THE WILLIAM DAVIDSON INSTITUTE
AT THE UNIVERSITY OF MICHIGAN BUSINESS SCHOOL

Foreign Speculators and Emerging Equity Markets

by Geert Bekaert and Campbell R. Harvey

Working Paper Number 79
August 1997

The Davidson Institute Working Paper Series

The Davidson Institute
701 Tappan Street
Ann Arbor, MI 48109-1234 USA
Tel. (734) 763-5020
Fax (734) 763-5850
wdi@umich.edu
http://www.wdi.bus.umich.edu

This paper is based on research that was partially supported by the William Davidson Institute.

THE WILLIAM DAVIDSON INSTITUTE
AT THE UNIVERSITY OF MICHIGAN BUSINESS SCHOOL

Foreign Speculators and Emerging Equity Markets

by Geert Bekaert and Campbell R. Harvey

Working Paper Number 79
August 1997

Comments Welcome

This paper is based on research that was partially supported by the William Davidson Institute.

Current Version: August 19, 1997

Foreign Speculators and Emerging Equity Markets*

Geert Bekaert
Stanford University, Stanford, CA 94305
National Bureau of Economic Research, Cambridge, MA 02138

Campbell R. Harvey
Duke University, Durham, NC 27708 USA
National Bureau of Economic Research, Cambridge, MA 02138

A number of countries have delayed the opening of their capital markets to international investment because of reservations about the impact of foreign speculators on both expected returns and market volatility. We propose a cross-sectional time-series model that attempts to assess the impact of market liberalizations, in the form of the offering of depositary receipts, country funds and other financial instruments, in an extranational market, on the cost of capital and market volatility in emerging equity markets. We also examine the impact of capital market liberalizations on the correlation of emerging equity market returns and the world market return. Our empirical approach is designed to control for other economic events which might confound the impact of foreign speculators on local equity markets. Whatever the empirical specification, the cost of capital always decreases after a capital market liberalization but the effect is economically and statistically weak. The effects on volatility and correlation are less robust.

* This research was partially supported by the Davidson Institute at the University of Michigan. Bekaert acknowledges the support of the Financial Research Initiative at Stanford University and a grant from the National Science Foundation. We have benefited from the comments of Stijn Claessens, Giorgio DeSantis and of seminar participants at 1997 Conference on International Financial Markets at Georgia Tech, the International Monetary Fund, the Stockholm School of Economics, the Swedish School of Economics, Tilburg University, the 1997 Western Finance Association meetings in San Diego and the 1997 French Finance Association meetings in Grenoble. We appreciate the research assistance of Rob Feldman, Fan Hu, Angela Ng and Han Hong. We are grateful to Darius Miller for providing the ADR announcement dates. E-mail: bekaert_geert@gsb.stanford.edu and charvey@mail.duke.edu.

Current Version: July 18, 1997

Foreign Speculators and Emerging Equity Markets

A number of countries have delayed the opening of their capital markets to international investment because of reservations about the impact of foreign speculators on both expected returns and market volatility. We propose a cross-sectional time-series model that attempts to assess the impact of market liberalizations, in the form of the offering of depositary receipts, country funds and other financial instruments, in an extranational market, on the cost of capital and market volatility in emerging equity markets. We also examine the impact of capital market liberalizations on the correlation of emerging equity market returns and the world market return. Our empirical approach is designed to control for other economic events which might confound the impact of foreign speculators on local equity markets. Whatever the empirical specification, the cost of capital always decreases after a capital market liberalization but the effect is economically and statistically weak. The effects on volatility and correlation are less robust.

1. Introduction

Throughout history and in many market economies, the speculator has been characterized as both a villain and a savior. Indeed, the reputation of the speculator generally depends on the country where he does business. In well-functioning advanced capital markets, such as the United States, the speculator is viewed as an integral part of the free-market system. In developing capital markets, the speculator, and in particular the international speculator, is looked upon with many reservations.

Indeed, reservations about the influence of foreign speculators in the market place have contributed to the reluctance of many developing countries to open their capital markets to foreigners. The goal of this paper is to examine the impact of increased foreign speculative activity in developing equity markets on local market volatility and expected equity returns - the cost of equity capital.

This analysis comes at an opportune time. Recently many so-called "emerging" markets have opened up their capital markets to foreign investors. Nevertheless, many important countries, including Brazil, Chile, Taiwan and Korea, are still reluctant to complete the capital liberalization process. The policy debate typically centers around a fear for excess volatility induced by foreign investors and a questioning of the economic benefits capital market integration may bring. Our analysis potentially constitutes an important input to this debate.

Although there is a growing body of related literature, which we will discuss below, our analysis is different in two respects. First we emphasize the *gradual* nature of the capital market integration process. This has implications for our identification of the event "increased foreign speculative activity," which we measure with three different indicators: the gradual introduction of American Depositary Receipts (ADRs) and country funds, the actual lifting of investment restrictions and the extent of U.S. capital flows into the emerging equity market. It also has implications for our empirical techniques, which differ greatly from previous work. Second, our empirical analysis pools time-series and cross-sectional information to measure the economic impact of increased foreign speculative activity on the cost of capital and volatility, controlling for other factors that may also affect these variables.

Finally, we also examine the effects of increased foreign speculative activity and

market integration on the correlation between emerging markets and the world market. Recent evidence from country funds investing in emerging markets but priced in the U.S. (Bailey and Lim (1996), and Bekaert and Urias (1996)) suggests that correlations may increase. We provide the first evidence of whether emerging market correlations with the world market increase after liberalizations.

The outline of our paper is as follows. In the second section, we briefly survey the literature on the impact of speculative activity on price volatility and welfare, focusing more specifically on the role of foreign speculators in emerging markets. The third section details how we measure conditional market volatility, conditional correlations and the cost of capital. The fourth section sets out the empirical framework, the fifth part reports the empirical results; in the sixth section we conduct a robustness analysis and the final section offers some concluding remarks.

2. The Role of Speculators in Emerging Markets

2.1 Speculation, market efficiency and volatility

Economic theory generally suggests that speculative activity enhances the informational and allocational role of asset markets thereby making markets more efficient [see Grossman (1995) and Grossman and Stiglitz (1980)]. The predictions for the effect of speculative activity on volatility are less clear cut. Moreover, there is no clear relation between volatility and market efficiency. In the models of Newbery (1988) and Ross (1989), for example, speculative activity increases volatility but is, at the same time, welfare improving.

Foreign speculative activity in emerging markets can play a particularly important role. First, the potential of market manipulation is acute in small emerging markets and liquidity is often poor. Although there are many policy initiatives that could increase liquidity and reduce the degree of collusion among large traders, there may not be a sufficient mass of domestic speculators to ensure market liquidity and efficiency. Second, opening the market to foreign speculators may change the valuation of local companies in a such a way as to reduce the cost of equity capital. The intuition behind the reduction in the cost of capital is described in the context of a one-factor model by Bekaert and Harvey (1995). In segmented capital markets, the cost of equity capital is related to

the the local volatility of the particular market. In integrated capital markets, the cost of equity capital is related to the covariance with world market returns. Given that emerging economies have different industrial mixes and are less subject to macroeconomic shocks originating from developed economies, covariances with world factors are low [see Harvey (1995)]. Since local market volatilities tend to be large, the cost of capital should decrease after capital market liberalizations.

Given that theory offers little guidance, we investigate empirically how volatility and the cost of capital is affected by foreign speculative activity. To do so, we isolate cases in which the importance of foreign speculators in the local market increased. We provide details on the liberalization process in emerging markets in section 2.2.

2.2. Investing in emerging equities

2.2.1 Capital market liberalizations

Table 1 updates the survey of Bekaert (1995) on capital market liberalizations for the 20 emerging markets in our sample. As one can see, many liberalizations are clustered in the late eighties or early nineties. Although such an event may be considered a prime candidate for testing the impact of increased foreign speculative activity, there are a number of factors that could confound this experiment. First, the investment restrictions may not have been binding. Second, liberalizations can take many different forms – relaxing currency controls, reducing foreign ownership restrictions, etc., – and not all market reforms take place at the same time. This makes the choice of the "liberalization date" in Table 1 open to debate. Third, despite the persistence of various restrictions on foreign investors, several emerging markets have been open to some form of foreign investment for a surprisingly long time. Two examples of such indirect participation of foreign speculators in local stock markets are Country Funds and American Depositary Receipts (ADRs). Recently, new investment vehicles called Country Baskets and WEBS have been introduced. While countries might enact official liberalizations of their capital markets, foreign investors still face many market imperfections, such as poor liquidity. Country Funds and ADRs provide the advantage of trading in transparent and liquid markets in New York and London. We will review the theoretical and empirical evidence on the effects of these external financing vehicles in turn.

2.2.2 Country funds

A closed-end country fund is an investment company that invests in a portfolio of assets in a foreign country (for example, an emerging market) and issues a fixed number of shares domestically (for example in the U.S.). Each fund provides two distinct market-determined prices: the country fund's share price quoted on the market where it trades, and its net asset value determined by the prices of the underlying shares traded on the foreign market. Closed-end mutual funds were the original vehicles for foreign investment in emerging financial markets. For example, until the late 1980's the closed-end Mexico Fund was the only way through which U.S. investors could invest in the Mexican market. The Korea Fund partially opened up the Korean equity market to foreign investors in 1984, long before the capital market liberalizations of 1991. Table 1 presents the dates of the country fund introduction for our sample of emerging markets.

Diwan, Errunza and Senbet (1993) examine theoretically the effects of the introduction of country funds on the pricing of the underlying assets in the originating emerging markets. They show that country funds drive up the prices of local companies and reduce the cost of capital. The country fund essentially renders the local market partially integrated with global markets. This results holds even though the typical size of a country fund is very small relative to the total market capitalization of the emerging market. Using an event-study of returns around country fund launchings, Tandon (1996) presents empirical evidence that seems to support these claims.

2.2.3 American Depositary Receipts

American Depositary Receipts are rights to foreign shares that trade in dollars on a U.S. exchange or over-the-counter. ADRs can be exchanged at any time for the underlying security in the local market. The underlying shares represented by the ADR are held in custody by the depositary bank, which converts dividends and other payments into dollars for distribution to holders of the receipts' representing the underlying shares. The depositary bank may also distribute company reports, and it exercises corporate voting rights on behalf of ADR holders in the foreign market [see Urias (1994)].

Table 1 details the earliest ADR introduction for the emerging markets in our sample. ADRs trade in dollars and overcome many of the investment restrictions, trans-

action costs, and informational problems associated with investing in foreign securities. For example, since ADRs are treated as U.S. securities in most legal situations, they enable mutual funds, pension funds, and other U.S. institutions to hold securities that are fungible with foreign shares.

The effects of ADRs on local stock market prices are theoretically similar to those of country funds [see Urias (1994)]. Importantly, local stocks that are correlated with the newly cross-listed security will respond as well, even though they are not themselves cross-listed, that is, there are *spill-over effects.* A variety of empirical studies[1] focussing on individual firm returns found mixed results, but mostly the local price effect of ADR introductions is positive. At the market level, Bekaert (1995) computes an index of openness based on the number of country funds and ADRs for each country. He finds that countries with a relatively large number of ADRs and/or country funds tend to be more integrated into global capital markets and hence may have lower costs of capital.

2.2.4 Capital flows

Arguably, the best measure of the foreign presence in an emerging market is the percentage of stocks held by foreign investors. However, the only available data are U.S. capital flows to emerging markets since 1985. These data are published monthly in the U.S. *Treasury Bulletin.*[2]

We accumulate the capital flows to obtain an approximate measure of the ratio of U.S. ownership to market capitalization. The accumulation takes into account the local market equity appreciation realized by the U.S. investor. That is, the dollar position of U.S. investors in emerging market i is:

$$\text{Own}_{i,t} = \text{Flow}_{i,t} + \text{Own}_{i,t-1}(1 + R_{i,t})$$

where $\text{Flow}_{i,t}$ is the net capital flow in period t and $R_{i,t}$ is the market i return in U.S. dollar terms from the IFC.

[1] See Foerster and Karolyi (1996), Miller (1996), the survey in Karolyi (1996) and Domowitz, Glen and Madhavan (1996, 1997).

[2] Table CM-V-4 reports on a monthly basis foreigners' gross purchases of foreign stocks (U.S. sales, column 7) and foreigners' gross sales of foreign stocks (U.S. purchases, column 14).

Table 2 reports some characteristics of these data for 17 of the 20 emerging markets in our sample. Data are not available for Jordan, Nigeria and Zimbabwe. The largest capital flows have gone to Mexico, Brazil, Korea and Argentina. The U.S. percentage ownership is largest in Mexico and Argentina. We also report both the mean net capital flows and the standard deviation of these flows calculated over January 1993 to December 1995. By far, the most volatile net flows are for Mexico and Brazil with Argentina being the third most volatile. These countries correspond to the group of countries with the highest return volatility [see Bekaert (1995) and Harvey (1995).]

Nevertheless, these data are not without problems. First, although for most countries capital flows were zero before 1985, for others, not knowing the initial foreign ownership (in 1985) makes the resulting estimates hard to interpret. Second, it also may be the case that foreigners hold portfolios different than the IFC index. Kang and Stulz (1997) show that foreign investors are more likely to invest in securities that are large and well known. The IFC indices possess some advantage here over more comprehensive local indices because of the IFC's focus on large, relatively liquid securities. Third, and perhaps most importantly, U.S. investors may invest in emerging markets through third countries, like the U.K. Hence, the large flows to the U.K. could partially reflect emerging market investment that we are unable to track. Fourth, the relation between volatility, costs of capital and foreign ownership may be nonlinear. That is, stocks will be priced differently when foreigners become the marginal investors. It is not clear at what level of foreign ownership this occurs.

Our approach is to test for a structural break in the U.S. ownership series in order to attempt to identify the change in the marginal investor. To do so, we employ the endogenous break point tests detailed in Bai, Lumsdaine and Stock (1996) and we report the results in the final column of Table 1.

3. Measuring volatility, correlation and the cost of capital

Measuring equity volatility, correlation and the cost of capital for emerging markets is no easy task. This section explains and motivates our approach, which differs greatly from previous studies.

3.1 Volatility and correlation

Previous studies of emerging market volatility have relied on two approaches. The first group of studies, see for example, De Santis and İmrohoroğlu (1996) and Aggarwal, Inclan and Leal (1996), use a generalized autoregressive conditional heteroskedasticity (GARCH) model [see Engle (1982) and Bollerslev (1986)]. The GARCH model is fit, country by country, and often includes dummy variables for regulatory shifts. This type of modeling has many limitations. The volatility process is only impacted by past returns, i.e. there is no other conditioning information. The parameters of the volatility model are assumed to be constant. Finally, the dummy variable approach lacks power to detect changes when information from only one country is used.

The second group of studies, see for example, Kim and Singal (1995) and Richards (1996), rely on an event study methodology. Volatility is modeled, following Schwert (1989a,b), using residuals from an AR(12) for returns controlling for calendar effects. While this approach is able to pool information from different countries, it does not control for other variables which impact volatility. This approach also ignores the changes in the stochastic process for returns that gradually integrating markets undergo.

We combine both methods and improve econometric methodology along various dimensions. First, we estimate a sophisticated time-series model for volatility for each country that allows both the conditional mean and the conditional variance to vary through time. We condition on both world and local information to capture the changes in the degree of market integration. This model delivers a time-series of conditional volatilities for each country as well as conditional correlations of each country's return with the world market return.

Second, we use these conditional volatility and correlation estimates in a pooled time-series/cross-sectional analysis described in the next section. Although we can only estimate an "average" response to foreign speculative activity that way, the increase in power is essential.

Since our volatility model builds on Bekaert and Harvey (1997), we offer only a brief description. Define the arithmetic excess return on the national equity index of country i in U.S. dollars as $r_{i,t}$. Our model has three components. First, the conditional mean,

$\mu_{i,t-1}$, is assumed to be time-varying:

$$r_{i,t} = \mu_{i,t-1} + \epsilon_{i,t}. \tag{1}$$

Second, the unexpected return, $\epsilon_{i,t}$, is determined by both a common world shock, $\epsilon_{w,t}$ and a purely idiosyncratic (country-specific) shock, $e_{i,t}$,

$$\epsilon_{i,t} = v_{i,t-1}\epsilon_{w,t} + e_{i,t}, \tag{2}$$

where $v_{i,t-1}$ is a time-varying weight that reveals the relative importance of world versus local information. Finally, the local idiosyncratic conditional variance, $(\sigma^{\ell}_{i,t})^2$, follows an asymmetric GARCH (1,1) which follows from the work of Glosten, Jagannathan and Runkle (1993):

$$(\sigma^{\ell}_{i,t})^2 = E[e^2_{i,t}|\boldsymbol{I}_{t-1}] = c_i + \alpha_i(\sigma^{\ell}_{i,t-1})^2 + \beta_i e^2_{i,t-1} + \gamma_i S_{i,t} e^2_{i,t-1}, \tag{3}$$

where $\boldsymbol{I}_{t-1}$ is the information available at time $t-1$ and $S_{i,t}$ is an indicator variable which takes on the value of one when the idiosyncratic shock is negative and zero otherwise. We also assume that

$$e_{i,t} = \sigma^{\ell}_{i,t} z_{i,t}, \tag{4}$$

where $z_{i,t}$ is a standardized residual with zero mean and unit variance. We investigate two distributional assumptions for the standardized residual, $z_{i,t}$: the normal distribution and a mixture of normal distributions. The latter distribution allows for both skewness and kurtosis.

The conditional mean of country i's return is assumed to be linear in the information variables:

$$\mu_{i,t-1} = \boldsymbol{\delta}'_{i,1}\mathbf{X}_{i,t-1} + \boldsymbol{\delta}'_{i,2}\mathbf{X}_{t-1} \tag{5}$$

where $\mathbf{X}_{t-1}$ represents global information variables and $\mathbf{X}_{i,t-1}$ are local information variables. The global information variables include: a constant, 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 U.S. bill), and the change in the 30-day Eurodollar rate. These variables are designed to capture fluctuations in expectations of the world business cycle [see Harvey

(1991)]. The local information variables include: a constant, the equity return, the exchange rate change, the dividend yield, equity market capitalization to GDP and trade to GDP. All of the information variables, except for the change in the 30-day Eurodollar rate, are lagged.[3] The financial market variables are lagged by one month and the macroeconomic variables are lagged by one year to allow for reporting delays.

The world market expected returns and variances are a special case of (1)-(5), with $i = w$, $\sigma^{\ell}_{i,t} = \sigma_{w,t}$, $v_{w,t-1} = 0$ and $\mu_{w,t-1} = \delta'_w \mathbf{X}_{t-1}$. Finally, the relative importance of world versus local information in the variance equation is defined as:

$$v_{i,t-1} = q_{i,0} + q'_{i,1} \mathbf{X}^{*\prime}_{i,t-1} \tag{6}$$

where, following Bekaert and Harvey (1997), $\mathbf{X}^{*}_{i,t-1}$ includes the subset of variables in $\mathbf{X}_{i,t-1}$ which might proxy for the degree of market integration: market capitalization to GDP and the size of the trade sector (exports plus imports divided by GDP). The data for this exercise are U.S. dollar total return indices for 20 countries provided by the IFC and the sample covers the 1976-1995 period. These data are described in more detail in Bekaert and Harvey (1995).

3.2 The cost of capital

The cost of capital is notoriously difficult to measure. The problems are compounded in our setting, since we believe that the cost of capital changes when markets integrate with world capital markets and that the process of integration is gradual. In such an environment, it will be very difficult to use realized returns to measure changes in the cost of capital. However, a change in the marginal investor and the different valuation it implies should have discrete effects on the price level of stocks [see also Korajczyk (1996) for similar arguments]. Hence, it is likely that a technique exploiting information in price levels may be more powerful. We develop such a framework using aggregate dividend yields.

The dividend yield has the advantage of being directly measurable – that is, it need not be pre-estimated – and being a stationary random variable.[4] Moreover, shocks to

[3] We use the Eurodollar rate quoted on the last day of the month. The return for the next month is conditionally known so no lagging is necessary.

[4] With emerging markets, the dividend yield calculation is not straightforward. In

prices should dominate its variation over time. Finally, the dividend yield is intricately linked to the cost of capital.

Consider a simple example. Assume rational expectations and a discounted dividend model for the stock price, P_t:

$$P_t = E_t \left[\sum_{i=1}^{\infty} \delta_{t+i}^{i} D_{t+i} \right], \tag{7}$$

where D_t are the dividends and δ_t is the discount factor. Let:

$$Y_t^x = \begin{cases} 0, & \text{before liberalization;} \\ 1, & \text{after liberalization.} \end{cases}$$

The x superscript indicates different measures of liberalization (see below). We further assume that the liberalization is a one-time, unexpected event. When the market is segmented, the required rate of return is constant and equal to r. When the market opens up, the required rate of return drops to $\overline{r}$. We can represent this simple model for expected returns as:

$$\delta_t = \frac{1}{1 + r - \eta Y_t^x} \tag{8}$$

where $\eta = r - \overline{r}$, the drop in the cost of capital. Under this set of assumptions, the relation between the change in the dividend yield, $\overline{D}_t/\overline{P}_t - D_t/P_t$ and the change in the cost of capital η, depends on the dividend process.

In the standard Gordon model, which assumes that $E_t D_{t+i} = (1+g)E_t D_{t-1+i}$, this relation is virtually one to one. It is straightforward to show:

$$\begin{aligned} \eta =& r - \overline{r} \\ =& (1+g)\frac{D_t}{P_t} - (1+\overline{g})\frac{\overline{D}_t}{\overline{P}_t} + g - \overline{g} \end{aligned} \tag{9}$$

If the growth rate of dividends is not affected by the capital market liberalization, a regression of D_t/P_t onto Y_t^x, yields $\eta/(1+g)$. Hence, the slope coefficient provides a slight underestimate of the true response of the cost of capital.

---

our cost of capital regressions, we use the dividend yields provided by the IFC which are a 12-month moving average of dividends divided by the current price level. However, in high inflation countries, one can make the case that an average of the last 12 months dividend yields is a more appropriate measure, since this assumes past dividends are reinvested in the stock market. We use this alternative dividend specification as one of our local instrumental variables.

Of course, there is a growing literature arguing that opening up capital markets may effect economic growth [Obstfeld (1994)], but we suspect that the first-order effect will likely be on the stock market price. Furthermore, in the cross-sectional analysis below, we will add control variables that can pick up variation in D_t/P_t that is not accounted for by changes in the cost of capital. For example, if the liberalization is accompanied by macroeconomic reforms and trade liberalization, the resulting increase in the growth potential of the country may be controlled for by a variable such as exports plus imports as a fraction of GDP or by country risk variables.

The Gordon model is not a realistic model for stock price determination but its main intuition remains valid with more general models. For example, Appendix A shows that when D_{t+1}/D_t is a log-normal AR(1) process with homoskedastic innovations, the partial derivative of the dividend yield with respect to the cost of capital is still likely to be close to 1.

A number of potential problems remain. First, expected returns are likely to vary through time. In this case, dividend yields forecast both future dividend changes and future returns [see Blanchard (1993) and Campbell (1991) for insightful decompositions]. Since expected returns are lower when markets become integrated, time-variation in expected returns may actually increase the power of our tests. The reason is that a given change in expected returns has a greater effect on the stock price when the expected return is persistent [see Campbell, Lo and MacKinlay (1996), chapter 7]. Another implication is that our regression coefficient will partially reflect the persistence of expected returns and hence exaggerate the effect on the cost of capital, unless we introduce a variable that controls for time-variation in expected returns.

Second, the change in the dividend yield may over-estimate the cost of capital because of its link to economic growth. A liberalization may enhance the growth prospects for a country leading to increased prices. Hence, a decrease in the dividend yield may reflect a lower cost of capital or better growth opportunities.

Third, our analysis so far assumes there is one unexpected liberalization. When liberalizations are anticipated, prices will adjust before the actual liberalization occurs. If some uncertainty remains about the liberalization, a positive price movement may still occur on the actual date. Since returns are likely to be positive in the period between anticipation and actual liberalization, expected liberalizations are another reason to be

wary of the use of returns for testing the cost of capital effect. We will attempt to take anticipated liberalizations into account in our measurement of the liberalization variable Y_t^x. This variable will also reflect the gradual nature of capital market liberalizations.

4. Econometric methodology

4.1 Defining the liberalization variables

We introduce two liberalization dummies, one based on the capital market liberalization dates in Table 1 and the other based on the capital flow break points (see Table 1).. We split our sample into four parts: 'early' (more than 30 months before liberalization), 'pre' (30 to six months prior to liberalization), 'during' (six months prior to three months after liberalization) and 'post' (four months after liberalization to 30 months post liberalization.) The reasoning is that when liberalizations are pre-announced or anticipated by market participants, expected returns and volatility may change some time before the liberalization date.

Our other measure uses launchnig data on ADRs and country funds to construct three indices. First, $A_{t,i}$ counts the number of ADR issues in the U.S. or London for country i over time. Hence, for some countries this index may equal the zero vector. Second, $CF_{t,i}$ similarly "counts" the country fund launchings. Finally, $L_{t,i} = A_{t,i} + CF_{t,i}$. When attempting to measure how volatility, world market correlation and the cost of capital are affected by changes in these indices, we face a number of immediate technical problems.

First, the effect of the very first ADR and/or country fund is likely to be much larger than that of further ADR issues and/or country funds launchings. This is suggested by the theoretical analyses mentioned above and makes sense at an intuitive level. To accommodate that possibility, we introduce the variable

$$Y_t^x = \frac{1-\lambda^{x_t}}{1-\lambda}, \qquad \text{for } x = A, CF \text{ or } L. \tag{10}$$

where $0 < \lambda < 1$. The size of λ determines how fast the additional impact of further liberalizations declines. Figure 1 shows what happens for three different λs assuming the index goes from 0 to 20 in steps of one [in reality, $Y^x(t)$ will be a step function]. As can be seen, for very low λs, the additional issues generate almost no additional effect.

Second, as indicated above, it is important to account for rational expectations of the market participants. Fortunately, for some ADRs, we have the actual announcement dates, using information provided by Miller (1996),[5] but we only have the launching dates for the country funds. If ADR issues are anticipated even before the announcement, our liberalization variables may still not capture the economically relevant timing. We conduct a number of robustness checks in section six.

Expectations of future liberalizations may be partially captured by adjusting λ. For example, a second ADR issue would produce a reduction in the cost of capital by $\eta\lambda$, where $\lambda \leq 1$. However, it seems natural that ADR issues trigger expectations of further ADR issues and market openings. This implies that the jump on the liberalization date may be higher and λ smaller if expectational effects play an important role.[6]

More generally, if such expectation effects are important, what matters is the first signal of liberalization. This may occur in the form of a country fund, ADR or a large scale liberalization. Our final liberalization variable splits up the sample into four parts as was done for the capital market liberalization dummy. However, the date used is the date of the first sign of openness through whatever form.

4.2 Econometric framework

Denote the variable of interest by Z_t^i, so we have $Z_t^i = \ell n(\sigma_{i,t})$, $Z_t^i = D_t^i/P_t^i$ or Z_t^i =correlation. Our general model is:

$$\begin{aligned} Z_t^i &= \alpha^i + \beta' \mathbf{W}_t^i + \gamma Y_t^{X_t^i} + \epsilon_t^i \\ \epsilon_t^i &= \rho^i \epsilon_{t-1}^i + u_t^i \end{aligned} \tag{12}$$

This model pools time-series and cross-sectional information and allows us to examine

[5] An appendix, available upon request, lists all of the ADRs and Country Funds. When announcement dates are unavailable, a proxy is used. For ADRs listed on the major stock exchanges (such as NYSE, NASDAQ, AMEX), a 4-month period prior to the actual initial public offering (IPO) date is used; for OTC ADRs, a 1-month prior to IPO is used, and for 144A ADRs, a 2-months prior to IPO period is used. These are estimated from median announcement leads on the ADRs for which we had both announcement and listing dates.

[6] Another potential limitation is that we do not have data on the market capitalizations of the ADRs. It is possible that the first issue is 'small' and relatively unimportant.

all observations simultaneously. The intercept specification allows for fixed effects. The set of variables that control for variation in Z_t^i, not accounted for by liberalizations, $\mathbf{W}_t^i$, are detailed below.

Notice that the liberalization variable is constrained to have the same slope coefficient, β, across countries. This greatly enhances the power of our tests. In a sense, we measure the average impact of a market liberalization controlling for other variables, in the spirit of the event study methodology in finance. An alternative would be to write down the process for Z_t^i, assuming that all parameters change after the liberalization and testing whether the parameter change is significant. Given the noise in the data, this approach is unlikely to be fruitful. Of course, there are reasons to expect why γ is not equal across countries. For example, the price response of a liberalization may depend on the nature of the existing restrictions, the persistence of expected returns (see above) or the size of the ADR or country fund. Some of these effects are controlled for by variables in $\mathbf{W}_t^i$ but not all. Underlying our approach is the view that the dominant effect of a market opening – a different marginal investor driving up the price – should be similar across countries. Hence, cross-sectional information effectively circumvents the peso-type problem that we only have at most one liberalization per country. It also allows us to make predictions about the likely effect of a capital market liberalization for countries which are as of yet closed to international investors.

Nevertheless, it is important to test whether the model is well specified. In section 6, we conduct a number of experiments to assess the robustness of our specification.

4.3 Estimation issues

We perform generalized least squares accounting for group-wise (country by country) heteroskedasticity, with a Prais-Winsten correction for serial correlation since it is unlikely that our control variables will capture all serial correlation in volatility or dividend yields. We do not correct for potential endogeneity problems. We also do not correct for correlation across residuals of different countries. First, given the low correlations between emerging market returns, it is unlikely that we will gain much efficiency by doing so. Second, it is technically non-trivial since the number of observations differs across countries.

4.4 Control variables

The control variables we use are detailed in Table 3. They generally fall into four categories: asset concentration, stock market development/economic integration, microstructure effects, and finally macroeconomic influences and political risk.

The asset concentration category includes the number of stocks in each of the country indices followed by the International Finance Corporation (IFC). We also investigate the more precise modified Herfindahl index of concentration. This index ranges from 0 (equal market capitalization) to 1 (one dominant firm).

The stock market development/economic integration category includes two macroeconomic measures and one financial measure. The macroeconomic variables are the capitalization of the stock market relative to the country's GDP and the size of the trade sector (exports plus imports) relative to GDP. Our financial variable is the cross-sectional standard deviation of the index stock returns (at every month). As a market becomes more mature, there is often less reliance on one particular sector (the correlation between stocks decreases) which increases the cross-sectional standard deviation.

There are many microstructural variables that might serve as good control variables. We have data on turnover and the number of stocks traded in any particular month. However, these data are only available for a portion of the sample. Instead, we focus on the cross-sectional standard deviation of the stock returns within each index. In the model of Ross (1989), volatility is directly linked to the rate of information flow. But this variable potentially wears two hats. In the Ross model, it measures the amount of information being revealed about the stocks traded in a particular country. However, it may also potentially reveal information about the diversity of the industrial sector. That is, a low cross-sectional standard deviation might mean that the economy is not well developed and equities represent only one or two industries.

To account for these two interpretations in the volatility and correlation models, we also allow for the cross-sectional standard deviation to interact with the relative level of market development measured by the market capitalization to GDP ratio minus its cross-sectional mean. If $MC_t^i/GDP_t < \overline{(MC_t/GDP_t)}$ and the regression coefficient on the interaction variable is positive, then an increased cross-sectional standard deviation negatively affects the market volatility. If $MC_t^i/GDP_t > \overline{(MC_t/GDP_t)}$, then the deriva-

tive of volatility with respect to the cross-sectional standard deviation is positive which is what is predicted by the information flow model of Ross (1989).

The final variables are linked to the condition of the macroeconomy. We examine the standard deviation of exchange rate changes as well as the average trailing inflation rates. We also include a variable designed to proxy for political risk: the Institutional Investor country credit rating. Erb, Harvey and Viskanta (1996) find that the Institutional Investor measure has high correlation with more direct measures of political risk which are available over shorter periods.

5. Empirical Results

5.1 Preliminary analysis

Figures 2 through 4 present changes in, respectively, the cost of capital, volatility and correlation around liberalizations. We compare the average conditional correlations, volatilities and the average dividend yield in the two years before introduction to the two years following introduction, liberalization or break point. In each panel A, we examine the official liberalization. Panel B looks at the minimum of the official liberalization, ADR introduction and Country Fund lauching. Panel C examines the change around the capital flow break point.

The results can be summarized as follows. The majority of dividend yields seem to decrease after a liberalization. One outlier is due to the Mexican debt crisis which followed shortly after the launch of the Mexico Fund in June 1981. Volatility decreases are slightly more prevalent than volatility increases, except when the minimum of the liberalization, ADR and Country Fund introduction is used as the liberalization variable. Correlations predominantly increase after liberalizations, although there are a few exceptions.

A disadvantage of this approach is that it does not control for other events in the economy. Our regression approach deals with this shortcoming.

5.2 Cost of capital

Table 4 presents our estimates of the cost of capital model. Panels A through C report the models for ADR and Country Fund introduction with three choices of the impact parameter, λ: 0.90, 0.50 and 0.10. The size of this parameter determines the effect of additional ADR or Country Funds. Low values imply that additional introductions have very little impact.

Panel A reports the impact of ADR introduction on the cost of capital. The coefficient on the ADR index is negative implying that the introduction reduces the cost of capital. However, the coefficient is only one standard error from zero in most of the models.

Country funds have a more significant impact on the cost of capital than the ADRs. In panel B, the coefficient on the country fund index is more than two standard errors from zero with low values of λ.

The third panel combines the ADR and Country Fund indices. The results are consistent with panels A and B. In each regression, the index enters with a negative coefficient. When $\lambda = 0.50$, the coefficient on the introduction index is about 1.5 standard errors below zero and when $\lambda = 0.10$, the coefficient is two standard errors from zero.

There are a number of interesting patterns in the control variables. The log of number of companies in the stock index enters with a negative coefficient (the more companies, the more developed the market, and the lower the cost of capital). However, the coefficient is not significant at conventional levels. The concentration ratio also enters with a negative coefficient which is significant. This implies that as some large firms emerge in a country, the cost of capital decreases.

The size of the trade sector, which is a development indicator, enters strongly with a negative coefficient in all regressions. As the size of the trade sector increases, the cost of capital decreases. The cross-sectional standard deviation is also important in each regression. More industrial diversity (suggesting development of the market) tends to decrease the cost of capital. Indeed, this variable enters the regression with coefficients six standard errors from zero. The political risk indicator fails to enter any of the regressions with a significant coefficient.

Finally, the macroeconomic climate variables have mixed impact. The volatility of

the foreign exchange rate changes enters with a negative coefficient which is difficult to explain. However, inflation enters with a significant positive coefficient indicating that lower inflation is associated with lower costs of capital. It is possible that the inclusion of three variables, proxying for macroeconomic stability (inflation, exchange rate variability and credit ratings) leads to the anomalous signs for the credit rating and exchange rate variability.

The next two panels consider the capital market liberalizations. The economic impact of liberalizations is similar to the impact of an ADR introduction - a decrease of about 0.10 in the dividend yield (comparing PRE with POST in Panel D). A Wald test reveals that this change is also not statistically significant. When we consider ADR/CF introduction as liberalization dates when they occur before the large scale official capital market liberalizations, the decrease in the dividend yield is about 0.14 but it remains statistically insignificant. When we consider the capital flow break points in the final panel of Table 4, the results are similar.

5.3 Volatility

The results presented in Table 5 indicate that ADR and Country Fund introductions increase local equity market volatility. The increase is only statistically significant when ADRs and Country Funds are introduced, for λ=0.5 and 0.1. In addition, a higher cross-sectional standard deviation, higher inflation and exchange rate volatility increase local market volatility in a statistically significant way. A larger number of companies reduces volatility but this effect is not statistically significant. A better credit rating significantly reduces volatility. The interaction variable between market capitalization and cross-sectional standard deviation has the expected positive sign. That is, the positive effect of increases in the cross-sectional standard deviation on volatility is mitigated when the market is small (and vice versa).

Whereas most of the signs of the coefficients conform to intuition, the sign on the concentration ratio is surprisingly negative, indicating that higher concentration reduces volatility. However, the coefficient is not significantly different from zero. Volatility also increases after major capital market liberalizations, but the effect is statistically insignificant. When capital flow break points are considered however, the effect is larger

and the Wald test rejects the null hypothesis of no change in volatility.

These results only partially confirm the findings in Bekaert and Harvey (1997), who have a smaller sample and fewer independent variables. They find that capital market liberalizations decrease or do not effect local market volatility. Note that the effects found here are only statistically significant in two cases and generally seem small. We will further examine the robustness of this result and the economic importance of volatility changes in section 6.

5.4 Correlation with the world market

Table 6 presents the impact of ADR and Country Fund introduction on the conditional correlations with the world market portfolio. In some of the regressions, the introduction variable is associated with an increase in correlation, but the effect seems economically small and is statistically insignificant. There are two other significant relations. An increase in the cross-sectional standard deviation decreases the correlation with the world market whereas a higher market capitalization increases the correlation. The first effect is larger when market capitalization is high relative to the cross-sectional average.

The results in Panels D through F present weak evidence of increases in the correlation with the world market. The probability value of the test statistic for correlation before and after liberalizations is 0.135. When these liberalization indicators are combined with ADR and Country Fund introductions, the p-value falls to 0.097. There is no evidence of increased correlation following breaks in capital flows. Further, the magnitude of the increase in correlation is small. While the results in Panel E show that the increase in correlations with the world market is statistically significant at the 10% level after capital market liberalizations, the increase is in the order of 2% – which is unlikely to affect economic decisions such as portfolio allocations.

6. Robustness of the results

In this section, we report results from a number of alternative specifications for the regressions. In turn, we consider the impact on the liberalization effects of introducing

a dummy variable for 1995, announcement effects for country funds and the presence of country specific responses to liberalizations.

6.1 The impact of 1995

The last year of our sample coincides with a very turbulent year for emerging markets following the Mexican peso crisis in December 1994. The currency crisis in Mexico was accompanied by large declines in stock market valuations in Mexico and other emerging markets. Clearly, this event may potentially have dramatic effects on our estimates of liberalization effects on the cost of capital, volatility and the correlation with the world market.

However, our results are robust to the introduction of a dummy variable for 1995. The dummy variable coefficient is not significantly different from zero. In the cost of capital regressions, the coefficient on the liberalization variable remains negative, although it is less negative. The tests conducted on the the post-liberalization versus the pre-liberalization cost of capital are virtually identical when an indicator variable is added.

The indicator variable has little impact on the volatility regressions. The coefficient on the liberalization variable in the augmented regression is very similar to that reported in the original specification. The 1995 variable also has little effect on the correlation estimates.

6.2 Announcement effects for Country Funds

In contrast to our data on ADRs, we do not have data on the announcements of country fund launchings, and consequently, use the actual listing data. To check robustness, we re-estimated our regressions assuming an announcement lead of three months. This lead time is based on the median lead time between the announcement and lauching of ADRs.

The volatility and cost of capital results are not much affected by this change with the exception that for $\lambda = 0.10$, the cost of capital decrease becomes smaller and less significant. The correlation effects are now all negative.

6.3 Country-specific liberalization effects

Perhaps the most important test of robustness is to allow for country-specific liberalization effects. To maintain power, the results reported in Tables 4 through 6 restrict the liberalization response to be the same for the different countries. It is possible that our control variables fail to control for some country-specific factors (e.g. the availability of other financing options for firms, taxes, etc.) that lead to response coefficients that are cross-sectionally very diverse. It is even possible that some influential countries drive the cross-sectional results.

To investigate these possibilities, we reestimate the regressions 17 times, each time allowing a different country to have a country-specific liberalization effect. We chose to focus on the model where $\lambda = 0.5$. Jordan, Nigeria and Zimbabwe are excluded from the analysis because they do not have ADRs or Country Funds during our sample. We will summarize the results for the cost of capital and volatility regressions.

There are a number of possible robustness checks. First, we examined the coefficients on the other independent variables. These coefficients were remarkably stable across the 17 different estimations. Second, we examined both the country-specific liberalization coefficient and the coefficient for the other 16 countries in each estimation.

In the volatility regression, the coefficient on the other 16 countries is always positive and is within one standard error of the common estimate reported in Table 5. The country specific coefficients are generally insignificant with two important exceptions: Greece and Pakistan. In Pakistan, in particular, there was a very large increase in volatility that coincides with the liberalization.

In the cost of capital regressions, the coefficient on the other 16 countries is always negative and is within one standard error of the coefficient reported in Table 4 for 15 of the 17 estimations. The country-specific coefficients are rarely significant. The only exception is Pakistan's whose coefficient is slightly more than two standard errors from zero.

In examining the impact of capital market liberalizations, we are trying to capture a complex process with a simple model. To some degree, our model is misspecificied. The extensive robustness checks gives us additional confidence in our proposed econometric

framework.[7]

6.4 Economic impact of liberalization effects

Whereas the effects of capital market liberalization on the cost of capital seem small, economic integration, as measured by the size of the trade sector, does seem to have a significant (both economically and statistically) effect on the cost of capital. This suggests one potential positive interpretation of the results. It may be that capital market liberalizations are correlated with some of the control variables. After all, capital market liberalizations are often part of a broader reform package. More specifically, what matters is the general stock market development and openness of a country, which is proxied by a number of our right-hand side variables.[8]

To assess the economic significance of a liberalization, we trace the impact on an emerging market of moving from a poorly developed capital market with poor economic performace to a median country following a capital market liberalization. To do this, we examine the cross-sectional distribution of all of the explanatory variables. We consider a change from either the 25th percentile to the median for the number of companies in the IFC index, the size of the trade sector, the cross-sectional standard deviation, the country credit rating and the country's equity capitalization. We look at a change from the 75th percentile to the median for the concentration ratio, inflation and foreign currency volatility. We allow for a capital market liberalization.

When use the coefficients from panel D in Tables 4-6 (official liberalizations), we find that the cost of capital decreases by 25 basis points, volatility decreases by 1% and correlation increases by 0.034. The increase in correlation is relatively large because the average correlation of emerging markets and the world market is only 0.14 (see Harvey (1995)). With the coefficients from panel E in Tables 4–6 (the minimum of ADR, Country Fund and official liberalizations), the results are similar: 29 basis point decrease in the cost of capital, 1.09% decrease in volatility and a 0.035 increase in correlation. The results using the capital flow break points are similar.

---

[7] Detailed robustness results are available on request.

[8] Henry (1997) makes a similar point and finds that economic reforms, which offten happened concurrent with capital market liberalizations, are an important source of stock market increases.

The economic exercise suggests that the broader impact of capital market liberalizations (including stock market development and economic reforms) is a small decrease in the cost of capital, a small decrease in volatility and an increase in correlation with the world market.[9]

7. Conclusions

There are many perceptions of the role of foreign speculators in emerging equity markets - many of which are negative. Our research looks at the various ways foreigners can access emerging market equity: ADRs, Country Funds or direct participation in the local market and tries to assess the impact on expected returns, volatility and correlation.

One of the major conclusions of our work so far is that the capital market integration process reduces the cost of capital but not by much. In fact, there are reasons to believe that the effect is both statistically and economically insignificant. Time-variation in expected returns and a positive effect of the liberalization on the growth potential of the country (as predicted by the new growth theory) should also decrease dividend yields, but the effect that we measure is of the order of 0.15%. Moreover, we have taken liberalizations as an exogenous event, whereas policy makers would probably chose to liberalize when it is most advantageous to do so. Policy endogeneity would also suggest our estimates are biased upwards (see Henry (1997) for a similar point).

Our analysis details a small increase in the volatility of stock returns following capital market liberalizations - but the effect becomes negative when potentially concurrent movements in the control variables are taken into account. Interestingly, there is only a small increase in correlation with the world market return. Many foreign investors are attracted to emerging markets for the diversification benefits. While correlations increase after markets open up, the magnitude of the increase is unlikely to deter investors seeking diversification.

Our research comes at a time when a number of countries are pondering the wis-

[9] The increase in market capitalization to GDP that we use moving from the 25th percentile to the median is very small (2.8% to 9.0%). If we repeat the analysis using the 75th percentile (2.8% to 21.3%), the decrease in volatility is 1.7% and 1.8% using the liberalization dates and the combined ADR/Country Fund/Liberalization dates respectively. The increase in correlations is 0.069 and 0.071.

dom of further liberalizing their capital markets. Our results suggests that, on balance, the economic openness of the economy is the major factor impacting expected returns, volatility and correlations. Nevertheless, much remains to be done. As this paper illustrates, it is extremely hard to identify when market integration really occurs. If we could use returns and other financial data to "date" market integration, we may be able to determine which liberalization initiatives (ADRs, Country Funds, large-scale capital market liberalizations) have proved most effective in bringing about market integration. On going research by Bekaert, Harvey and Lumsdaine (1997) offers some insight on this important question.

References

Aggarwal, Reena, Carla Inclan and Ricardo Leal, 1996, Volatility in emerging stock markets, Unpublished working paper, Georgetown University, Washington, D.C.

Bai, Jushan, Robin Lumsdaine and James H. Stock, 1996, Testing for and dating breaks in stationary and nonstationary multivariate time series, Unpublished manuscript, Princeton University, Princeton, NJ.

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, 1995, Time-varying world market integration, *Journal of Finance* 50, 403–444.

Bekaert, Geert and Campbell R. Harvey, 1996, Capital markets: An engine for economic growth, Working paper, Duke University and Stanford University.

Bekaert, Geert and Campbell R. Harvey, 1997, Emerging equity market volatility, *Journal of Financial Economics* 43, 29-78.

Bekaert, Geert, Campbell R. Harvey and Robin Lumsdaine, 1997, Dating the integration of world capital markets, Unpublished working notes, Stanford University and Duke University.

Bekaert, Geert and Michael S. Urias, 1996, Diversification, integration and emerging market closed-end funds, *Journal of Finance* 51, 835-870.

Blanchard, Olivier, 1993, Movements in the equity premium, *Brookings Papers on Economic Activity* 2, 75–118.

Bollerslev, Tim, 1986, Generalized autoregressive conditional heteroskedasticity, *Journal of Econometrics* 72, 307–327.

Bollerslev, Tim and Robert J. Hodrick, 1992, Financial market efficiency tests, National Bureau of Economic Research, 4108, Cambridge, MA.

Campbell, John Y., 1991, A variance decomposition for stock returns, *Economic Journal.*

Campbell, John Y., Andrew W. Lo and A. Craig MacKinlay, 1996, *The econometrics of financial markets*, Princeton University Press.

Campbell, John Y. and Robert J. Shiller, 1988, The dividend-price ratio and expectations of future dividends and discount factors, *Review of Financial Studies* 1, 195–228.

De Santis, Giorgio and Selahattin İmrohoroğlu, 1996, Stock returns and volatility in emerging financial markets, Unpublished working paper, University of Southern California, Los Angeles, CA.

Domowitz, Ian, Jack Glen, and Ananth Madhavan, 1996, International cross-listing, market segmentation and foreign ownership restrictions: The case of Mexico, Unpublished working paper, University of Southern California.

Domowitz, Ian, Jack Glen, and Ananth Madhavan, 1997, Market segmentation and stock prices: Evidence from an emerging market, *Journal of Finance* 52, 1059–1086.

Engle, Robert F., 1982, Autoregressive conditional heteroskedasticity with estimates of U.K. inflation, *Econometrica* 50, 987-1008.

Erb, Claude B., Campbell R. Harvey and Tadas E. Viskanta, 1996, Political risk, economic risk and financial risk, *Financial Analysts Journal* November/December, 29–46.

Foerster, Stephen R. and G. Andrew Karolyi, 1996, The effects of market segmentation and illiquidity on asset prices: Evidence from foreign stocks listing in the U.S., Unpublished working paper, University of Western Ontario, Canada.

Glosten, Lawrence R., Ravi Jagannathan, and David E. Runkle, 1993, On the relation between the expected value and the volatility of the nominal excess return on stocks, *Journal of Finance* 48,

1779–1802.

Grossman, Sanford, 1995, Dynamic asset allocation and the informational efficiency of markets, *Journal of Finance* 50, 773-788.

Grossman, Sanford, and Joseph Stiglitz, 1980, On the impossibility of informationally efficient markets, *American Economic Review* 70, 393-408.

Harvey, Campbell R., 1991, The world price of covariance risk, *Journal of Finance* 46, 111–157.

Harvey, Campbell R., 1995, Predictable risk and returns in emerging markets, *Review of Financial Studies* 8, 773–816.

Henry, Peter Blair, 1997, Stock market liberalization, economic reform, and emerging market equity prices, Unpublished working paper, MIT, Cambridge, MA.

Karolyi, G. Andrew, 1996, What happens to stocks that list shares abroad? A survey of the evidence and its managerial implications, Working paper, University of Western Ontario, London, Canada.

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

Kim, E. Han and Vijay Singal, 1994, Opening up of stock markets: Lessons from emerging economies, Unpublished working paper, Virginia Tech.

Korajczyk, Robert A., 1996, A measure of stock market integration for developed and emerging markets, *World Bank Economic Review* 10, 267-290.

Miller, Darius P., 1996, The impact of international market segmentation on securities prices: Evidence from Depositary Receipts, Unpublished working paper, University of California, Irvine CA.

Newbery, David, 1987, When do futures stabilize spot prices, *International Economic Review* 28, 291-297.

Richards, Anthony J., 1996, Volatility and predictability in national markets: How do emerging and mature markets differ? Unpublished working paper, International Monetary Fund, Washington, DC.

Ross, Stephen A., 1989, Information and volatility: The no-arbitrage martingale approach to timing and resolution irrelevancy, *Journal of Finance* 44, 1–17.

Schwert, G. William, 1989a, Why does stock market volatility change over time? *Journal of Finance* 44, 1115–1154.

Schwert, G. William, 1989b, Business cycles, financial crises and stock volatility, *Carnegie-Rochester Conference Series on Public Policy* 31, 83–126.

Tandon, Kishore, 1996, External financing in emerging markets: An analysis of market responses, Unpublished working paper, City University of New York, NY.

Urias, Michael, 1994, The impact of security cross-listing on the cost of capital in emerging markets, Unpublished dissertation, Stanford University, Stanford CA.

World Bank, 1993, Emerging stock markets factbook, International Finance Corporation, Washington, D.C.

Appendix: The relation between dividend yields and the cost of capital

The goal of this Appendix is to show that there is still a close relation between dividend yields and the cost of capital, even if the dividend process is more general and realistic than the example given in the text.

We know:

$$\frac{P_t}{D_t} = E_t\left[\sum_{i=1}^{\infty} \delta^i \frac{D_{t+i}}{D_t}\right] \tag{A1}$$

Now, let the log dividend growth rate be normally distributed with constant second moments.

$$\Delta d_t = \rho \Delta d_{t-1} + \epsilon_t \qquad E_{t-1}[\epsilon_t] = \sigma^2 \tag{A2}$$

where $d_t = \ell n(D_t)$ and $\epsilon_t \sim N(0, \sigma^2)$. This process for dividend growth is not entirely realistic, because there may be seasonal patterns in dividend growth rates and the innovations are likely to be heteroskedastic (see Bollerslev and Hodrick (1992)). Nevertheless, a more general model in the log-linear class will have implications similar to the model analyzed here.

Using (A2) in (A1) we obtain:

$$\frac{P_t}{D_t} = \sum_{i=1}^{\infty} \delta^i exp\left(\rho \frac{1-\rho^i}{1-\rho} \Delta d_t + v_i\right) \tag{A3}$$

where v_i is a function of σ^2 and ρ. In particular, since

$$\begin{aligned} E_t\left[\frac{D_{t+i}}{D_t}\right] &= E_t\left[exp(\Delta d_{t+1} + \cdots + \Delta d_{t+i})\right] \\ &= exp\left(\rho \frac{1-\rho^i}{1-\rho} \Delta d_t + v_i\right) \end{aligned} \tag{A5}$$

where

$$v_i = \frac{1}{2} \frac{\sigma^2}{(1-\rho)^2}\left[i - 2\rho \frac{1-\rho^i}{1-\rho} + \rho^2 \frac{1-\rho^{2i}}{1-\rho^2}\right] \tag{A6}$$

Hence,

$$\frac{P_t}{D_t} = q_t \sum_{i=1}^{\infty} \delta^i exp\left(v_i - \frac{\rho^i}{1-\rho} \Delta d_t\right) \tag{A7}$$

with

$$q_t = exp\left(\frac{\rho}{1-\rho} \Delta d_t\right).$$

It is straightforward to solve for D_t/P_t as a function of the parameters $\Theta = [\rho, \delta, \sigma^2]$ and Δd_t.

We conduct simulations where the dividend growth process is calibrated so that its mean and standard deviation match that of the U.S. data (see Campbell and Shiller (1988)). We then restrict attention to simulations where the resulting dividend yield is within a two standard error band of the sample mean for the U.S. data. The response of the dividend yield to a 1% change in the cost of capital is in the interval (0.92, 0.99) for all the simulations conducted.

This framework can also be used to illustrate the difficulty in measuring changes in the cost of capital from actual returns. To this end, we conduct another simulation experiment. We simulate two samples of 200 years on $[\Delta d_t, D_t/P_t, R_t]$, where

$$R_{t+1} = exp(\Delta d_{t+1}) \frac{D_t}{P_t} \left[1 + \frac{P_{t+1}}{D_{t+1}} \right].$$

The underlying dividend process is

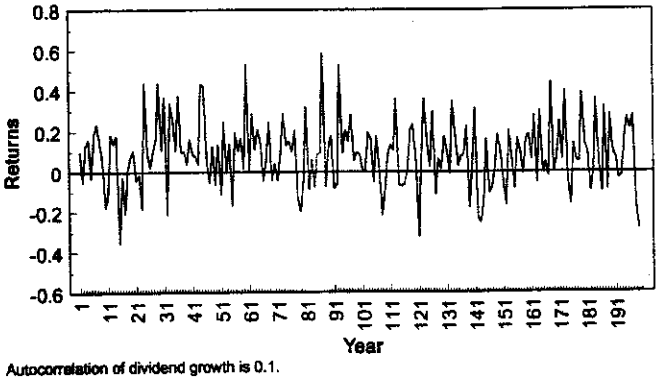
$$\Delta d_t = 0.1 \Delta d_{t-1} + \epsilon_t$$

where ϵ_t is $N(0, \sigma^2)$ and σ^2 is set to match the standard deviation of U.S. dividend growth rates. We generate samples for $r = 6\%$ and $r = 8\%$. The sample of interest combines the first 100 years of the simulation for $r = 8\%$ and the second 100 years for the simulation with $r = 6\%$ This process approximates the actual volatility of U.S. stock returns quite well. It is this volatility that makes detecting the change in the cost of capital quite difficult using returns. The superiority of dividend yields is clearly demonstrated in Figures A1 and A2.

Figure A1

Simulation Results for Returns

For r=8% to r=6% mid-sample change

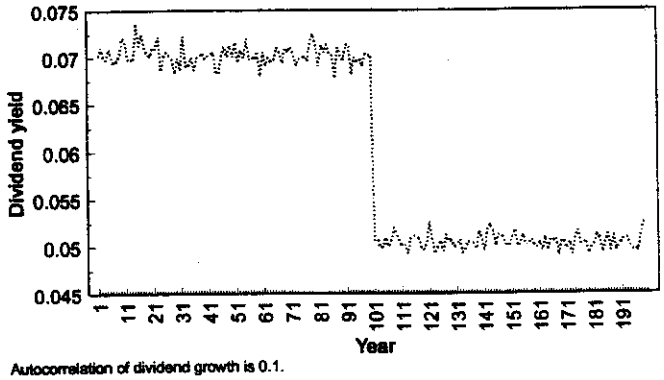


Autocorrelation of dividend growth is 0.1.

Figure A2

Simulation Results for Dividend Yields

For r=8% to r=6% mid-sample change



Autocorrelation of dividend growth is 0.1.

Figure 1

The decreasing impact of ADR and CF launchings

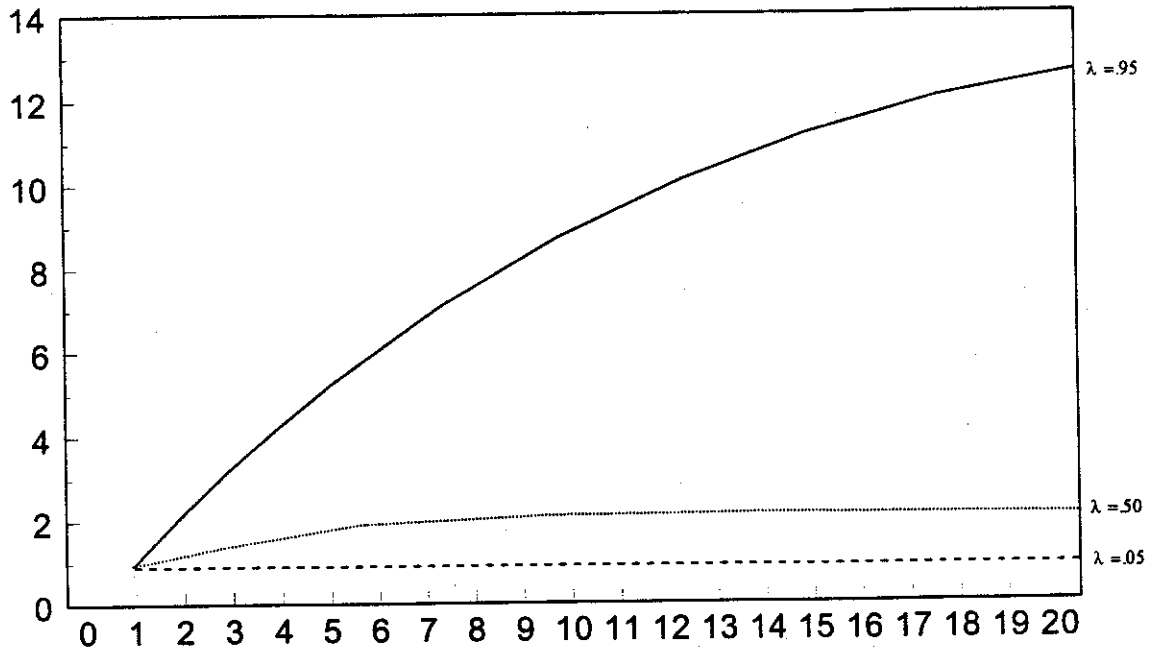
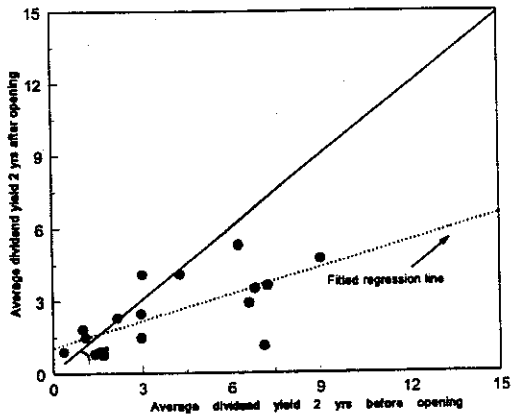


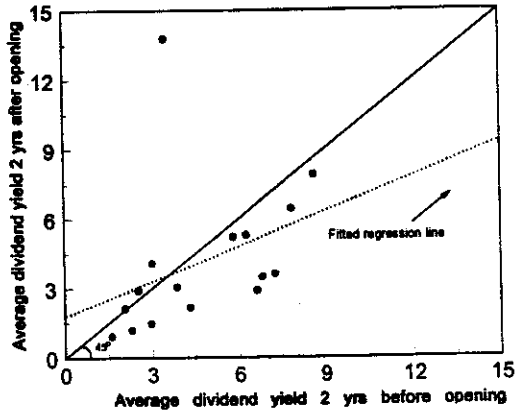
Figure 2

The impact of opening capital markets on the cost of capital:

A. Official liberalizations



B: Minimum of official liberalization, ADR and Country Fund intro dates



C: Net U.S. capital flow break point

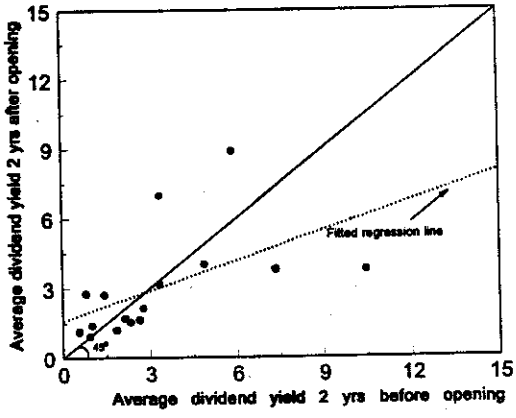
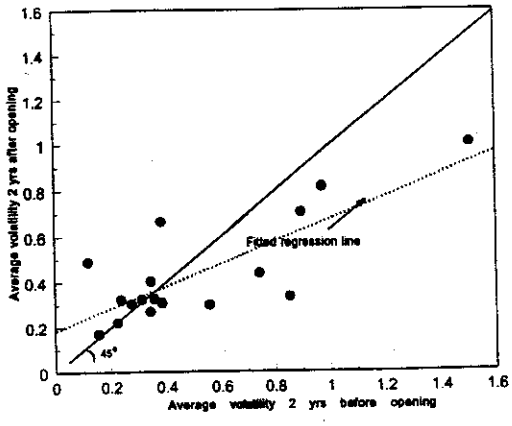


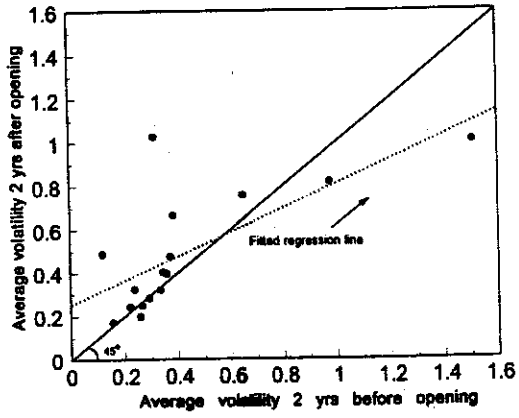
Figure 3

The impact of opening capital markets on volatility:

A: Official liberalizations



B: Minimum of official liberalization, ADR and Country Fund intro dates



C: Net U.S. capital flow break point

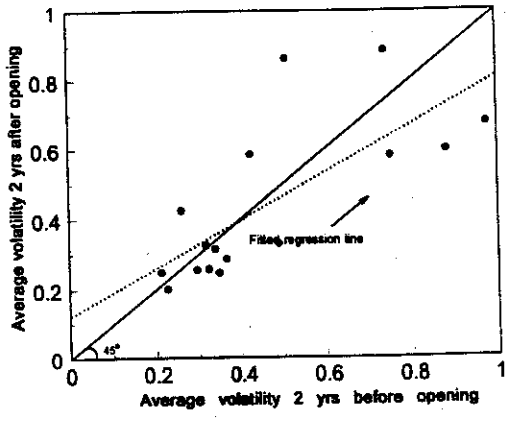
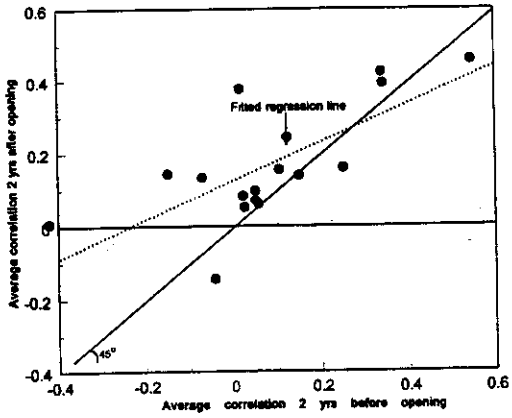


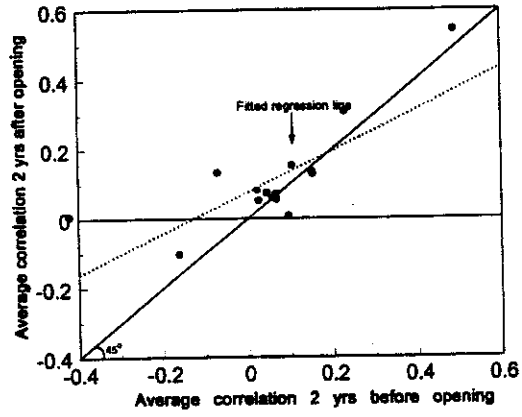
Figure 4

The impact of opening capital markets on correlationn

A: Official liberalizations



B: Minimum of official liberalization, ADR and Country Fund intro dates



C: Net U.S. capital flow break point

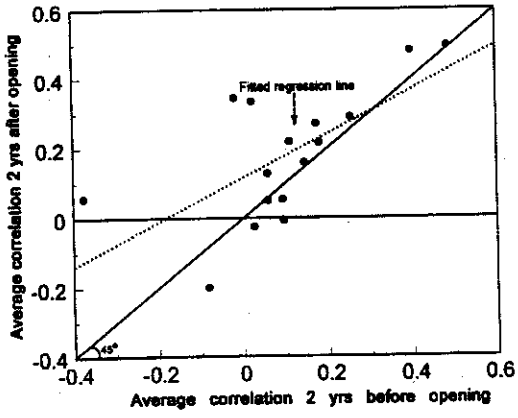


Table 1

The opening of equity markets in emerging countries

Country	Official Liberalization date	ADR introduction	Country Fund introduction	Estimate of Increase in Net US Capital Flows
Argentina	89.12	91.08	91.10	93.05
Brazil	91.05	92.01	87.10	88.07
Chile	90.04	90.03	89.09	88.02
Colombia	91.02	92.12	92.05	93.09
Greece	87.12	88.08	88.09	87.01
India	92.11	92.02	86.06	93.05
Indonesia	90.09	91.04	89.01	93.07
Jordan	87.12	n/a	n/a	n/a
Korea	88.09	90.11	84.08	93.04
Malaysia	88.12	92.08	87.12	92.05
Mexico	89.05	89.01	81.06	90.06
Nigeria	95.01	n/a	n/a	n/a
Pakistan	91.02	n/a	91.07	93.05
Philippines	91.11	91.03	87.05	90.02
Portugal	88.12	90.06	87.08	94.09
Taiwan	91.01	91.12	86.12	92.09
Thailand	88.12	91.01	85.07	88.08
Turkey	89.08	90.07	89.12	90.01
Venezuela	90.01	91.08	n/a	94.03
Zimbabwe	93.04	n/a	n/a	n/a

Source: The liberalization dates are provided in Bekaert (1995) and updated using the IFC Factbooks. Appendices are available on request that present the ADR and Country Fund introduction dates. The estimate of the break point in cumulative net capital flows is obtained from the algorithm in Bai, Lumsdaine and Stock (1996).

Table 2

The characteristics of U.S. capital flows

Country	Cumulative Net Flows (US$ millions) Dec-95	Cumulative Net Flows to Market Cap Dec-95	Average Growth in Net Flows (US$ millions) Jan-93-Dec95	Std. dev. Growth in Net Flows (US$ millions) Jan-93-Dec95
Argentina	4831.30	0.2181	136.65	360.01
Brazil	10540.05	0.1114	237.55	1036.73
Chile	3582.16	0.0745	78.70	199.03
Colombia	340.38	0.0400	11.16	35.51
Greece	363.02	0.0357	8.97	15.75
India	660.36	0.0114	17.98	42.29
Indonesia	2523.16	0.0669	63.73	125.64
Jordan	n/a	n/a	n/a	n/a
Korea	5935.46	0.0480	141.92	286.44
Malaysia	2270.83	0.0159	44.54	243.95
Mexico	11463.39	0.1897	-14.93	2332.51
Nigeria	n/a	n/a	n/a	n/a
Pakistan	79.83	0.0123	1.98	10.30
Philippines	3936.77	0.1232	69.62	271.91
Portugal	696.83	0.0637	14.20	39.91
Taiwan	239.39	0.0021	5.74	33.07
Thailand	1746.14	0.0184	23.32	164.10
Turkey	609.45	0.0442	14.57	66.80
Venezuela	1.30	0.0005	0.92	21.47
Zimbabwe	n/a	n/a	n/a	n/a

Source: Capital flows data from the U.S. Treasury Bulletin. Market capitalizations from the IFC.

Table 3

Control Variables for the cross-sectional analysis

Symbol	Description (source)	Volatility	Cost of Capital
MCAP	Market capitalization to GDP where GDP lagged 12 months (EMDB-IFC and IFS-IMF)	yes	no
INFL	Annual inflation lagged 12 months (IFS-IMF)	yes	yes
NUMC	Log of number of companies in IFC country index (EMDB-IFC)	yes	yes
CONCR	Modified Herfindahl concentration index based on individual stocks in index (EMDB-IFC)	yes	yes
STDL2	Cross-sectional standard deviation of individual stock returns at each month (EMDB-IFC)	yes	yes
FXV	3-year standard deviation of exchange rate changes (EMDB-IFC)	yes	yes
XMGDP	Exports plus imports divided by GDP lagged 12 months (IFS-IMF)	yes	yes
CCR	Log of country credit rating (Institutional Investor)	yes	yes

Source: EMBD-IFC is the Emerging Markets Database of the IFC,
IFS-IMF is the International Financial Statistics of the IMF,
the credit ratings were drawn from past issues of Insitutional Investor.

Table 4
The Impact of ADR and Country Fund Introduction on the Cost of Capital

A. Intro=ADRs

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	Intro
0.9	-0.0781	-1.5561	-0.6983	0.000589	-2.7556	-1.5016	0.0998	-0.0397
	0.1112	0.6768	0.1119	0.000142	1.1889	0.4514	0.4783	0.0394
0.5	-0.0868	-1.5737	-0.6974	0.000588	-2.7338	-1.5031	0.0802	-0.0537
	0.1107	0.6752	0.1117	0.000142	1.1818	0.4514	0.4760	0.0714
0.1	-0.0890	-1.5747	-0.6980	0.000588	-2.7330	-1.5038	0.0669	-0.0752
	0.1104	0.6742	0.1116	0.000142	1.1798	0.4510	0.4753	0.0871

B. Intro=Country funds

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	Intro
0.9	-0.0535	-1.5667	-0.6944	0.000592	-2.7069	-1.4693	0.1546	-0.0403
	0.1119	0.6779	0.1114	0.000142	1.1848	0.4589	0.4872	0.0441
0.5	-0.0584	-1.5472	-0.6978	0.000591	-2.7062	-1.4666	0.1492	-0.1810
	0.1108	0.6751	0.1112	0.000142	1.1829	0.4534	0.4831	0.1159
0.1	-0.0777	-1.5117	-0.6989	0.000588	-2.7210	-1.4920	0.0999	-0.3487
	0.1102	0.6748	0.1115	0.000142	1.1793	0.4499	0.4774	0.1738

C. Intro=ADRs and Country Funds

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	Intro
0.9	-0.0569	-1.5738	-0.6963	0.000592	-2.7376	-1.4762	0.1536	-0.0409
	0.1119	0.6783	0.1117	0.000142	1.1943	0.4575	0.4853	0.0349
0.5	-0.0655	-1.5718	-0.6984	0.000590	-2.7308	-1.4805	0.1421	-0.1333
	0.1105	0.6753	0.1114	0.000142	1.1908	0.4520	0.4819	0.0997
0.1	-0.0780	-1.5525	-0.7000	0.000588	-2.7437	-1.4979	0.0993	-0.2223
	0.1102	0.6746	0.1115	0.000142	1.1848	0.4496	0.4780	0.1451

D. With Regulatory Liberalization Indicators

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	EARLY	PRE	DURING	POST	WaldTest
-0.0800	-1.4766	-0.6897	0.000591	-2.7460	-1.5169	0.0633	0.1196	0.0503	-0.0467	-0.0396	0.4240
0.1136	0.6895	0.1135	0.000141	1.1795	0.4559	0.4901	0.1850	0.1554	0.1179	0.0745	0.5150

E. With ADR, Country Fund and Regulatory Liberalization Indicators

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	EARLY	PRE	DURING	POST	WaldTest
-0.0894	-1.4741	-0.6801	0.000590	-2.7246	-1.4812	0.0469	0.4592	0.3215	0.1630	0.1854	0.0429
0.1114	0.6797	0.1125	0.000142	1.1737	0.4527	0.4744	0.2483	0.1872	0.0733	0.6345	0.8359

F. With Cumulative Net Capital Flow Break Points

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	EARLY	PRE	DURING	POST	WaldTest
-0.0910	-1.6281	-0.6841	0.000589	-2.7243	-1.6033	0.0640	-0.0216	-0.0801	-0.0533	-0.1546	0.2914
0.1122	0.6814	0.1123	0.000142	1.1871	0.4641	0.4804	0.1888	0.1649	0.1358	0.0939	0.5893

In panels A-C, we estimate a time-series cross-sectional estimation with the cost of capital as the dependent variable. Lambda represents how fast the additional impact of further liberalizations declines. With low lambdas, additional issues generate almost no additional effect. The Intro variable is defined in the panel title. In panels D-F, we estimate a model with dummy variables around the liberalization definition. The Wald test is whether the cost of capital declines from Pre to Post liberalization.

Table 5

The Impact of ADR and Country Fund Introduction on Volatility

A.Intro=ADRs

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	Intro
0.9	-0.0009	-0.1682	0.3579	0.000072	2.1823	0.1591	-0.3040	-0.1536	0.4079	-0.0194
	0.0440	0.1923	0.0545	0.000028	0.4860	0.2024	0.0917	0.1419	0.4005	0.0119
0.5	-0.0356	-0.2005	0.3617	0.000068	2.2269	0.2155	-0.3168	-0.2310	0.4493	0.0160
	0.0453	0.1921	0.0546	0.000028	0.4874	0.2033	0.0919	0.1428	0.4018	0.0360
0.1	-0.0530	-0.1836	0.3637	0.000069	2.2304	0.2379	-0.3180	-0.2678	0.4834	0.0764
	0.0444	0.1916	0.0547	0.000028	0.4853	0.2019	0.0913	0.1411	0.4024	0.0508

B. Intro=Country funds

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	Intro
0.9	-0.0556	-0.2575	0.3669	0.000069	2.1965	0.2277	-0.3128	-0.2558	0.4738	0.0161
	0.0478	0.1938	0.0552	0.000028	0.4780	0.2007	0.0899	0.1406	0.4036	0.0148
0.5	-0.0473	-0.2093	0.3693	0.000067	2.1725	0.2258	-0.3092	-0.2777	0.5026	0.0461
	0.0430	0.1898	0.0551	0.000028	0.4777	0.1994	0.0896	0.1430	0.4046	0.0348
0.1	-0.0464	-0.1848	0.3701	0.000066	2.1721	0.2314	-0.3094	-0.2725	0.5088	0.0765
	0.0421	0.1904	0.0551	0.000028	0.4786	0.1994	0.0899	0.1403	0.4045	0.0474

C. Intro=ADRs and Country Funds

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	Intro
0.9	-0.0318	-0.2186	0.3651	0.000069	2.1972	0.1993	-0.3129	-0.2241	0.4563	0.0019
	0.0468	0.1923	0.0550	0.000028	0.4801	0.2013	0.0903	0.1441	0.4033	0.0105
0.5	-0.0648	-0.1799	0.3739	0.000066	2.1547	0.2537	-0.3117	-0.3180	0.5498	0.0759
	0.0432	0.1892	0.0552	0.000028	0.4736	0.1987	0.0890	0.1420	0.4054	0.0325
0.1	-0.0616	-0.1450	0.3745	0.000065	2.1401	0.2577	-0.3121	-0.3000	0.5496	0.1232
	0.0425	0.1906	0.0552	0.000028	0.4746	0.1991	0.0895	0.1399	0.4049	0.0476

D. With Regulatory Liberalization Indicators

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	EARLY	PRE	DURING	POST	WaldTest
-0.1009	-0.2694	0.3793	0.000071	1.9823	0.1702	-0.3038	-0.2955	0.5720	-0.1431	-0.0655	-0.0420	0.0277	3.0083
0.0489	0.1919	0.0561	0.000028	0.4699	0.1934	0.0878	0.1385	0.4080	0.0677	0.0610	0.0584	0.0443	0.0829

E. With ADR, Country Fund and Regulatory Liberalization Indicators

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	EARLY	PRE	DURING	POST	WaldTest
-0.0707	-0.2164	0.3724	0.000068	2.0425	0.1671	-0.3078	-0.2670	0.5428	-0.1120	-0.0858	-0.0488	-0.0019	2.5019
0.0467	0.1922	0.0557	0.000028	0.4760	0.1980	0.0896	0.1407	0.4074	0.0635	0.0603	0.0582	0.0440	0.1137

F. With Cumulative Net Capital Flow Break Points

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	EARLY	PRE	DURING	POST	WaldTest
-0.0894	-0.1985	0.3833	0.000062	2.1840	0.2152	-0.2701	-0.3448	0.5949	-0.2244	-0.1640	-0.0512	0.0110	7.3179
0.0427	0.1901	0.0561	0.000028	0.4635	0.1923	0.0884	0.1397	0.4093	0.0735	0.0729	0.0731	0.0578	0.0068

In panels A-C, we estimate a time-series cross-sectional estimation with the fitted conditional volatility as the dependent variable. Lambda represents how fast the additional impact of further liberalizations declines. With low lambdas, additional issues generate almost no additional effect. The Intro variable is defined in the panel title. In panels D-F, we estimate a model with dummy variables around the liberalization definition. The Wald test is whether the volatility declines from Pre to Post liberalization. All variable definitions are presented in Table 3.

Table 6
The Impact of ADR and Country Fund Introduction on Correlation with World Market Returns

A. Intro=ADRs

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	Intro
0.9	0.00697	0.00065	-0.02262	-0.000001	-0.05773	-0.01004	0.01411	0.29348	-0.06885	-0.00190
	0.00641	0.02707	0.00544	0.000002	0.05050	0.02660	0.01460	0.02208	0.03846	0.00194
0.5	0.00701	-0.00174	-0.02242	-0.000001	-0.05803	-0.00989	0.01374	0.29552	-0.06960	-0.00614
	0.00643	0.02717	0.00541	0.000002	0.05068	0.02665	0.01469	0.02210	0.03840	0.00538
0.1	0.00627	-0.00150	-0.02243	-0.000002	-0.05819	-0.00977	0.01346	0.29277	-0.06955	-0.00586
	0.00640	0.02731	0.00543	0.000002	0.05075	0.02668	0.01472	0.02192	0.03844	0.00679

B. Intro=Country funds

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	Intro
0.9	0.00766	0.00128	-0.02269	-0.000001	-0.05564	-0.00966	0.01247	0.29576	-0.06991	-0.00334
	0.00646	0.02705	0.00543	0.000002	0.05056	0.02659	0.01459	0.02214	0.03844	0.00277
0.5	0.00500	0.00096	-0.02257	-0.000002	-0.05887	-0.00945	0.01285	0.29236	-0.06873	-0.00031
	0.00635	0.02712	0.00543	0.000002	0.05074	0.02667	0.01475	0.02214	0.03848	0.00520
0.1	0.00435	0.00163	-0.02237	-0.000002	-0.06033	-0.00911	0.01335	0.28929	-0.06726	0.00352
	0.00626	0.02712	0.00543	0.000002	0.05063	0.02666	0.01468	0.02188	0.03846	0.00629

C. Intro=ADRs and Country Funds

Lambda	NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	Intro
0.9	0.00756	0.00039	-0.02263	-0.000001	-0.05632	-0.01028	0.01319	0.29695	-0.06918	-0.00211
	0.00656	0.02706	0.00541	0.000002	0.05063	0.02664	0.01465	0.02239	0.03836	0.00186
0.5	0.00629	-0.00105	-0.02262	-0.000001	-0.05679	-0.01022	0.01236	0.29380	-0.06960	-0.00392
	0.00648	0.02726	0.00543	0.000002	0.05086	0.02669	0.01474	0.02205	0.03844	0.00508
0.1	0.00475	0.00148	-0.02245	-0.000002	-0.05926	-0.00949	0.01304	0.28953	-0.06796	0.00074
	0.00638	0.02732	0.00544	0.000002	0.05072	0.02666	0.01467	0.02179	0.03847	0.00642

D.With Regulatory Liberalization Indicators

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	EARLY	PRE	DURING	POST	WaldTest
0.00316	0.00157	-0.02284	-0.000002	-0.06184	-0.00909	0.01402	0.28644	-0.06996	-0.01069	-0.01417	-0.00967	-0.00240	2.2402
0.00647	0.02729	0.00551	0.000002	0.05075	0.02669	0.01480	0.02243	0.03889	0.01019	0.00925	0.00806	0.00598	0.1345

E. With ADR, Country Fund and Regulatory Liberalization Indicators

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	EARLY	PRE	DURING	POST	WaldTest
0.00318	0.00268	-0.02379	-0.000002	-0.06614	-0.00908	0.01401	0.28798	-0.07157	-0.00935	-0.01454	-0.00392	-0.00154	2.7488
0.00639	0.02710	0.00550	0.000002	0.05060	0.02650	0.01465	0.02203	0.03864	0.01002	0.00912	0.00794	0.00588	0.0973

F. With Cumulative Net Capital Flow Break Points

NUMC	CONCR	STDL2	INFL	FXV	XMGDP	CCR	MCAP	STDSTAR	EARLY	PRE	DURING	POST	WaldTest
0.00627	-0.00082	-0.02289	-0.000001	-0.05515	-0.00982	0.01175	0.29110	-0.07062	0.00649	0.00251	0.00078	-0.00409	0.5946
0.00636	0.02728	0.00547	0.000002	0.05074	0.02662	0.01468	0.02211	0.03866	0.01100	0.01013	0.00892	0.00673	0.4409

In panels A-C, we estimate a time-series cross-sectional estimation with the fitted conditional conditional correlations with the world market as the dependent variable. Lambda represents how fast the additional impact of further liberalizations declines. With low lambdas, additional issues generate almost no additional effect. The Intro variable is defined in the panel title. In panels D-F, we estimate a model with dummy variables around the liberalization definition. The Wald test is whether the correlation declines from Pre to Post liberalization. All variable definitions are presented in Table 3.