerging market stocks are more subject to global influences when they become more accessible to foreign investors. Future empirical tests of market integration of emerging and developed markets should take into account the investibility of stocks.

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Table 1
Summary statistics of emerging stock markets

The data are from Standard and Poor's Emerging Markets Database, with sample period up to September 2000 (except for Portugal whose sample ends in March 1993). For each country, the table presents the number of firms in the sample, the starting dates for the return data, the monthly U.S. dollar return, and the monthly volatility of the sample firms. The monthly return and volatility are the cross sectional averages of the mean returns and standard deviations over all the sample firms within the country. The last three columns report the time series averages of the median firm size, monthly turnover, and trading days of the sample firms in each country. The medians are computed by month across firms. Size is measured as the market value of equity in millions of U.S. dollars. Turnover is the number of shares traded in a month computed as a percentage of the number of shares outstanding at the beginning of the month. Trading days denote the number of days that stocks are traded in a month.

Country	No. of firms	Start date	Monthly return	Monthly volatility	Size	Turnover	Trading days
Argentina	47	198901	2.61	25.50	185.88	2.77	20
Brazil	141	198901	2.82	23.98	305.74	1.72	20
Chile	60	198901	0.73	12.14	369.38	0.46	19
China	259	199301	1.91	18.32	194.30	9.26	20
Colombia	38	198901	-0.16	13.69	194.71	0.43	16
Czech Republic	76	199402	-1.37	15.95	59.01	0.25	17
Egypt	77	199602	-1.60	12.12	82.18	1.47	20
Greece	83	198901	1.10	15.76	164.01	2.95	20
Hungary	24	199301	1.46	17.30	147.48	5.35	17
India	178	198901	0.52	16.60	204.64	1.67	18
Indonesia	129	199001	0.12	22.09	173.70	2.68	17
Israel	52	199702	1.89	10.57	405.53	2.19	20
Jordan	70	198901	-0.86	8.24	21.13	1.53	17
Korea	224	198901	0.44	22.40	307.56	12.47	24
Malaysia	195	198901	0.62	22.18	427.87	2.07	20
Mexico	143	198901	0.80	14.62	434.32	1.94	18
Morocco	18	199602	0.35	7.45	453.95	0.71	18
Nigeria	41	198901	0.73	16.35	40.95	0.10	17
Pakistan	121	198901	-0.15	13.79	32.69	0.73	16
Peru	50	199301	0.14	15.45	54.07	4.38	19
Philippines	83	198901	-0.28	22.04	173.40	1.61	20
Poland	41	199301	0.98	17.74	129.81	6.26	19
Portugal	52	198901	0.76	10.26	282.28	1.95	19
Russia	42	199602	5.32	49.39	349.38	0.60	11
Saudi Arabia	21	199801	0.01	6.69	791.11	2.97	24
Slovakia	20	199602	-1.07	20.68	17.96	0.28	6
South Africa	95	199301	0.69	14.16	1161.17	1.44	20
Sri Lanka	63	199301	-0.70	13.30	19.87	0.66	17
Taiwan	131	198901	0.13	15.19	634.59	24.12	23
Thailand	121	198901	-1.60	23.28	309.20	3.29	20
Turkey	72	198901	2.60	24.54	185.30	5.81	21
Venezuela	27	198901	0.82	20.76	142.96	0.93	18
Zimbabwe	35	198901	0.70	20.52	30.08	0.35	11
Average	86		0.62	17.67	257.16	3.19	18

Table 2
Frequency distribution of investible weights

The sample is from Standard and Poor's Emerging Markets Database. The database provides information regarding the investibility of a stock. It includes a variable called the "degree open factor" that indicates the amount of the stock that foreigners may legally own. The degree open factor or 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. Panel A presents the distribution of firm-month observations by different groups of investible weights. Panel B presents the distribution of different investible groups of stocks by country, region, industry, size, and year. At the end of each year, each stock is assigned to one of the three investible groups: 1) non-investible stock where investible weight equals zero; 2) partially investible stock where investible weight is between zero and 0.50; and 3) highly investible stock where investible weight is above 0.50. The frequency distribution of the three investibility groups is computed for each year and the numbers shown in Panel B are the averages of these numbers.

Panel A:

Category	No. of firm-month observations	Percentage
0.00 = investible weight	74,798	38.05
0.00 < investible weight ≤ 0.10	9,126	4.64
0.10 < investible weight ≤ 0.20	8,265	4.20
0.20 < investible weight ≤ 0.30	18,676	9.50
0.30 < investible weight ≤ 0.40	4,686	2.38
0.40 < investible weight ≤ 0.50	12,249	6.23
0.50 < investible weight ≤ 0.60	1,730	0.88
0.60 < investible weight ≤ 0.70	2,049	1.04
0.70 < investible weight ≤ 0.80	2,283	1.16
0.80 < investible weight ≤ 0.90	2,925	1.49
0.90 < investible weight < 1.00	6,554	3.33
investible weight = 1.00	53,256	27.09
Total	196,597	100.00

Panel B:	Non-investible	Partially investible	Highly investible
	Investible weight = 0.0	Investible 0.0 < weight ≤ 0.5	Investible 0.5 < weight ≤ 1.0
By country			
Argentina	24.14	0.46	75.40
Brazil	31.56	20.82	47.61
Chile	33.57	34.33	32.10
China	79.22	1.79	18.99
Colombia	59.30	2.53	38.16
Czech Republic	81.89	7.88	10.23
Egypt	59.49	10.42	30.09
Greece	24.09	5.07	70.84
Hungary	37.12	0.69	62.18
India	52.41	47.59	0.00
Indonesia	30.96	45.57	23.48
Israel	4.51	33.37	62.11
Jordan	82.26	16.23	1.51
Korea	28.55	49.88	21.58
Malaysia	5.29	10.37	84.35
Mexico	27.25	2.68	70.07

Morocco	49.28	2.22	48.50
Nigeria	100.00	0.00	0.00
Pakistan	77.72	1.72	20.56
Peru	46.99	2.65	50.36
Philippines	51.38	27.38	21.24
Poland	2.60	5.90	91.50
Portugal	23.90	15.39	60.71
Russia	61.07	6.20	32.73
Saudi Arabia	100.00	0.00	0.00
Slovakia	77.59	4.48	17.92
South Africa	1.93	14.04	84.03
Sri Lanka	84.15	2.51	13.34
Taiwan	17.46	81.86	0.68
Thailand	14.46	83.77	1.77
Turkey	10.01	7.25	82.73
Venezuela	48.18	0.00	51.82
Zimbabwe	84.60	15.40	0.00
By region			
Asia	41.41	37.17	21.42
Latin	35.00	11.84	53.16
Europe/Middle East/Africa	47.79	8.52	43.69
By industry			
Agriculture, forestry, & fishing	46.85	18.88	34.26
Mining	39.60	20.70	39.70
Construction	46.57	23.56	29.87
Manufacturing	45.53	26.29	28.18
Transportation & pub. utilities	34.85	31.86	33.29
Wholesale trade	45.47	17.47	37.06
Retail trade	37.49	33.18	29.33
Finance, insurance, & real estate	37.37	25.20	37.43
Services	39.68	27.02	33.30
Public administration	22.79	10.32	66.89
By size			
Small	60.98	14.21	24.81
2	48.01	20.21	31.77
3	40.53	25.49	33.98
4	34.49	29.24	36.27
Large	25.05	37.08	37.87
By year			
1989	68.40	11.50	20.09
1990	68.64	10.63	20.73
1991	55.20	19.24	25.57
1992	39.25	35.49	25.26
1993	38.70	32.71	28.58
1994	35.64	32.28	32.08
1995	31.04	33.25	35.71

1996	35.05	32.00	32.95
1997	31.03	30.20	38.77
1998	34.45	21.35	44.20
1999	32.43	21.85	45.72
2000	30.91	22.83	46.26

Table 3
Pooled regression of monthly return volatility on investibility, country, industry, size, and time dummy variables

We estimate the following time-series and cross-sectional regression model:

$$\ln(r_{i,t}^2) = \alpha + \sum_{k=1}^{3} \rho_k INVEST_{k,t} + \sum_{k=1}^{33} \beta_k COUNTRY_{k,t} + \sum_{k=1}^{10} \gamma_k INDUSTRY_{k,t} + \sum_{k=1}^{5} \delta_k SIZE_{i,t} + \sum_{k=1}^{141} \tau_k MONTH_{k,t} + \varepsilon_{i,t}, \quad (1)$$

$$\sum_{k=1}^{3} \rho_k = 0,\ \sum_{k=1}^{33} \beta_k = 0,\ \sum_{k=1}^{10} \gamma_k = 0,\ \sum_{k=1}^{5} \delta_k = 0,\ and\ \sum_{k=1}^{141} \tau_k = 0.$$

The dependent variable, $ln(r_{i,t}^2)$, is the log of monthly U.S. dollar returns squared of stock *i* at time *t*. $INVEST_{1,t}$, $INVEST_{2,t}$, and $INVEST_{3,t}$ are dummy variables that take the value of one if the investible weight of stock *i* at time *t* is zero, between zero and 0.50, and above 0.50, respectively, and zero otherwise. $COUNTRY_{k,t}$, $INDUSTRY_{k,t}$, and $SIZE_{k,t}$ take the value of one if stock *i* at time *t* is from country *k*, industry *k*, and size group *k*, respectively, and zero otherwise. $MONTH_{k,t}$ is a time dummy that takes the value of one if time *t* equals *k* and zero otherwise.

Independent variables	(1)		(2)		(3)	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
Intercept	3.6216	233.32	3.7754	533.73	3.5503	222.79
Investibility dummy						
0.0 = Investible weight	-0.0645	-5.92	-0.2116	-22.09	-0.0803	-6.82
0.0 < Investible weight ≤ 0.5	-0.1248	-10.25	0.0807	8.53	-0.0555	-4.59
0.5 < Investible weight ≤ 1.0	0.1892	16.40	0.1309	14.85	0.1358	12.01
Size dummy						
Small			0.2104	15.77	0.1840	13.89
2			0.0958	7.76	0.0832	6.89
3			-0.0197	-1.62	-0.0299	-2.51
4			-0.0980	-8.05	-0.0794	-6.68
Large			-0.1885	-15.32	-0.1579	-12.76
Country dummy	Yes		No		Yes	
Industry dummy	Yes		No		Yes	
Time dummy	No		Yes		Yes	
F-test for $\rho_1 = \rho_3$	181.00	0.00	470.57	0.00	120.70	0.00
F-test for $\rho_1 = \rho_2 = \rho_3$	134.95	0.00	256.54	0.00	73.35	0.00
Adjusted R^2	0.0692		0.0790		0.0981	

Table 4
Pooled regression of monthly return volatility on investibility, country, industry, size, and time dummy variables for three different turnover groups

This table presents the estimation results for the following time-series and cross-sectional regression model for three different turnover groups.

$$\ln(r_{i,t}^2) = \alpha + \sum_{k=1}^{3} \rho_k INVEST_{k,t} + \sum_{k=1}^{33} \beta_k COUNTRY_{k,t} + \sum_{k=1}^{10} \gamma_k INDUSTRY_{k,t} + \sum_{k=1}^{5} \delta_k SIZE_{i,t} + \sum_{k=1}^{141} \tau_k MONTH_{k,t} + \varepsilon_{i,t}, \quad (1)$$

$$\sum_{k=1}^{3} \rho_k = 0, \sum_{k=1}^{33} \beta_k = 0, \sum_{k=1}^{10} \gamma_k = 0, \sum_{k=1}^{5} \delta_k = 0, \textit{ and } \sum_{k=1}^{141} \tau_k = 0.$$

The dependent variable, $ln(r_{i,t}^2)$, is the log of monthly U.S. dollar return squared of stock *i* at time *t*. $INVEST_{1,t}$, $INVEST_{2,t}$, and $INVEST_{3,t}$ are dummy variables that take the value of one if the investible weight of stock *i* at time *t* is zero, between zero and 0.50, and above 0.50, respectively, and zero otherwise. $COUNTRY_{k,t}$, $INDUSTRY_{k,t}$, and $SIZE_{k,t}$ take the value of one if stock *i* at time *t* is from country *k*, industry *k*, and size group *k*, respectively, and zero otherwise. $MONTH_k$ is a time dummy that takes the value of one if time *t* equals *k* and zero otherwise.

Independent variables	Low turnover		Medium turnover		High turnover	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
Intercept	3.2751	72.71	3.5457	140.43	3.7538	157.06
Investibility dummy						
0.0 = Investible weight	-0.0813	-4.05	-0.0280	-1.42	-0.0059	-0.29
0.0 < Investible weight ≤ 0.5	-0.0605	-2.98	-0.0822	-4.20	-0.0849	-4.12
0.5 < Investible weight ≤ 1.0	0.1418	7.08	0.1102	6.02	0.0908	4.63
Size dummy						
Small	0.1339	5.36	0.1818	8.21	0.1151	5.70
2	0.0445	1.94	0.0421	2.19	0.0678	3.71
3	-0.0603	-2.86	-0.0193	-1.05	-0.0174	-0.89
4	-0.0739	-3.70	-0.0637	-3.42	-0.0374	-1.81
Large	-0.0442	-2.17	-0.1409	-7.20	-0.1281	-5.40
Country dummy	Yes		No		Yes	
Industry dummy	Yes		No		Yes	
Time dummy	No		Yes		Yes	
F-test for $\rho_1 = \rho_3$	41.62	0.00	17.91	0.00	8.05	0.00
F-test for $\rho_1 = \rho_2 = \rho_3$	25.29	0.00	19.46	0.00	12.95	0.00
Adjusted R^2	0.106		0.113		0.118	

Table 5
Pooled regression of monthly residual return volatility on investibility, country, industry, size, and time dummy variables

We estimate the following time-series and cross-sectional regression model:

$$\ln(e_{i,t}^2) = \alpha + \sum_{k=1}^{3} \rho_k INVEST_{k,t} + \sum_{k=1}^{33} \beta_k COUNTRY_{k,t} + \sum_{k=1}^{10} \gamma_k INDUSTRY_{k,t} + \sum_{k=1}^{5} \delta_k SIZE_{i,t} + \sum_{k=1}^{141} \tau_k MONTH_{k,t} + \varepsilon_{i,t},$$

$$\sum_{k=1}^{3} \rho_k = 0, \sum_{k=1}^{33} \beta_k = 0, \sum_{k=1}^{10} \gamma_k = 0, \sum_{k=1}^{5} \delta_k = 0, \textit{ and } \sum_{k=1}^{141} \tau_k = 0.$$

The dependent variable, $ln(e_{i,t}^2)$, is the log of monthly U.S. dollar residual returns squared of stock *i* at time *t* where residual returns are obtained from the cross-sectional regression equation (2). $INVEST_{1,t}$, $INVEST_{2,t}$, and $INVEST_{3,t}$ are dummy variables that take the value of one if the investible weight of stock *i* at time *t* is zero, between zero and 0.50, and above 0.50, respectively, and zero otherwise. $COUNTRY_{k,t}$, $INDUSTRY_{k,t}$, and $SIZE_{k,t}$ take the value of one if stock *i* at time *t* is from country *k*, industry *k*, and size group *k*, respectively, and zero otherwise. $MONTH_{k,t}$ is a time dummy that takes the value of one if time *t* equals *k* and zero otherwise.

Independent variables	(1)		(2)		(3)	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
Intercept	-5.9112	-392.13	-5.9599	-782.83	-5.9964	-375.27
Investibility dummy						
0.0 = Investible weight	0.0742	7.88	-0.0031	-0.38	0.0662	6.49
0.0 < Investible weight ≤ 0.5	-0.1650	-15.23	-0.0503	-5.93	-0.1022	-9.46
0.5 < Investible weight ≤ 1.0	0.0908	8.98	0.0533	6.81	0.0361	3.60
Size dummy						
Small			0.2088	18.30	0.1923	16.91
2			0.0563	5.19	0.0456	4.30
3			-0.0282	-2.63	-0.0313	-2.99
4			-0.0837	-7.83	-0.0763	-7.29
Large			-0.1532	-13.79	-0.1304	-11.66
Country dummy	Yes		No		Yes	
Industry dummy	Yes		No		Yes	
Time dummy	No		Yes		Yes	
F-test for $\rho_1 = \rho_3$	1.05	0.31	17.31	0.00	3.10	0.08
F-test for $\rho_1 = \rho_2 = \rho_3$	115.99	0.00	27.39	0.00	46.00	0.00
Adjusted R^2	0.138		0.144		0.155	

Table 6
Summary statistics of cross-sectional regression estimates

This table presents the summary statistics of cross-sectional regression estimates to compute the investible factors net of country, industry, and size effects. The model is given by

$$r_i = \alpha + \sum_{k=1}^{3} \rho_k INVEST_k + \sum_{k=1}^{33} \beta_k COUNTRY_k + \sum_{k=1}^{10} \gamma_k INDUSTRY_k + \sum_{k=1}^{5} \delta_k SIZE_i + e_i. \quad (2)$$

The dependent variable is the monthly U.S. dollar return of stock *i*. $INVEST_1$, $INVEST_2$, and $INVEST_3$ are dummy variables that take the value of one if the investible weight of stock *i* at time *t* is zero, between zero and 0.50, and is above 0.50, respectively, and zero otherwise. $COUNTRY_k$, $INDUSTRY_k$, and $SIZE_k$ take the value of one if stock *i* at time *t* is from country *k*, industry *k*, and size group *k*, respectively, and zero otherwise. For each month *t*, the regression model is estimated, resulting in time-series estimates of α's (equal-weighted emerging market return) and ρ_k's (investible factors). World beta is the slope coefficient of the regression on MSCI world market index return. Numbers in parenthesis are *p*-values.

Panel A: Summary statistics	Mean	Std. Dev.	Median	Min.	Max.	World beta
MSCI world market index return	0.946	4.063	1.222	-13.321	11.317	1.000
IFCI composite return	1.047	6.642	1.322	-28.113	18.255	0.933
Equal-weighted emerging market return (α)	1.156	5.673	0.935	-19.448	18.881	0.614
Non-investible portoflio return ($\alpha+\rho_1$)	1.776	5.448	1.566	-16.676	23.723	0.558
Partially investible portfolio return ($\alpha+\rho_2$)	0.647	6.145	0.363	-20.748	18.419	0.621
Fully investible portfolio return ($\alpha+\rho_3$)	1.143	6.572	0.787	-20.514	18.915	0.709
P-value for equality test for ($\alpha+\rho_1$) = ($\alpha+\rho_2$) = ($\alpha+\rho_3$)	0.295	0.085				

Panel B: Correlation	MSCI	IFCI	(α)	(ρ_1)	(ρ_2)	(ρ_3)
MSCI world market index return	1.000					
IFCI composite return	0.571	1.000				
	(0.00)					
Equal-weighted emerging market return (α)	0.440	0.837	1.000			
	(0.00)	(0.00)				
Non-investible factor return (ρ_1)	-0.124	-0.357	-0.281	1.000		
	(0.14)	(0.00)	(0.00)			
Partially investible factor return (ρ_2)	0.016	0.141	0.089	-0.448	1.000	
	(0.84)	(0.09)	(0.29)	(0.00)		
Fully investible factor return (ρ_3)	0.169	0.383	0.228	-0.676	0.056	1.000
	(0.04)	(0.00)	(0.01)	(0.00)	(0.51)	

Table 7
World factor model

This table presents the estimation results of the world factor model in Bekaert and Harvey (1997) for the three investibility groups. We estimate the following model:

$$r_{q,t} = \delta_q'\mathbf{X}_{t-1} + \varepsilon_{q,t}, \qquad \varepsilon_{q,t} = \nu_q \varepsilon_{w,t} + e_{q,t},$$
$$\left(\sigma^l_{q,t}\right)^2 = E\left[e^2_{q,t} \middle| \mathbf{I}_{t-1}\right] = a_q + b_q \left(\sigma^l_{q,t-1}\right)^2 + c_q e^2_{q,t-1}, \qquad e_{q,t} = \sigma^l_{q,t} z_{q,t}, \qquad z_{q,t} \mid I_{t-1} \sim N(0,1),$$

where I_{i-1} is the information available at time t-1. The unexpected portion of investibility group q's return $\varepsilon_{q,t}$ is assumed to be driven by world shocks ($\varepsilon_{w,t}$) and an idiosyncratic shock ($e_{q,t}$), and its dependence on world shocks is determined by v_q. The local idiosyncratic standard deviation is $\sigma^l_{q,t}$ and $z_{q,t}$ is a standardized residual with zero mean and unit variance. $\mathbf{X}_{t-1}$ represents a set of world information variables, including a constant, the lagged excess return on portfolio *q*, the world market dividend yield in excess of the 30-day Eurodollar rate, the default spread (Moody's Baa minus Aaa bond yields), the change in the term structure spread (U.S. 10-year bond yield minus 3-month T-bill yield), and the change in the 30-day Eurodollar rate. The world market correlation in the model is given by

$$Corr_{q,t} = v_q \sigma_{w,t} / \sigma_{q,t}.$$

The proportion of variance accounted for by the world factors is

$$VR_{q,t} = v_q^2 \sigma^2_{w,t} / \sigma^2_{q,t}.$$

Mean values of these implied statistics are reported, with standard deviations in brackets. Figures inside the parenthesis are White (1982) standard errors.

	Parameter Estimate	Implied Statistics	
	v_q	Correlation ($\overline{Corr_q}$)	Variance ratio ($\overline{VR_q}$)
Full sample: 02/1989 to 09/2000			
Non-investible portfolio	0.499	0.403	0.165
	(0.106)	[0.052]	[0.039]
Partially investible portfolio	0.634	0.468	0.223
	(0.119)	[0.062]	[0.056]
Highly investible portfolio	0.750	0.523	0.281
	(0.103)	[0.084]	[0.085]
Subsample: 02/1989 to 12/1994			
Non-investible portfolio	0.228	0.227	0.059
	(0.197)	[0.084]	[0.060]
Partially investible portfolio	0.424	0.375	0.142
	(0.196)	[0.038]	[0.030]
Highly investible portfolio	0.608	0.471	0.224
	(0.194)	[0.043]	[0.041]
Subsample: 01/1995 to 09/2000			
Non-investible portfolio	0.744	0.562	0.330
	(0.177)	[0.117]	[0.120]
Partially investible portfolio	0.873	0.624	0.398
	(0.156)	[0.099]	[0.115]
Highly investible portfolio	1.034	0.654	0.437
	(0.184)	[0.097]	[0.123]