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The dynamics of emerging market equity flows

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Abstract

We study the interrelationship between capital flows, returns, dividend yields and world interest rates in 20 emerging markets. We estimate a vector autoregression with these variables to measure the degree to which lower interest rates contribute to increased capital flows and shocks in flows affect the cost of capital among other dynamic relations. We precede the VAR analysis by a detailed examination of endogenous break points in capital flows and the other variables. These structural breaks are traced to the liberalization of emerging equity markets. Our evidence of structural breaks calls into question past research which estimates VAR models over the full sample. After a liberalization, we find that equity flows increase by 1.4% of market capitalization. We also show that shocks in equity flows initially increase returns which is consistent with a price pressure hypothesis. While the effect is diminished over time, there also appears to be a permanent impact. This is consistent with our finding that our proxy for the cost of capital, the dividend yield, decreases. Finally, our analysis of the transition dynamics from pre-liberalization to post-liberalization suggests that when capital leaves, it leaves faster than it came in. These results may help us understand the dynamics of the recent crises in Latin America and East Asia. © 2002 Published by Elsevier Science Ltd.

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1. Introduction

With a number of recent crises in emerging markets, the role of foreign capital in developing countries is under intense scrutiny once again. One country, Malaysia, imposed capital controls on October 1, 1998, in an effort to thwart the perceived destabilizing actions of foreign speculators. After a decade of capital market liberalizations and increased portfolio flows into developing countries, this process may now be stalled or even reversed. The goal of this paper is to explore the dynamics, causes and consequences of capital flows in 20 emerging markets over the last 20 years. Importantly, we explicitly investigate the role of the recent financial liberalization process in these dynamics.

Our work is related to two literatures. First, there is a growing body of research that studies the joint dynamics of capital flows and equity returns [see for example, Warther, 1995; Choe et al., 1999, Froot et al., 2001; Clark and Berko, 1997; Edelen and Warner, 1999; Stulz, 1999]. The first hypothesis of interest is whether foreign investors are "return chasers", in the terms of Bohn and Tesar (1996), that is, are flows caused by changes in expected returns? A related hypothesis is that international investors are momentum investors, leading to a positive relation between past returns and flows. The second set of hypotheses focuses on the effect of flows on returns. Both Froot et al. (focusing on 28 emerging markets) and Clark and Berko (focusing on Mexico) find that increases in capital flows raise stock market prices, but the studies disagree on whether the effect is temporary or permanent. If the increase in prices is temporary, it may be just a reflection of "price pressure", which has also been documented for mutual fund flows and stock indices [Warther, 1995; Shleifer, 1986]. If the price increase is permanent, it may reflect a long-lasting decrease in the cost of equity capital associated with the risk sharing benefits of capital market openings in emerging markets.

Our work is also related to a second literature on capital market liberalizations and the integration process in emerging markets [see Bartolini and Drazen, 1997; Bekaert and Harvey, 1995, 2000a,b; Henry, 2000a,b; Kim and Singal, 2000]. During the sample period, many emerging markets removed capital controls, which often went hand in hand with other reforms in the domestic financial system, trade liberalization, macro-economic stabilization programs (especially in Latin-America) and large scale privatizations [see Bekaert and Harvey, 2000b for detailed time lines on important structural changes in emerging countries]. These structural changes complicate any empirical analysis of emerging markets during this period, since they could cause permanent or at least long-lasting changes in the data-generating processes. In Bekaert et al. (2002), we use the structural break methodology of Bai, Lumsdaine, and Stock (hereafter BLS) (1998) to "date" when market integration occurred and document structural changes in a number of financial and economic time-series.[1]

[1] Kawakatsu and Morey (1999) also use endogenous break point techniques to date stock market openings and examine stock market efficiency before and after the opening.

The main tool of analysis in this paper is a vector-autoregressive (VAR) framework as in Froot et al. (2001), but with a number of differences. First, we add two variables to the bivariate set-up of returns and equity flows in Froot et al.: the world interest rate and local dividend yields. The low level of US interest rates has often been cited as one of the major reasons for increased capital flows to emerging markets in 1993 [see World Bank, 1997; as well as Calvo et al. (1993, 1994) and Fernandez-Arias, 1996] and our framework will allow us to trace out the effects of an unexpected reduction in world interest rates on capital flows to emerging markets. We are ultimately interested in the effects of structural reforms in emerging markets on local returns and particularly, on the local cost of capital. The inclusion of the world interest rate helps in that endeavor in that it removes the effect of exogenous global determinants of capital flows. We add dividend yields to the VAR as our cost of capital measure, since they capture potential permanent price effects induced by increased foreign capital after liberalizations better than average returns [see Bekaert and Harvey, 2000a] and they also serve as an indicator of expected returns allowing differentiation of the 'return chasing' and 'momentum investing' hypotheses.

Second, we precede our VAR analysis with a detailed endogenous break point analysis of our three main time series (net equity flows as a proportion of local market capitalization, log returns and the log dividend yield) using the novel techniques in BLS (1998) and Bai and Perron (1998a,b). This analysis helps pin down a relevant time-period over which to conduct the VAR analysis but is also interesting in its own right. For example, we study the transition dynamics of some of our variables around the break points. Such analysis is particularly important given that recent events in South-East Asia indicate that the integration process may now be halted and reversed. Studying capital flow dynamics and their impact on the local market may therefore yield predictions for the likely effects of the recent re-imposition of capital controls in some countries. Also, if capital market liberalizations induce one-time portfolio rebalancing on the part of global investors, one may expect net flows to increase substantially after a liberalization and then to decrease again [see Bachetta and van Wincoop (2000) for a formal model generating such dynamics]. The Bai-Perron statistics look for multiple breaks in a time series and may uncover such dynamics. We also test this prediction directly.

Third, although equity flows are our main focus, we also investigate how they relate to bond flows. For example, increased equity flows may substitute for decreased bond flows or both may increase simultaneously as a result of a general financial liberalization package.

We find that equity capital flows increase after liberalization but level out three years after their liberalization. This provides evidence that foreign investors rebalance their portfolios towards the newly available emerging market assets. Our analysis of the transition dynamics suggests that the movement of equity capital is much faster when it leaves than when it enters. In general, we find sharply different results if our models are estimated over the entire sample—which ignores a fundamental non-stationarity in the data—versus a post-break (liberalization) sample. One of our main findings is that unexpected equity flows are indeed associated with strong short-lived increases in returns. However, we also find that they lead to permanent reductions

in dividend yields. As we explain later, the dividend yield change may reflect a change in the cost of capital. Hence, the reduction in the dividend yield suggests that additional flows reduce the cost of capital and that the actual return effect is not a pure price pressure effect.

The paper is organized as follows. The second section presents the vector autoregressive empirical model that we use to interpret the relation between expected returns, dividend yields and capital flows. The third section explores the methods that we use to establish structural breaks in the time-series of interest. The fourth section describes the data. The results are presented in the fifth and sixth sections. The final section offers some concluding remarks.

2. The econometric framework

2.1. Variables and main hypotheses

Since there is currently no well-accepted model of transition dynamics around a liberalization, we conduct our empirical analysis in the context of vector autoregressions (VARs). For part of our analysis, these VARs are reduced-form representations of an unspecified structural model, but some of the empirical hypotheses we want to test require a structural interpretation of the VARs. In our primary empirical system, we generalize the set-up of Froot et al. (2001), who run a bivariate VAR on the ratio of net capital flows to market capitalization and market returns. Their main identifying structural restriction is that the shock to flows may affect returns but not vice versa. In addition, past returns only affect current returns through their effects on flows. Two interesting questions can be investigated in this framework:

1. *What is the effect of an unexpected shock to capital flows on current returns and what are its dynamics (that is, does it die out or is it permanent)?* The dynamic effects of the shock serve to distinguish the price pressure hypothesis from the permanent change in the cost of capital hypothesis.
2. *Do past returns affect current capital flows?* In particular, Bohn and Tesar (1996) argue that capital flows are motivated by capital "chasing" high expected returns, rather than portfolio rebalancing motives. One issue here is that high past returns need not signal high future returns, unless momentum is an important determinant of expected return (see Bohn and Tesar (1997). In our framework, we will be able to distinguish the expected return-updating hypothesis from the momentum hypothesis.

In contrast to previous work, our primary VAR will contain four variables. Let $\mathbf{Y}_t = [i_t, nf_t, dy_t, r_t]'$, where i_t is the world interest rate, nf_t is the net equity capital flow divided by market capitalization, dy_t is the log-dividend yield and r_t is the logged equity return.

The presence of the world interest rate allows a more subtle testing of the hypotheses in (1). It has often been argued that the emerging markets received a lot of US

capital in 1993 because investors were chasing higher yielding assets with interest rates in the US reaching historical lows. It should be mentioned that there may be good reasons for an inverse link between US interest rates and capital flows to emerging markets. For example, the low US interest rates may have increased the Americans' wealth and therefore increased their risk tolerance, leading them to rebalance towards riskier emerging market securities. Whatever the reason, our framework will allow a direct test of the magnitude and dynamics of a decrease in the world interest rate on capital flows to emerging markets.

With the world interest rate in the system, we can now divide the effect of higher capital flows on returns into two components. Capital flow increases induced by lower world interest rates may, for example, be less likely to lead to permanent price increases than capital flow increases that are not caused by world factors, but also may reflect portfolio rebalancing after a capital market liberalization.

The addition of the log-dividend yield is motivated by the work of Bekaert and Harvey (2000a). They argue that the extreme volatility in emerging market returns implies that changes in the cost of capital can be better assessed by investigating changes in dividend yields. In any rational pricing model, dividend yields will be decreasing in the growth rate of dividends (cash flows) and increasing in the discount rate. Because of their low variability, dividend yields will capture permanent price effects induced by cost of capital changes more accurately than average returns. Bekaert and Harvey document that liberalizations tend to lead to small drops in dividend yields. One problem is that a lower dividend yield may also reflect an improvement in growth opportunities. Nevertheless, our set-up will allow us to test the effect of a change in the world interest rate, and/or capital flows on the dividend yield in emerging markets and contrast that with the effect on returns. In addition, given that the dividend yield is a good proxy for expected returns, which is also borne out in the predictability tests for emerging markets by Harvey (1995), its inclusion allows for a proper test of the Bohn-Tesar hypotheses mentioned above.

To perform tests of the main hypotheses, we use impulse response analysis based on a structural interpretation of the VAR. Consider, without loss of generality, a first-order VAR, suppressing the constant:

$$\mathbf{Y}_t = \mathbf{A}\mathbf{Y}_{t-1} + \varepsilon_t, \tag{1}$$

with all eigenvalues of **A** having moduli less than one so that the VAR is stationary.

We compute impulse responses, $IR(i,j,k) = \partial \mathbf{e}'_i \mathbf{Y}_{t+k} / \partial \varepsilon^*_{t,j}$, where $\varepsilon^*_{t,j}$ are the "structural" shocks and $\mathbf{e}_i$ is an indicator variable selecting the ith variable, e.g. $\mathbf{e}_1 = [1,0,0,0]$. We look at one standard deviation shocks. The structural shocks, $\boldsymbol{\varepsilon}^*_{t,j}$, are determined by the ordering in the VAR, that is, $\varepsilon_t = \mathbf{P}'\varepsilon^*_t$, where **P** is an upper-triangular matrix and ε^*_t are uncorrelated structural shocks, such that $\Sigma = E[\varepsilon_t \varepsilon'_t] = \mathbf{P}'\mathbf{P}$.

The ordering of the variables is as defined above, with the world interest rate coming first. Hence, the world interest residual is implicitly assumed not to be affected by the other shocks in the system. As in Froot et al. (2001), we order flows before returns, but we insert the dividend yield in the middle. Dividend yields and returns are contemporaneously negatively correlated, but a shock to the dividend

yield may reflect a near-permanent price change due to the liberalization process or a change in expected returns, and it is therefore natural to order dividend yields before returns. We are interested in:

1. the effects of the world interest rate, i_t, on the ratio of net capital flows to market capitalization, returns and dividend yields,
2. the impact of flows on returns and dividend yields to test the price pressure versus permanent impact hypotheses, and
3. the effect of past returns and dividend yields on flows to test 'return chasing' and 'momentum investing'.

For this last response, our setup removes the contemporaneous correlation between returns or dividend yields and flows, ascribed potentially to price pressure effects, because flows are ordered before these two variables. For example, a shock to the dividend yield not contemporaneously correlated with capital flows may reflect a change in growth opportunities or a change in expected returns which may affect future foreign capital inflows.

We also report impulse responses of shocks to the world interest rate, current capital flows, returns, and dividend yields on two cumulative variables: the average long-run return and the change in US holdings.

First, we define $r_{t+k,k} = \frac{1}{k}\sum_{i=0}^{k-1} r_{t+1+i}$ as the per period cumulative long-horizon return. Next, consider the definition of net capital flows to capitalization:

$$nf_t = \frac{f_t}{mcap_t},$$

where f_t is the net capital flow and $mcap_t$ is the equity market capitalization. The cumulative capital flow to market capitalization is:

$$\begin{aligned} cf_{t,t+k} &= \sum_{i=1}^{k} nf_{t+i} \\ &= \frac{f_{t+1}}{mcap_{t+1}} + \ldots + \frac{f_{t+k}}{mcap_{t+k}} \\ &= \frac{1}{mcap_{t+k}}\left[f_{t+1} \times \frac{mcap_{t+k}}{mcap_{t+1}} + \ldots + f_{t+k}\right]. \end{aligned}$$

So, $cf_{t,t+k}$ accumulates the flows occurring between t and $t+k$ and allows each flow to change value as a result of the market return.

Now consider the definition of the cumulative holdings in the local market:

$$h_t = \left[\sum_{i=0}^{t} f_i \frac{mcap_t}{mcap_i}\right]\frac{1}{mcap_t}$$
$$= \sum_{i=0}^{t}\frac{f_i}{mcap_i}$$
$$= \sum_{i=0}^{t} nf_i.$$

So holdings accumulate the flows from the beginning of time (notice the counter begins at $i = 0$) allowing for the market return and express them as a proportion of current market capitalization. From this analysis, it is immediate that

$$cf_{t,t+k} = h_{t+k} - h_t,$$

is the change in holdings. Whereas impulse responses on the VAR variables die out in any stationary VAR, these cumulative effects represent the permanent effect on returns and capital flows when we let k go to infinity.

2.2. VAR dynamics

Before we test the main hypotheses, we document the information in the VARs regarding the dynamic relations between our four variables using two different statistics.

First, we investigate dynamic regression coefficients between the various variables, for example, what is the correlation between world interest rates today and capital flows or returns in the future? Formally, we investigate:

$$\beta_{i,j,k} = \frac{Cov\,[\mathbf{e}'_i\mathbf{Y}_{t+k},\, \mathbf{e}'_j\mathbf{Y}_t]}{Var[\mathbf{e}'_j\mathbf{Y}_t]}, \tag{2}$$

where $\mathbf{e}_i$ are indicator vectors, e.g. $\mathbf{e}_1 = [1,0,0,0]$.

Given that the VAR is stationary, $\mathrm{Var}[\mathbf{Y}_t] = \mathbf{C}(0)$ can be computed as

$$Vec[\mathbf{C}(0)] = [\mathbf{I} - \mathbf{A}\otimes\mathbf{A}]^{-1} vec(\Sigma), \tag{3}$$

where $\Sigma = E[\varepsilon_t\,\varepsilon'_t]$ and $\mathbf{I}$ is the identity matrix. The VAR fully summarizes the short-run and long-run dynamics of $\mathbf{Y}_t$; e.g.

$$E[\mathbf{Y}_t\mathbf{Y}_{t-k}] = \mathbf{C}(k) = \mathbf{A}^k\mathbf{C}(0). \tag{4}$$

With this information, projection coefficients at all horizons can be computed.

With the long-run variables introduced above, changes in holdings and long-run returns, we can investigate the relation between these variables on the one hand and world interest rates and capital flows on the other hand. For example, we compute:

$$\gamma_k = \frac{Cov\,[r_{t+k,k},\, nf_t]}{Var[nf_t]} = \frac{\frac{1}{k}\mathbf{e}_4'[\mathbf{I} + \mathbf{A} + \ldots + \mathbf{A}^{k-1}]\mathbf{C}(0)\mathbf{e}_2'}{\mathbf{e}_2'\mathbf{C}(0)\mathbf{e}_2}, \tag{5}$$

where $\mathbf{e}_2$ ($\mathbf{e}_4$) are indicator variables selecting flows (returns). Also, $[\mathbf{I}+\mathbf{A}+\ldots+\mathbf{A}^{k-1}] = [\mathbf{I}-\mathbf{A}^k][\mathbf{I}-\mathbf{A}]^{-1}$. We can also let k go to infinity here. Analogously, we can investigate the long-run beta of changes in holdings with respect to current interest rates, returns and dividend yields.

Second, whereas the regression coefficients provide useful summary information, they are univariate relations that may hide intricate dynamic patterns. For example, there may be a positive relation between current capital flows and future returns, but part of this correlation may come indirectly through the effect of world interest rates on capital flows. It would be interesting to see whether there is still a relation between capital flows and future returns, controlling for the world interest rate effect. Similarly, are capital flows mostly predictable by external variables like world interest rates, or by internal variables (returns and dividend yields) that may proxy for expected returns for example? This question has been addressed before [see Calvo et al., 1993, 1994; and Fernandez-Arias, 1996], but in the context of our VAR it is particularly simple to implement. We conduct a series of Granger-causality tests, testing whether world interest rates Granger-cause the other variables, and whether returns and dividend yields Granger-cause capital flows or vice versa. If liberalization is a gradual process and is pre-announced, dividend yields may decrease and returns temporarily increase before flows pick up. In this case, returns and dividend yields may Granger-cause flows. Hence, it may be hard to distinguish this effect from momentum investing (positive feedback trading), since this would also imply that positive returns predict higher flows.

2.3. The dynamics of capital flows and breaks

It does not make much sense to conduct this analysis over the full sample of data, given that many of the markets that we study may have undergone an integration process somewhere in the middle of the sample. If the market truly went from segmented to integrated, the dynamics of all the variables in our VAR except the world interest rate would be affected. Consider Fig. 1 which sketches what a standard model of risk sharing [see the description in Bekaert et al., 2002] would predict, namely "a permanent change in prices leading to a new regime of lower expected returns". Interestingly, this process is associated with short-term increases in returns (the return to integration) and long-run decreases in expected returns, plus a permanent decrease in dividend yields. This pattern would more generally result from "investor base broadening", the spreading of risks among more investors (see Stulz, 1999, for a summary of the scarce evidence to date on this). If flows drive prices temporarily away from fundamentals, the price effect ought to be temporary ("the price pressure hypothesis"). This behavior can be examined in the context of our

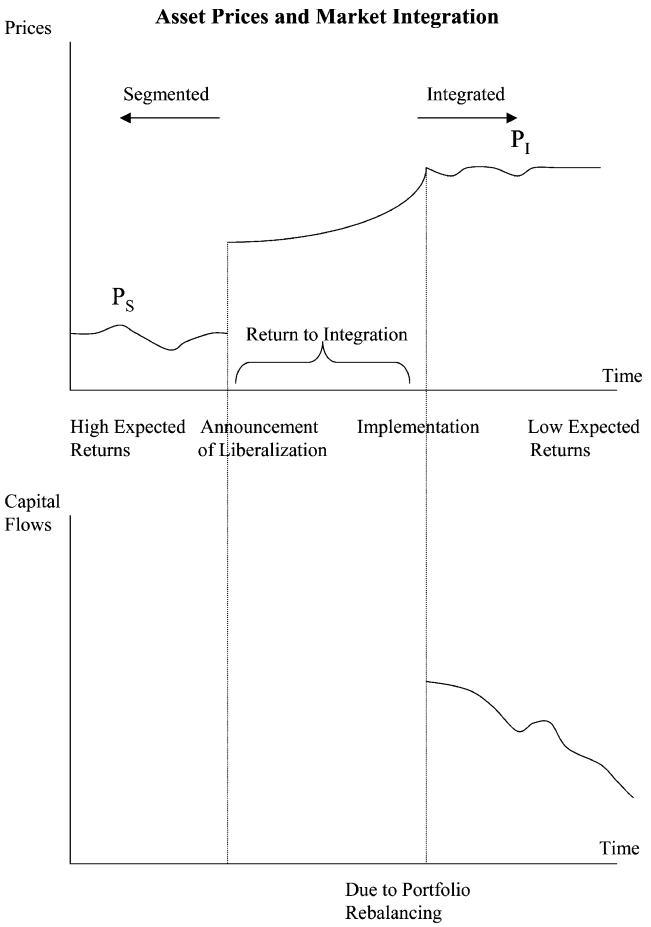

Fig. 1. Asset prices and market integration.

VAR by contrasting the effects of capital flows on r_t, $r_{t+k,k}$ and dy_t. We expect a positive (negative) contemporaneous relation between returns (dividend yields) and unexpected flows that is permanent under the first but transitory and reversed under the second hypothesis.

Fig. 1 also suggests a potential scenario for capital flows. Flows are of course virtually zero before the liberalization. After the liberalization, which may be gradual, large inflows occur as foreign investors include the emerging market into their portfolios. However, once the rebalancing is accomplished, net flows need no longer be positive. Bachetta and van Wincoop (2000) model the dynamics of capital flows by allowing for a gradual decrease in a tax on investments into an emerging market and show how capital flows can over-shoot. Of course, this is a simple story and there are many competing models for the behavior of emerging market capital flows

including models that predict a foreign lending boom followed by the inevitable crash! [see, for example, Calvo and Mendoza, 1998.]

To deal with this problem, we apply the most recent methodology on break date inference. We first apply the methodology developed in BLS to all of our univariate series, and also use it to determine a break date for the joint system. This break point analysis then determines the post-break period to which we will apply our VAR analysis described above. The break point analysis also reveals a period of transitions and the transition dynamics are of interest in their own right.

A disadvantage of the BLS methodology is that it only allows for one break. There are a number of reasons why there may be more than one break especially in the net flows series. As indicated above, flows may be temporarily high to effect a portfolio rebalancing after capital market integration. There may be a second break at the end of this process. Recently, we have seen a reversal of capital flows with a number of well-publicized crises in Mexico 1994–1995, and in South-East Asia in 1997–98. Even much before this, the debt crisis may have caused some Latin American markets to become effectively segmented from the rest of the world, although capital flows before then were small. Therefore we also apply the techniques of Bai and Perron (1998a,b) which allow for multiple breaks, but only apply to univariate series. Additional details are presented in the econometrics section.

We also investigate the dynamics of capital flows around a potential liberalization break using a very simple regression procedure. If the capital flow story of Fig. 1 is accurate, mean equity flows should be higher after the break than before, but decrease again after portfolio re-balancing is completed. In other words, let $D1_t$ be a dummy that comes on after the break and $D2_t$ the dummy that comes on three years after the break, then in the regression

$$nf_t = a + bD1_t + cD2_t + e_t, \tag{6}$$

we would find b to be positive, and c to be negative. We choose three years because of the time it takes from announcement to effective implementation of a market liberalization. Bekaert and Harvey (2000a) provide evidence that liberalizations are often gradual.

Finally, to examine the transition dynamics, we compute a statistic we call the "transition half-life statistic" (THL). The THL statistic is measured as follows. Consider the point in time at which the break occurs and imagine the current realization of the variable is at the unconditional mean *before* the break. Now consider forecasting k periods in the future using the new dynamics. If the VAR is stationary, eventually the forecasts will reach the new unconditional mean. How fast they will get there depends on the persistence of the system and how far away the post-break mean is from the starting point (pre-break mean). Our THL statistic records the time it takes (in months) to reach half the distance between old and new mean. We can also reverse the computation. That is, we compute the THL statistic starting from the new mean going to the old mean using the pre-break dynamics. Comparing the two statistics is informative about the different dynamics before and after the break. We will compute this statistic for capital flows and dividend yields. For capital flows, a bold interpretation of the pre-break THL statistic is that it reveals something about

how capital flows will react when the integration process is reversed, as is recently happening in a few countries. We do not compute the THL statistic for returns, because we conjecture that the measurement of mean returns is too noisy to make the computation valuable.

3. Data

Our data consists of capital flows, interest rates, dividend yields, and returns. Our source of monthly data on capital flows is the US Treasury International Capital (TIC) reporting system.[2] For the 20 emerging markets we study, we are able to calculate the net US flows for stocks and bonds for 17 countries. The Treasury does not track data on Jordan, Nigeria, and Zimbabwe. We use the International Finance Corporation's Emerging Markets Database as a source of the US dollar returns and the dividend yields. The world interest rate is constructed as a GDP weighted average of the short-term government Treasury bills in the G-7 countries.[3] The interest rate and GDP data are from Datastream.

With so many countries and relatively small sample periods, a country by country analysis may both lack power and prevent us from presenting the results in an intelligible way. Therefore we present most of our results using country groupings. We use three different types of groupings. The first set is aimed primarily at noise reduction. We aggregate results over all countries with three weighting schemes: equally weighted, value weighted (using the market capitalization of the equity market from the IFC) and volatility weighted. The volatility weighting constructs weights using the inverse of the sum of squared residuals of all the regressions in the VAR for a particular country relative to the inverse sum of the squared residuals over all countries. Hence, the "noisiest" VARs are down-weighted. Before applying this procedure, we re-scaled the residuals, so that at a global, all-country level, capital flows accounted for 40% of the total variance, returns and dividend yields each 25%, and interest rates, 10%. If the coefficients (like impulse responses) are independent across countries, this aggregation would lead to a reduction of the typical country-specific standard error by a factor of over four, since there are 17 countries in our sample. Hence, even if the country-specific standard errors are double the size of the coefficients, we would obtain significance.

The second grouping is geographical. We contrast the results for six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela) and six Asian countries (Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand). Although these results may be sensitive to country-specific outliers, the contrasts between the development models of Latin-America and South-East Asia and the recent crises in both areas make this grouping meaningful.

[2] See Tesar and Werner (1994, 1995) for a description and analysis of these data.

[3] See the data appendix for additional details on the construction of the dividend yields and the world interest rate.

Our last groupings focus on the characteristics of capital flows. Table 1 summarizes some of the characteristics we use in the selection process. First, we investigate the magnitude of equity and bond flows. We calculate the return-adjusted cumulative equity flows divided by market capitalization. This is a measure of US ownership in the country. We present average ownership over the full sample as well as the 1990s. The largest average ownership is found for Mexico (since 1990) followed by Brazil and Argentina. The country with the largest average ownership in Asia is Thailand in the 1990s. To allow comparison with bond flows, where return adjustments and market capitalizations are not available, we also calculate the cumulative equity flows to GDP without return adjustments. In this analysis, Mexico, Chile and Malaysia have the largest cumulative U.S. equity flows to GDP. Bond flows to GDP are presented in the next column. The highest averages of the cumulative bond flows to GDP are found in Mexico, Venezuela and Argentina. Clearly, cumulative net bond flows are much smaller than equity flows. By adding cumulative equity and bond flows, we obtain a measure of total external financing through portfolio capital. We also report sample averages and averages in the 1990s. There are two countries with net negative external financing, Chile and Taiwan, both, not surprisingly, countries with stringent capital controls. Mexico, Venezuela and Malaysia have the highest external financing to GDP. Generally, both equity and bond flows are larger in the nineties than for the full sample, and total external financing is larger in the nineties for 15 out of 17 countries.

We now consider different groups of countries based on this information for the 1990s sample. First, we rank the countries according to the importance of external finance. In addition to the three countries previously mentioned (Mexico, Venezuela and Malaysia), we add Argentina, Brazil and Korea to the top group. The bottom six countries are, in addition to Chile and Taiwan, India, Greece, the Philippines and Pakistan, all with less than 0.35% of GDP in external financing through US bond and equity flows.

Finally, we want to select countries that primarily rely on equity capital and countries that primarily rely on fixed income. This is not trivial to do, since for some countries the absolute flows may be very small and, in particular, for bonds, they may be negative. Our approach was to rank countries based on the difference between the average cumulative post-1989 equity and bond flows to GDP. The bottom six countries are deemed bond-reliant, the top six equity reliant. We exclude countries when they do not place in the top 10 ranked according to cumulative bond flows or cumulative equity flows to GDP, respectively. The countries relying primarily on equity are Chile, the Philippines, Malaysia, Portugal, Thailand and Korea. We excluded Taiwan because of its insignificant absolute equity flows. Although Mexico, Brazil and Argentina are top countries in terms of equity flows to GDP, they appear in the fixed income group because of their substantial positive fixed income flows. The other three countries are Venezuela, Pakistan, and Indonesia. Because of the relative non-importance of bond flows in general, it is possible that countries grouped in the “rely on bonds” category receive more equity than bond capital.

At the bottom of the table, we present country groupings. We find that Latin American countries tend to have high US equity ownership. Asian countries have

Table 1
Summary analysis of net equity flows and net bond flows

Country	Average of cumulative equity flows/equity capitalization		Average of cumulative equity flows/GDP		Average of cumulative bond flows/GDP		Average of total cumulative external financing to GDP		Equity flow and bond flow correlation	H_0: Equity flows do not Granger cause bond flows	H_0: Bond flows do not Granger cause equity flows
	Full	Post-1990	Full	Post-1990	Full	Post-1990	Full	Post-1990		P-value	P-value
Argentina	0.0093	0.0837	0.0035	0.0090	0.0040	0.0104	0.0074	0.0194	0.055	0.558	0.114
Brazil	0.0519	0.1271	0.0037	0.0093	0.0030	0.0077	0.0067	0.0170	0.013	0.000	0.165
Chile	0.0233	0.0578	0.0090	0.0226	−0.0326	−0.0642	−0.0236	−0.0416	−0.049	0.036	0.897
Colombia	0.0137	0.0323	0.0017	0.0044	−0.0001	0.0022	0.0015	0.0065	0.189	0.000	0.000
Greece	0.0012	0.0173	0.0008	0.0023	−0.0009	−0.0009	−0.0001	0.0014	0.046	0.262	0.019
India	0.0048	0.0112	0.0008	0.0019	−0.0010	−0.0009	−0.0002	0.0011	0.195	0.000	0.000
Indonesia	0.0302	0.0764	0.0027	0.0069	0.0023	0.0058	0.0050	0.0127	−0.007	0.834	0.181
Jordan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Korea	0.0417	0.0781	0.0037	0.0088	0.0016	0.0056	0.0053	0.0144	0.071	0.000	0.000
Malaysia	0.0115	0.0263	0.0088	0.0210	−0.0058	0.0004	0.0030	0.0214	−0.135	0.996	0.763
Mexico	0.1186	0.2411	0.0104	0.0253	0.0196	0.0466	0.0300	0.0719	0.103	0.973	0.000
Nigeria	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Pakistan	0.0058	0.0148	0.0007	0.0018	0.0006	0.0014	0.0012	0.0032	0.110	0.000	0.100
Philippines	0.0176	0.0444	0.0046	0.0115	−0.0052	−0.0101	−0.0006	0.0014	0.035	0.832	0.998
Portugal	0.0284	0.0701	0.0028	0.0070	−0.0016	−0.0033	0.0012	0.0037	0.043	0.000	0.002
Taiwan	0.0010	0.0020	0.0001	0.0004	−0.0110	−0.0278	−0.0109	−0.0274	0.022	0.973	0.953
Thailand	0.0320	0.0667	0.0026	0.0059	−0.0005	−0.0001	0.0021	0.0058	−0.063	0.013	0.001
Turkey	0.0188	0.0477	0.0010	0.0028	0.0003	0.0010	0.0014	0.0038	−0.169	0.611	0.441
Venezuela	−0.0049	−0.0091	0.0004	0.0011	0.0139	0.0327	0.0144	0.0338	0.0070	0.990	0.892
Zimbabwe	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(*continued on next page*)

Table 1 (*continued*)

Country	Average of cumulative equity flows/equity capitalization		Average of cumulative equity flows/GDP		Average of cumulative bond flows/GDP		Average of total cumulative external financing to GDP		Equity flow and bond flow correlation	H_0: Equity flows do not Granger cause bond flows	H_0: Bond flows do not Granger cause equity flows
	Full	Post-1990	Full	Post-1990	Full	Post-1990	Full	Post-1990		P-value	P-value
Full	0.0238	0.0581	0.0034	0.0083	−0.0008	0.0004	0.0026	0.0087	0.027		
Asia	0.0223	0.0490	0.0037	0.0091	−0.0031	−0.0044	0.0006	0.0047	−0.013		
Latin	0.0353	0.0888	0.0048	0.0119	0.0013	0.0059	0.0061	0.0178	0.053		
Rely on stocks	0.0257	0.0572	0.0052	0.0128	−0.0073	−0.0119	−0.0021	0.0009	−0.016		
Rely on bonds	0.0352	0.0890	0.0036	0.0089	0.0072	0.0174	0.0108	0.0263	0.047		
Top external	0.0380	0.0912	0.0051	0.0124	0.0060	0.0172	0.0111	0.0296	0.019		
Bottom external	0.0089	0.0246	0.0027	0.0067	−0.0083	−0.0171	−0.0057	−0.0103	0.060		

Full represents an equally-weighted average across all countries. Asia is an equally-weighted average across six Asian countries (Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand), and Latin is equally-weighted average across six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela). We also report equally-weighted across the six countries that rely most on equity financing (Chile, the Philippines, Malaysia, Portugal, Thailand and Korea), equally-weighted across the six countries that rely most on bond financing (Venezuela, Mexico, Argentina, Pakistan, Indonesia and Brazil), equally-weighted across the six countries that have the highest proportion of external financing, that is, the bond plus equity capital flows to GDP (Mexico, Malaysia, Venezuela, Argentina, Brazil and Korea) and the six countries with the lowest proportion of external financing to GDP (Chile, Taiwan, Pakistan, the Philippines, Greece and India). The correlations are estimated over the full sample. The break dates for each country are presented in Table 2. The Granger-causality tests are from a bivariate VAR of equity returns and bond returns estimated over the full sample.

had sharply negative bond outflows in the 1990s perhaps due in part to the Asian crisis. Latin American countries tend to rely more on equity financing than Asian countries. The countries grouped in the "relying on bonds" category are generally countries that heavily rely on external portfolio capital, including equity capital. As a proportion of market capitalization, these countries have higher U.S. holdings than the "stock reliant" countries.

Table 1 presents some additional information on the relation between bond and stock flows. Given that our analysis focuses on equity flows, it is important to know whether bond flows are substitutes for equity flows. We present the correlation of the net capital flows which is, in general, small. The highest correlation is found for India and Colombia. The largest negative correlations are found for Turkey and Malaysia. In the majority of the countries, the correlation is positive, and of the five negative correlations, three are in South-East Asian countries.

We also present Granger-causality tests based on a bivariate system of stock flows to market capitalization and bond flows to GDP. We can reject the hypothesis at the 5% level that equity flows do not Granger-cause bond flows in Brazil, Chile, Colombia, India, Korea, Pakistan, Portugal and Thailand. We can reject the hypothesis at the 5% level that bond flows do not Granger-cause equity flows in Colombia, Greece, Indonesia, Korea, Mexico, Portugal and Thailand. Hence, there are five countries for which there are significant predictive relations in both directions, potentially suggesting the effect of a third variable on general capital flows or persistence in capital flows after a capital market liberalization. There is no support for a consistent pattern where bonds always lead equity (or vice versa) or where bonds and equity are clear substitutes.

Fig. 2 presents the results from the impulse response analysis based on the bivariate VAR. We examine value- and equally-weighted impulse responses as well as the regional groupings. There are two interesting observations. First, positive shocks to stock (bond) flows are followed by positive responses in bond (stock) flows. Again, this is potentially consistent with gradual portfolio rebalancing towards emerging markets in general (both equities and bonds, after a capital market liberalization or induced by changes in world interest rates, for example). Second, notice the distinction between Latin America and Asia. A shock to equity flows in Latin America has a much larger short-term impact on bond flows than it does in Asia. Moreover, there is an initial slightly negative effect of bond flows on stock flows in Latin

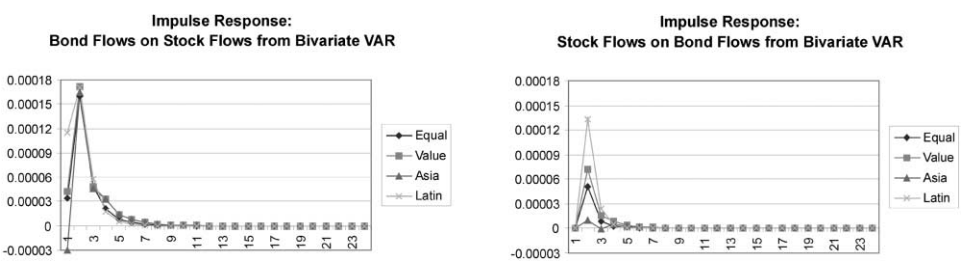

Fig. 2. The relation between net bond and net equity flows.

America whereas the effect in Asia is positive. From the second period onwards, the effects are positive and very similar in magnitude across the two regions. From both graphs, it is clear that the effects die out within six months. We also conducted a break point analysis of bond and equity flows. In the countries that experienced significant breaks in equities and bond capital flows, the break in bonds preceded the break in equities in four countries (Argentina, Korea, Malaysia and Thailand). The break in equities preceded the break in bonds in five countries (Brazil, Colombia, Greece, India and the Philippines). With the exception of one country, the Philippines, the equity and bond breaks are clustered closely in time for all of these countries.[4]

Taken together, our results suggest that bond and equity flows are not substitutes but both increased in the nineties with the liberalization process.

4. Breaks and initial pre and post-break analysis

4.1. Break analysis

To select an appropriate break date for use in subsequent analysis, we rely on several pieces of information. First, we use the results of the univariate break analysis for three series: returns, dividend yields and net equity flows. We compute the median break date, the 90% confidence interval for the date in months as well as a statistic that provides a test of the null hypothesis that no break occurred. Detailed results on all break tests are reported in Appendix Tables 1–3.

Second, we conduct a multivariate analysis of breaks using the BLS framework. We investigate three specifications. The first is a trivariate system with equity capital flows, dividend yields and returns. The second specification is a quadravariate system that includes an equation for the world interest rate. However, the coefficients in the world interest rate equation are not allowed to break in the estimation but the dependence of the other variables in the system on the world interest rate may break. The third specification adds the bond capital flows to the system of equations to see if the breaks we find are affected by this addition. For 13 of the 17 countries, the multivariate breaks fall within the range of the univariate breaks for either bond or equity flows. For four countries, (Greece, Mexico, Portugal and Taiwan), the break dates correspond to the break dates in dividend yields or returns, but the confidence intervals for the breaks are always tighter in the multivariate estimation consistent with what the theory would predict. Finally, the break dates from the three multivariate systems are very close to each other.

Third, we conduct the Bai-Perron tests that allow for multiple breaks. In a number of countries more than one break occurs. For example, in the dividend yield estimation for Mexico there are three significant breaks: January 1983, July 1986 and March 1991. The first date closely follows the onset of the Latin American debt

[4] See Appendix Table 1.

crisis. The second date closely follows the abolition of the official exchange rate and coincides with major debt restructuring. The final date closely follows the privatization of Telmex and the beginning of the NAFTA negotiations. For the flows estimation, we find little evidence in favor of multiple breaks, although this may be due to low power. Argentina shows two breaks in equity flows, with the second one being detected in the BLS tests. There are three breaks for equity flows in Korea, partially reflecting the gradual lifting of foreign ownership. Finally, there are two break dates for bond flows in Taiwan, one preceding and one following the liberalization plan of January 1991. Hence, there appears to be a pattern in the multiple break analysis that is linked to important events tied to either deliberalization or liberalization of capital markets.

Finally, we link the statistical breaks to the economic events detailed in Bekaert and Harvey (2000b). The end-result is presented in Table 2, where we also briefly indicate the motivation for each break date. All the dates we choose are dates found by one of the break analyses we conducted, but the final choice uses exogenous information on regulatory reforms to make sure we use a relevant break date. We rely heavily on the break dates that arise from the quadravariate system as well as the Bai-Perron breaks for dividend yields and equity flows. For example, the Bai-Perron break for equity capital flows in Thailand is August 1988. This closely corresponds to the opening of the market to foreigners by the creation of the Alien Board for trading in late 1987. The quadravariate and quintravariate date for Taiwan is April 1988. This closely corresponds to the lifting of exchange controls. Pakistan is particularly interesting. Most consider the official liberalization to be February 1991. The Bai-Perron break in dividend yields is earlier, in December 1990. However, an examination of the chronology shows that the liberalization was announced in November 1990.[5]

4.2. The impact of breaks on unconditional means

Table 3 presents an analysis of both the means and standard deviations of the four country-specific variables that we study in the VARs: dividend yields, log returns, net bond flows to GDP and net equity flows to equity market capitalization. Individual country results and results for our country groupings are presented for the full sample, as well as the pre- and post-break periods using the dates in Table 2.

There are a number of interesting differences between the pre-break and post-break periods. The dividend yields are sharply lower on average (2.5 in post-break and 4.7 in pre-break). The yields decrease in 13 of 17 countries. This is consistent with the idea that expected returns decrease after a liberalization. Although returns are much noisier than dividend yields, we also observe that the average return

[5] We also closely examined the results of estimations with a smaller trimming factor, which suggested breaks near the end of the sample that are associated with the Asian crisis. Since these dates are very much near the end of our sample, we did not exclude post-break observations.

Table 2
Selection of break dates

Country	Date	Series	Reason
Argentina	May 92	dy-BP	Also dy-U. Close to Eq. flows-BP (Dec 92). Follows introduction of Argentine Fund (Oct 91) which is the first time US investors could access this market in modern times.
Brazil	Mar 90	Quad	Close to dy-U (Nov 90) and Eq.Flows-U (Jan 90). Official is May 91. Exactly coincides with introduction of Collor Plan (Mar 90).
Chile	Nov 90	dy-BP	About one year from Official (Jan 92). Quad identifies the debt crisis. Shortly follows introduction of reform package (Apr 90), major ADR (July 90) and renewal of Andean Pact (Nov 90).
Colombia	Oct 91	dy-BP1	Close to Official (Feb 91). Eq.Flows-U follows (July 93). Exact month that Peso deregulated (Oct 91). In addition, exact month that foreign country funds are allowed to have up to 10% of ownership and foreign firms are permitted to remit 100% of profits.
Greece	Jul 88	Quad	Also dy-BP date. Official (Dec 87). Closely coincides with date of first ADR (Aug 88).
India	Apr 92	Quad	Between dy-U (Jan 92) and Eq.Flows-U (May 93). Official is Nov 92. Closely follows establishment of Securities Exchange Board (Jan 92). In addition, the first ADR is Feb 92.
Indonesia	May 92	dy-BP	Official Sep 89. Equity and bond flows break much later. First ADR launched Feb 92. Foreign Board for trading by foreigners established in July 92.
Jordan	Apr 92	dy-BP	Official is Dec 95. Closely precedes the lifting of controls on outbound and inbound direct investments; allowance of private holding of foreign exchange and other financial assets, and provision of market access to foreign financial institutions in 1993.
Korea	Oct 92	Eq.Flows-BP3	Close to dy-BP (Feb 91). Official is Jan 92. Foreigns can own up to 10% of stocks in selected industries (Jan 92). More industries included in May 92.
Malaysia	Feb 91	dy-BP	Exactly coincides with the Privatization Master Plan (Feb 91). Precedes the Outline Perspective Plan in Jun 91 which encouraged foreign investment and privatisation. Official date is earlier Dec 88.

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Table 2 (*continued*)

Country	Date	Series	Reason
Mexico	Mar 91	dy-BP3	Less than a year from Eq.Flows-U (Jul 90). Closely follows Telmex privatization in Dec 90 and the initiation of NAFTA talks in Feb 90 and bond flows in Mar 90. Official is early, May 89.
Nigeria	Jun 95	dy-U	Official is Aug 95 but earlier in 1995 the Budget called for the opening of markets to foreign portfolio investors. Hence, the market might have anticipated the official introduction of the Nigerian Investment Decree in Aug 95.
Pakistan	Dec 90	dy-BP1	Very close to Official in Feb 91. Indeed, the announcement of the liberalizations that were implemented in Feb 91 was made in Nov 90.
Philippines	Jul 90	Eq.Flows-U	Close to dy-U (Oct 91). Official is Jun 91. Follows major bank restructuring agreement in Feb 90. First ADR is Mar 91.
Portugal	Feb 89	Quad	Close to dy-U. Official is July 86. Portugal Fund launched in Aug 87. Precedes privatization law in Mar 90.
Taiwan	Apr 88	Quad	Also dy-U date. Exchange controls lifted in Jul 87. Official is later, in Jan 91.
Thailand	Aug 88	Eq.Flows-BP	Official Sep 87 when Alien Board introduced. dy-U is Jan 90 which seems late
Turkey	Oct 89	dy-BP	Jul 89 communique stating that markets will be open to foreigners. Official in Aug 89. Turkish Investment Fund in Dec 89. Eq.Flow-BP is later, in Dec 91 and Bond Flow-BP is Jun 92.
Venezuela	Mar 92	dy-U	Official Jun 90 but first ADR is later, in Aug 91. Major privatizations in Sep 91 and Nov 91. All other estimations strongly influenced by 1997-98.
Zimbabwe	Jun 93	dy-U	Official is same date when new investment guidelines took effect. However, break is not significant.

The dating involves a number of different estimation strategies: (i) a joint estimation of quadravariate (Quad) system with world interest rates, net equity flows (Eq.Flows), dividend yields (dy), and returns, (ii) univariate (U) estimation allowing for a single break, and (iii) Bai-Perron (BP) tests which allow for up to three breaks (BP1, BP2, BP3) and are also univariate. The official liberalization dates (Official) are from Bekaert and Harvey (2000a). We also consulted with the chronology of important financial, economic and political events developed in Bekaert and Harvey (2000b) which is available at http://www.duke.edu/~charvey.

Table 3
Pre-post analysis of the variables used in vector autoregressions

Country		Dividend yield		Net bond flows/GDP		Net equity flows/mcap		Log returns	
		Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Argentina	Full	1.559	1.372	0.00018	0.00088	0.00075	0.00547	0.0116	0.2138
	Pre	1.125	1.318	−0.00002	0.00008	−0.00023	0.00452	0.0159	0.2458
	Post	2.639	0.783	0.00066	0.00154	0.00320	0.00674	0.0011	0.0963
Brazil	Full	5.494	4.403	0.00007	0.00064	0.00085	0.00205	0.0083	0.1602
	Pre	7.029	4.078	0.00000	0.00004	0.00024	0.00119	0.0056	0.1566
	Post	3.069	3.775	0.00019	0.00103	0.00180	0.00268	0.0126	0.1664
Chile	Full	4.946	2.022	−0.00027	0.00191	0.00034	0.00139	0.0177	0.0966
	Pre	5.779	2.022	−0.00026	0.00088	0.00021	0.00138	0.0188	0.1067
	Post	3.441	0.760	−0.00030	0.00299	0.00057	0.00139	0.0158	0.0756
Colombia	Full	4.655	3.119	0.00011	0.00087	0.00057	0.00206	0.0206	0.0797
	Pre	7.377	2.503	−0.00003	0.00011	−0.00005	0.00080	0.0224	0.0580
	Post	2.269	0.737	0.00044	0.00150	0.00120	0.00268	0.0187	0.0971
Greece	Full	5.593	3.299	0.00002	0.00027	0.00020	0.00185	0.0054	0.0948
	Pre	6.173	3.915	−0.00001	0.00005	−0.00010	0.00200	−0.0038	0.0865
	Post	4.926	2.242	0.00005	0.00039	0.00055	0.00162	0.0161	0.1029
India	Full	2.613	1.350	−0.00065	0.00240	0.00014	0.00041	0.0088	0.0793
	Pre	3.172	1.186	−0.00102	0.00268	0.00001	0.00008	0.0167	0.0725
	Post	1.247	0.456	0.00025	0.00103	0.00045	0.00066	−0.0103	0.0916
Indonesia	Full	1.368	0.695	0.00007	0.00033	0.00147	0.00259	−0.0191	0.1300
	Pre	0.276	0.159	0.00000	0.00004	0.00101	0.00142	−0.0150	0.1045
	Post	1.633	0.481	0.00023	0.00059	0.00164	0.00292	−0.0207	0.1391
Korea	Full	3.819	2.846	0.00011	0.00068	0.00069	0.00188	0.0035	0.0998
	Pre	4.632	1.593	0.00000	0.00027	0.00024	0.00090	0.0102	0.0885
	Post	1.593	0.549	0.00040	0.00120	0.00193	0.00300	−0.0148	0.1247

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Table 3 (*continued*)

Country		Dividend yield		Net bond flows/GDP		Net equity flows/mcap		Log returns	
		Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Malaysia	Full	1.990	0.624	0.00015	0.00195	0.00020	0.00065	−0.0002	0.0960
	Pre	2.160	0.398	−0.00007	0.00118	0.00022	0.00044	0.0061	0.0860
	Post	1.870	0.722	0.00056	0.00286	0.00018	0.00078	−0.0055	0.1037
Mexico	Full	4.298	4.172	0.00032	0.00178	0.00111	0.00404	0.0132	0.1337
	Pre	5.743	4.496	0.00015	0.00195	0.00077	0.00254	0.0155	0.1457
	Post	1.506	0.422	0.00064	0.00132	0.00175	0.00592	0.0089	0.1076
Pakistan	Full	4.496	2.619	0.00002	0.00024	0.00039	0.00229	0.0042	0.0828
	Pre	7.709	0.789	0.00000	0.00000	0.00000	0.00020	0.0101	0.0299
	Post	2.765	1.882	0.00006	0.00040	0.00069	0.00303	−0.0005	0.1073
Philippines	Full	1.540	1.476	0.00012	0.00105	0.00054	0.00239	0.0175	0.1039
	Pre	2.263	1.906	−0.00008	0.00028	0.00005	0.00313	0.0443	0.1042
	Post	0.913	0.534	0.00047	0.00162	0.00087	0.00162	−0.0009	0.1001
Portugal	Full	2.456	1.128	−0.00002	0.00016	0.00101	0.00397	0.0206	0.1045
	Pre	1.006	0.544	0.00000	0.00002	0.00015	0.00069	0.0515	0.1796
	Post	2.802	0.939	−0.00003	0.00023	0.00129	0.00452	0.0108	0.0628
Taiwan	Full	0.994	0.541	−0.00017	0.00043	0.00003	0.00028	0.0131	0.1331
	Pre	1.677	0.701	−0.00003	0.00007	0.00002	0.00026	0.0400	0.1469
	Post	0.832	0.334	−0.00033	0.00058	0.00004	0.00029	0.0046	0.1279
Thailand	Full	5.523	3.311	0.00004	0.00043	0.00030	0.00098	0.0056	0.0962
	Pre	7.680	2.860	−0.00001	0.00013	0.00035	0.00100	0.0165	0.0736
	Post	3.005	1.557	0.00011	0.00061	0.00024	0.00096	−0.0070	0.1162

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Table 3 (*continued*)

Country		Dividend yield		Net bond flows/GDP		Net equity flows/mcap		Log returns	
		Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Turkey	Full	4.349	2.205	0.00001	0.00013	0.00049	0.00240	0.0177	0.1803
	Pre	7.275	2.917	0.00000	0.00002	−0.00006	0.00052	0.0535	0.2191
	Post	3.708	1.352	0.00002	0.00020	0.00066	0.00272	0.0064	0.1659
Venezuela	Full	1.648	0.914	0.00015	0.00287	0.00001	0.00396	0.0083	0.1409
	Pre	1.394	0.914	0.00021	0.00329	−0.00010	0.00158	0.0266	0.1383
	Post	1.890	0.847	0.00001	0.00146	0.00015	0.00557	−0.0123	0.1418
All countries	Full	3.373	2.123	0.00002	0.00100	0.00053	0.00227	0.0092	0.1192
	Pre	4.263	1.900	−0.00007	0.00065	0.00016	0.00133	0.0197	0.1201
	Post	2.359	1.081	0.00020	0.00115	0.00101	0.00277	0.0014	0.1134
Latin America	Full	3.767	2.667	0.00009	0.00149	0.00061	0.00316	0.0133	0.137
	Pre	4.741	2.555	0.00001	0.00106	0.00014	0.00200	0.0175	0.142
	Post	2.469	1.221	0.00027	0.00164	0.00145	0.00416	0.0074	0.114
Asia	Full	2.539	1.582	0.00005	0.00081	0.00054	0.00146	0.0034	0.110
	Pre	3.115	1.270	−0.00003	0.00033	0.00032	0.00119	0.0170	0.101
	Post	1.641	0.696	0.00024	0.00124	0.00082	0.00159	−0.0074	0.119
Rely on stocks	Full	3.379	1.901	0.00002	0.00103	0.00051	0.00188	0.0108	0.0995
	Pre	3.920	1.554	−0.00007	0.00046	0.00020	0.00126	0.0246	0.1064
	Post	2.271	0.844	0.00020	0.00159	0.00085	0.00205	−0.0003	0.0972
Rely on bonds	Full	3.144	2.363	0.00013	0.00112	0.00076	0.00340	0.0044	0.1436
	Pre	3.879	1.959	0.00006	0.00090	0.00028	0.00191	0.0098	0.1368
	Post	2.250	1.365	0.00030	0.00105	0.00154	0.00448	−0.0018	0.1264

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Table 3 (*continued*)

Country		Dividend yield		Net bond flows/GDP		Net equity flows/mcap		Log returns	
		Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Top external	Full	3.135	2.389	0.00016	0.00147	0.00060	0.00301	0.0075	0.1407
	Pre	3.681	2.133	0.00005	0.00113	0.00019	0.00186	0.0133	0.1435
	Post	2.095	1.183	0.00041	0.00157	0.00150	0.00411	−0.0017	0.1234
Bottom external	Full	3.364	1.885	−0.00016	0.00105	0.00027	0.00144	0.0111	0.0984
	Pre	4.462	1.753	−0.00024	0.00066	0.00003	0.00117	0.0210	0.0911
	Post	2.354	1.035	0.00004	0.00117	0.00053	0.00143	0.0041	0.1009

All countries represents an equally-weighted average across all countries. Asia is equally-weighted across six Asian countries (Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand), and Latin is equally-weighted across six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela). We also report equally-weighted across the six countries that rely most on equity financing (Chile, the Philippines, Malaysia, Portugal, Thailand and Korea), equally-weighted across the six countries that rely most on bond financing (Venezuela, Mexico, Argentina, Pakistan, Indonesia and Brazil), equally-weighted across the six countries that have the highest proportion of external financing, that is, the bond plus equity capital flows to GDP (Mexico, Malaysia, Venezuela, Argentina, Brazil and Korea) and the six countries with the lowest proportion of external financing to GDP (Chile, Taiwan, Pakistan, the Philippines, Greece and India). The means and standard deviations are estimated over the full sample, the pre-break sample and the post-break sample. The break dates for each country are presented in Table 2.

decreases after the breaks. Note that return volatility actually declines from 41.6% to 39.3% on an annualized basis.

The capital flows also exhibit differences. The equity capital flows to capitalization ratio increases five-fold after the break. Increases occur in 15 of 17 countries. Similarly, the bond flows to GDP ratio increases from a negative number in the pre-break period to a positive number in the post-break period. Increases occur in 13 of 17 countries. It is also interesting to note that while the volatility of equity returns and dividend yields decreases after our breaks, the volatility of both the equity and bond capital flows increases. Indeed, the volatility of the bond and equity flow ratios doubles from pre to post-break.

4.3. Mean dynamics of capital flows

We estimated the regression specified in eq. (6) for each individual country and pooled across all countries for the various country groups introduced in Section 3. The pooled regression allows for fixed effects, and corrects for temporal heteroskedasticity. The results are in Table 4. We report the regressions both for equity flows and bond flows. The equity results are consistent with the liberalization inducing a large portfolio rebalancing that induces large capital flows just after the break, but less after the transition period (which we fixed at three years). On an annualized basis, equity flows increase by 1.4% of local market capitalization, but then drop by 0.55% after three years. Bond flows continue to increase throughout.

One might expect this phenomenon to be artificially driven by the Asian crisis. During late 1997 and 1998, large amounts of foreign capital left Asia and this was not driven by a liberalization-induced portfolio rebalancing. However, the overall phenomenon we find does not occur for Asia, where equity flows on average continue to increase three years after the liberalization. The positive/negative pattern however is very strong in Latin-America. Not surprisingly the result also strongly appears for the 6 countries relying most on foreign capital, whereas it does not show for the least foreign portfolio capital reliant countries. The fact that the result shows up for the countries that rely more heavily on bonds and not for those that rely most heavily on stocks is probably due to the geographical composition of these groups, with Latin-American countries dominating the former, but not the latter.

4.4. Transition dynamics

The results of our THL statistic using the quadravariate VAR are summarized in Fig. 3 for capital flows and dividend yields. We can interpret these results as indicative of how flows and dividends react when the markets become integrated and how they might react when the integration process is reversed. The pre-mean/new dynamics plot illustrates that for almost half the countries, capital comes in very fast, so that adjustment happens very quickly, usually within one month. This may provide indirect evidence of portfolio rebalancing. But there are also some notable exceptions. In Chile, Colombia, Greece, India, Korea, the Philippines, Portugal, Thailand, and Venezuela the transition lasts at least five months. More striking is that in 15

Table 4
Changes in capital flows after breaks

Country	Net equity flows			Net bond flows		
	Intercept	Break	3-yrs post	Intercept	Break	3-yrs post
Argentina	−0.00023	0.00613	−0.00526	−0.00002	0.00053	0.00029
	−0.69	4.04	−3.13	−2.34	2.92	0.87
Brazil	0.00030	0.00135	0.00019	−0.00001	0.00012	0.00014
	2.13	2.06	0.27	−0.98	1.54	0.89
Chile	0.00021	0.00015	0.00035	−0.00026	−0.00042	0.00063
	1.71	0.52	0.86	−3.09	−1.16	1.09
Colombia	−0.00005	0.00124	0.00007	−0.00004	0.00020	0.00052
	−0.53	2.75	0.11	−3.66	1.59	1.92
Greece	−0.00010	0.00024	0.00059	−0.00001	−0.00001	0.00011
	−0.57	1.30	1.92	−2.52	−1.04	2.23
India	0.00001	0.00027	0.00032	−0.00102	0.00102	0.00047
	1.49	3.24	2.02	−3.15	3.16	2.19
Indonesia	0.00080	0.00159	−0.00132	0.00000	0.00017	0.00011
	3.03	2.65	−1.97	0.66	2.04	0.75
Korea	0.00024	0.00102	0.00141	0.00024	0.00102	0.00141
	2.24	4.19	1.70	2.24	4.19	1.70
Malaysia	0.00022	0.00025	−0.00050	−0.00007	−0.00004	0.00112
	3.19	1.19	−2.27	−0.63	−0.15	2.35
Mexico	0.00077	0.00350	−0.00427	0.00015	0.00063	−0.00022
	3.25	2.70	−3.17	1.00	2.00	−0.65
Pakistan	0.00000	0.00026	0.00071	0.00000	0.00001	0.00008
	−0.04	2.10	1.20	−0.20	1.11	1.14

(*continued on next page*)

Table 4 (*continued*)

Country	Net equity flows			Net bond flows		
	Intercept	Break	3-yrs post	Intercept	Break	3-yrs post
Philippines	0.00005 0.10	0.00089 1.40	−0.00010 −0.24	−0.00008 −2.68	−0.00010 −1.09	0.00105 3.42
Portugal	0.00015 1.47	0.00042 2.23	0.00106 1.72	0.00000 −3.00	−0.00007 −3.40	0.00006 1.99
Taiwan	0.00002 0.39	−0.00002 −0.45	0.00006 1.15	−0.00003 −4.53	−0.00011 −1.69	−0.00027 −1.82
Thailand	0.00035 2.20	−0.00003 −0.15	−0.00012 −0.63	−0.00001 −1.19	−0.00005 −0.76	0.00025 2.54
Turkey	−0.00006 −0.77	0.00089 3.41	−0.00026 −0.58	0.00000 −1.17	0.00005 1.29	−0.00005 −1.14
Venezuela	−0.00010 −0.60	0.00066 1.13	−0.00079 −0.61	0.00021 0.89	−0.00022 −0.82	0.00004 0.13
All countries		0.00116 7.56	−0.00046 −2.75		0.00012 2.82	0.00022 3.51
Asia		0.00046 4.72	0.00003 0.23		0.00018 2.55	0.00040 3.51

Table 4 (*continued*)

Country	Net equity flows			Net bond flows		
	Intercept	Break	3-yrs post	Intercept	Break	3-yrs post
Latin		0.00219	−0.00154		0.00014	0.00022
		5.97	−3.72		1.43	1.50
Rely on stocks		0.00043	0.00024		−0.00007	0.00054
		3.82	1.39		−0.82	3.86
Rely on bonds		0.00236	−0.00168		0.00021	0.00006
		6.06	−3.97		2.75	0.68
Top external		0.00224	−0.00154		0.00021	0.00029
		6.18	−3.69		2.33	2.08
Bottom external		0.00032	0.00031		0.00008	0.00026
		3.31	2.55		1.05	2.27

Based on a regression of net equity flows and net bond flows on two indicator variables. The net equity (bond) flows represent the net equity (bond) flows between the United States and each emerging market. The flow data are monthly from the Department of the Treasury. The first indicator takes the value of one after a break. The second indicator takes on the value of one three years after the break.There are seven pooled estimations: all countries, six Asian countries (Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand), six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela), the six countries that rely most on equity financing (Chile, the Philippines, Malaysia, Portugal, Thailand and Korea), the six countries that rely most on bond financing (Venezuela, Mexico, Argentina, Pakistan, Indonesia and Brazil), the six countries that have the highest proportion of external financing, that is, the bond plus equity capital flows to GDP (Mexico, Malaysia, Venezuela, Argentina, Brazil, and Korea) and the six countries with the lowest proportion of external financing to GDP (Chile, Taiwan, Pakistan, the Philippines, Greece and India). We do not report the intercepts in the group estimations. The break dates for each country are presented in Table 2. All regressions have heteroskedasticity-consistent standard errors. The pooled regressions allow for fixed effects.The values below each coefficient represent the t-statistic.

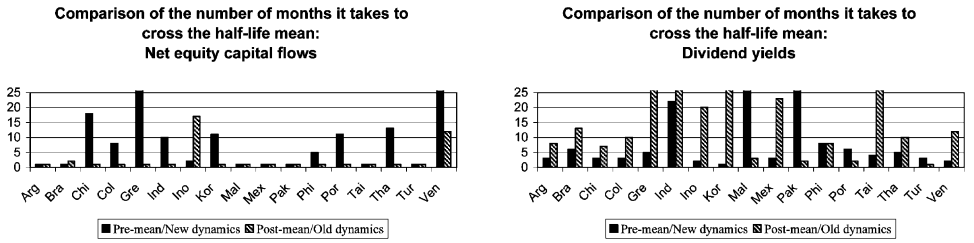

Fig. 3. Transition dynamics.

of the 17 countries, the transition implied by the post-mean/old dynamics is faster (with Brazil moving from 1 to 2 months), suggesting that when capital leaves, it leaves faster than it came! This is an interesting finding in light of the recent crises which resulted in capital flight from many emerging markets. Indeed, our empirical findings use data from long before these crises.

In 13 of the 17 countries, a dividend yield decrease followed the liberalization (structural change), indicating a decrease in the cost of capital. In contrast to the evidence on capital flows, this decrease in the cost of capital seems to take some time (more than 1 month in all countries besides Korea, and a median of 4 months), but in the reverse experiment, this process would take even longer (median of 10 months). One interpretation of this finding is that liberalizations have made dividend yields less persistent.

5. VAR dynamics

5.1. Dynamic regression coefficients

Table 5 reports the results of our analysis of dynamic regression coefficients. We report the coefficients at three horizons, $k = 12$ (one year), $k = 36$ (three years), and $k = 60$ (five years). We also report the cumulative responses over these horizons, and the infinite cumulative response. To give an idea of the cross-sectional distribution of the coefficients across countries, we order the coefficients from low to high and report the coefficients for the third and 15th country (there are 17 countries). We also report the equally-weighted average over the six Latin American, over the six Asian and over all countries. The table only reports the post-break analysis. As reported in a previous version of the paper [Bekaert et al., 1999], many of the results are not robust across time periods demonstrating once again that capital liberalizations have caused breaks in the dynamic relations between our variables that cannot be ignored.

The first three panels investigate slope coefficients with the world interest rate as the regressor. These reflect the long-run correlations between capital flows, dividend yields or returns at time $t+k$ and the world interest rate at time t. The relation between future capital flows and current world interest rates varies significantly across countries. The equally-weighted response is positive, but the relation is negative for both

Table 5
Dynamic analysis

Response	Sample		k=12	k=36	k=60	cumk=12	cumk=36	cumk=60	Infinity
Future capital flows to world interest rates	Post	3rd country	−0.0194	−0.0155	−0.0047	−0.4688	−0.7078	−1.1395	−1.5049
		15th country	0.0327	0.0057	0.0019	0.8146	1.0514	1.0640	1.0647
		Equal weight	0.0061	0.0335	0.0974	0.0435	0.4887	1.9761	1.7526
		Latin America	−0.0099	−0.0060	−0.0019	−0.0176	−0.2356	−0.3197	−0.3635
		Asia	−0.0051	−0.0007	−0.0003	−0.1356	−0.1784	−0.1883	−0.1542
Future dividend yields to world interest rates	Post	3rd country	−17.37	−8.65	−7.04	−254.19	−639.35	−878.84	−1921.20
		15th country	12.90	4.94	3.12	143.11	337.66	387.38	438.63
		Equal weight	9.75	29.08	80.52	93.40	532.26	1774.50	−432.55
		Latin America	−5.49	−5.15	−3.77	−60.82	−191.63	−298.70	−484.82
		Asia	−2.06	−1.46	−1.26	−20.08	−58.44	−91.34	−205.83
Future returns to world interest rates	Post	3rd country	−1.6042	−0.5033	−0.3056	−2.4314	−1.2862	−0.8134	−70.7920
		15th country	1.2979	0.5596	0.4689	1.4222	1.2763	0.8150	96.3130
		Equal weight	−0.2725	−1.1221	−3.2031	−0.0969	−0.4803	−1.1041	−12.2110
		Latin America	0.0433	0.1353	0.0993	−0.0364	0.0625	0.0852	9.4885
		Asia	0.9303	0.3931	0.2868	1.3551	0.8231	0.6259	115.8200
Future dividend yields to capital flows	Post	3rd country	−16.95	−1.75	−0.58	−445.25	−563.99	−567.52	−565.10
		15th country	15.52	15.45	5.90	176.83	546.87	919.73	1937.00
		Equal weight	0.88	−6.57	−28.48	16.76	−34.97	−424.62	−77.44
		Latin America	−4.46	−0.28	0.30	−116.65	−153.65	−150.99	−123.13
		Asia	8.20	12.95	13.52	102.04	370.81	692.88	4358.00

(*continued on next page*)

Table 5 (*continued*)

Response	Sample		k=12	k=36	k=60	cumk=12	cumk=36	cumk=60	Infinity
Future returns to capital flows	Post	3rd country	–0.1451	–0.0212	–0.0041	–0.1238	–0.0674	–0.0446	–12.6570
		15th country	3.3869	1.7917	1.6850	5.0591	4.2570	2.6447	141.2800
		Equal weight	1.4284	1.4957	2.2963	2.4706	1.7563	1.7887	–1332.8000
		Latin America	–0.0225	0.0265	0.0080	0.1033	0.0559	0.0397	2.4257
		Asia	0.8740	0.4617	0.3981	3.3117	1.4720	1.0542	185.1700
Future capital flows to dividend yields	Post	3rd country	–0.00015	–0.00001	0.00000	–0.00588	–0.00462	–0.00543	–0.02422
		15th country	0.00044	0.00015	0.00009	0.00801	0.01374	0.01609	0.01565
		Equal weight	0.00023	0.00046	0.00112	0.00230	0.01025	0.02826	–0.01513
		Latin America	0.00006	0.00006	0.00003	0.00019	0.00183	0.00285	0.00370
		Asia	–0.00001	0.00002	0.00002	–0.00069	–0.00032	0.00010	0.00334
Future capital flows to returns	Post	3rd country	–0.00030	–0.00011	–0.00006	–0.00125	–0.00437	–0.00408	–0.00627
		15th country	0.00043	0.00007	0.00007	0.00967	0.01373	0.01713	0.01418
		Equal weight	0.00009	0.00012	0.00016	0.00484	0.00727	0.01055	–0.22599
		Latin America	–0.00007	–0.00004	–0.00002	0.00650	0.00507	0.00434	0.00356
		Asia	0.00004	–0.00001	0.00000	0.00280	0.00276	0.00264	0.00665

For our analysis of dynamic regression coefficients, we report the coefficients at three horizons, k=12 (1 year), k=36 (three years), and k=60 (five years). We also report the cumulative responses over these horizons, and the infinite cumulative response. To investigate the cross-sectional distribution of the coefficients across countries, we order the coefficients from low to high and report the coefficients for the third and 15th country (there are 17 countries). We also report the equally-weighted average over the six Latin American, over the six Asian and over all countries. The break dates are provided in Table 2.

the Latin American and Asian countries. For example, a 1% decrease in the world interest rate is associated with a cumulative 36-month increase of US holdings of the local equity market equal to 0.24% in Latin America and 0.18% in South-East Asia in the post-break period.

The relation between the world interest rate and future dividend yields equally-weighted across the countries is at first positive but the cumulative infinite response is negative. The responses in Latin America and Asia are always negative, indicating that lower interest rates are associated with future increases in dividend yields. This is surprising under the "push" hypothesis where lower interest rates drive developed market capital into emerging markets and drive up prices there, hence lowering dividend yields. Of course, we report long-run effects, and the "push" effect may be very short-lived. The effects we document die out very slowly, which is largely due to the large persistence of the dividend yield in most countries. Note that the coefficients seem large primarily because of the log-transformation of dividend yields. To get an approximate regression coefficient for the level of the dividend yield, one should multiply the reported coefficients by the average dividend yield level (0.035).

For the implicit regression of future returns on the world interest rate, we divide the cumulative effects by k, to obtain a per period return effect (except, of course, for $k = \infty$). Not surprisingly, given the noisiness in returns, the coefficients show also a wide range across countries. Nevertheless, they are consistently positive for both Latin America and Asia. Hence, decreases in world interest rates are associated with long-run decreases in returns, not increases as we might expect. The same caveats we mentioned above apply. In addition, we should add that a true test of the "push" hypothesis should focus on the effects of an unexpected shock to world interest rates, especially since world interest rates are quite predictable. Such an analysis follows later when we consider impulse responses.

The following panels consider the long-run relation between capital flows and future dividend yields and returns. The relation between capital flows and future dividend yields also shows a lot of cross-sectional dispersion, with positive coefficients for Asia and negative ones for Latin America. Hence, the slope coefficients do not clearly reveal a permanent cost of capital effect from increased capital flows. The correlations between capital flows and returns are largely positive; higher flows are correlated with higher future returns but the coefficients are quite small.

The next panel considers an implicit regression of future capital flows on current log-dividend yields. The cumulative responses can now be interpreted as the change in total holdings over this period. The coefficients are generally small for the same reason previous coefficients involving dividend yields were large — the log-transformation. For an average dividend yield level of 0.035, one should multiply the coefficients by 28.6. If higher dividend yields proxy for higher expected returns, and the return chasing hypothesis is true, one would expect a positive contemporaneous relation, which may persist because of positive autocorrelation in dividend yields and flows. This is indeed the case for both Latin-America and Asia at the five-year horizon, but the effects are very small. It remains true when the country-by-country results are averaged at the five-year horizon but not when the infinite cumulative response is computed.

The last panel investigates the correlation between current returns and future capital flows. At the horizons that we consider, we would not expect to see much of an effect, even if foreigners are momentum traders. Indeed, we find very small effects, that are positive when cumulated for Asia and Latin-America, but negative when averaged over all countries.

In general, the slope coefficients do not lead to strong conclusions about univariate correlation patterns between the various variables. This motivates investigating more complex patterns, either partial regression coefficients as in the Granger-causality analysis that follows, or impulse responses which control for the predictability of causal factors.

5.2. Granger-causality tests

Granger-causality tests are reported in Table 6. The first three columns investigate the predictive power of a much discussed external factor (a "push" factor), the world interest rate, on equity flows, dividend yields and returns. The statistical results are weak. This is not surprising before the break if markets were truly segmented preventing free capital flows. The only significant result is that in Korea we can reject that the world interest rate fails to Granger-cause returns. But even in the POST period, significant results are rare. Except for single cases of near or below 5% rejections of the no Granger-causality hypotheses in Korea, the Philippines, and Turkey, the only country where the world interest rate played a significant role predicting capital flows, dividend yields and returns simultaneously is Brazil.

These results may indicate that the world interest rate is not an important predictor of capital flows and returns and that the previous literature (e.g. Froot et al., 2001) justifiably ignored it, but it may also reflect the short sample periods we have available. When looking at impulse responses in the next sub-section, our various country groupings may yet reveal the interest rate to be an important external determinant of capital flows.

The price pressure hypothesis would suggest that increased capital flows temporarily induce high returns which are reversed afterwards in which case we would expect capital flows to Granger-cause returns. In the portfolio rebalancing story, on the other hand, even before the full liberalization is implemented, anticipation should have already led to permanent price increases, making it less obvious that we will see significant results in the post period. As Fig. 1 indicates, returns show the most interesting dynamics during the transition period. If there is an effect on the dividend yield, the effect may represent a more permanent change in the cost of capital. The statistical evidence on Granger-causality is not overwhelming. We reject the hypothesis of no predictability of returns by capital flows at the 5% level for only six countries: Brazil (pre-break), Greece (pre-break), Korea (post-break), Malaysia (full period), Pakistan (post-break), and Thailand (pre-break).

In three of the six countries where capital flows predict returns, they also predict dividend yields significantly. In three other countries (Indonesia, the Philippines and Venezuela), we also record a significant relation between capital flows and dividend yields.

Table 6
Granger causality tests

Probability values from the null hypothesis that:								
Country		World interest rates do not Granger cause net equity flows	World interest rates do not Granger cause dividend yields	World interest rates do not Granger cause returns	Net equity flows do not Granger cause dividend yields	Net equity flows do not Granger cause returns	Returns do not Granger cause net equity flows	Dividend yields do not Granger cause net equity flows
Argentina	Full	0.951	0.652	0.283	0.927	0.438	0.819	0.955
	Pre	0.981	0.940	0.183	0.978	0.395	0.687	0.903
	Post	0.316	0.624	0.172	0.804	0.064	0.832	0.557
Brazil	Full	0.936	0.911	0.921	0.002	0.575	0.621	0.093
	Pre	0.940	0.962	0.885	0.000	0.008	0.024	0.157
	Post	0.090	0.028	0.071	0.029	0.454	0.305	0.733
Chile	Full	0.691	0.162	0.348	0.595	0.956	0.526	0.924
	Pre	0.806	0.268	0.121	0.208	0.991	0.586	0.607
	Post	0.406	0.986	0.340	0.082	0.938	0.697	0.234
Colombia	Full	0.146	0.298	0.051	0.581	0.310	0.913	0.000
	Pre	0.299	0.797	0.757	0.349	0.299	0.982	0.127
	Post	0.191	0.664	0.134	0.802	0.415	0.959	0.015
Greece	Full	0.535	0.093	0.765	0.496	0.129	0.481	0.947
	Pre	0.909	0.327	0.734	0.720	0.024	0.188	0.792
	Post	0.635	0.826	0.453	0.898	0.575	0.994	0.994
India	Full	0.901	0.588	0.978	0.879	0.051	0.507	0.774
	Pre	0.312	0.665	0.999	0.996	0.900	0.730	0.121
	Post	0.570	0.240	0.141	0.927	0.090	0.812	0.842
Indonesia	Full	0.995	0.308	0.290	0.187	0.511	0.307	0.669
	Pre	0.099	0.195	0.372	0.040	0.201	0.495	0.833
	Post	0.999	0.920	0.513	0.163	0.754	0.384	0.566

(*continued on next page*)

Table 6 (*continued*)

Probability values from the null hypothesis that:								
Country		World interest rates do not Granger cause net equity flows	World interest rates do not Granger cause dividend yields	World interest rates do not Granger cause returns	Net equity flows do not Granger cause dividend yields	Net equity flows do not Granger cause returns	Returns do not Granger cause net equity flows	Dividend yields do not Granger cause net equity flows
Korea	Full	0.741	0.953	0.049	0.934	0.010	0.000	0.981
	Pre	0.144	0.998	0.030	1.000	0.614	0.518	0.982
	Post	0.999	0.070	0.558	0.287	0.010	0.000	0.890
Malaysia	Full	0.948	0.876	0.340	0.413	0.023	0.092	0.125
	Pre	0.759	0.442	0.462	0.280	0.194	0.114	0.423
	Post	0.901	0.788	0.592	0.468	0.095	0.213	0.033
Mexico	Full	0.998	0.051	0.617	0.682	0.884	0.960	0.734
	Pre	0.871	0.111	0.189	0.326	0.302	0.996	0.455
	Post	0.575	0.214	0.726	0.623	0.647	0.994	0.510
Pakistan	Full	0.346	0.426	0.142	0.000	0.000	0.466	0.048
	Pre	0.545	0.090	0.458	0.943	0.702	0.495	0.862
	Post	0.532	0.277	0.205	0.000	0.015	0.844	0.179
Philippines	Full	0.015	0.444	0.597	0.415	0.831	0.563	0.499
	Pre	0.383	0.249	0.685	0.008	0.320	0.353	0.001
	Post	0.052	0.240	0.456	0.833	0.976	0.423	0.180
Portugal	Full	0.692	0.438	0.570	0.958	1.000	0.988	0.964
	Pre	0.527	0.889	0.903	0.963	0.795	0.738	0.977
	Post	0.750	0.133	0.281	0.820	0.983	0.985	0.907
Taiwan	Full	0.598	0.697	0.819	0.956	0.651	0.759	0.408
	Pre	0.650	0.303	0.421	0.491	0.847	0.703	0.599
	Post	0.692	0.740	0.803	0.723	0.301	0.782	0.472

Table 6 (*continued*)

Probability values from the null hypothesis that:								
Country		World interest rates do not Granger cause net equity flows	World interest rates do not Granger cause dividend yields	World interest rates do not Granger cause returns	Net equity flows do not Granger cause dividend yields	Net equity flows do not Granger cause returns	Returns do not Granger cause net equity flows	Dividend yields do not Granger cause net equity flows
Thailand	Full	0.992	0.265	0.585	0.005	0.251	0.006	0.383
	Pre	0.996	0.159	0.349	0.326	0.001	0.069	0.137
	Post	0.562	0.490	0.589	0.013	0.202	0.187	0.538
Turkey	Full	0.951	0.928	0.040	0.996	0.331	0.303	0.490
	Pre	0.427	0.991	0.037	0.054	0.148	0.705	0.524
	Post	0.953	0.651	0.009	0.984	0.230	0.427	0.090
Venezuela	Full	0.990	0.167	0.296	0.288	0.526	0.938	0.546
	Pre	0.823	0.580	0.323	0.019	0.054	0.893	0.759
	Post	0.977	0.967	0.830	0.303	0.386	0.869	0.398

Granger causality analysis is based on a quadravariate system of world interest rates, net equity capital flows, dividend yields and equity returns. The VARs are estimated over the full sample, the pre-break sample and the post-break sample. The break dates for each country are presented in Table 2.

Do endogenous factors play a large role in determining capital flows? If that is the case, returns and/or dividend yields ought to have predictive power for capital flows. Interestingly, there is little predictive power of dividend yields (only Colombia, Malaysia, Pakistan, and the Philippines), and returns predict capital flows only in Brazil (pre-break), Korea and Thailand.

The lack of significant predictive relations between our variables, revealed by country-specific Granger-causality tests, stresses again the need to focus on cross-sectionally averaged results. To analyze some of the predictive relations further, we report three partial regression coefficients in Table 7. The first is the coefficient in the flow equation on past flows. Froot et al. (2001) note that the predictive power of flows for future returns may in fact be due to both a strong contemporaneous relation between flows and returns (see next section) and the persistence in flows. Our estimates suggest a monthly persistence coefficient of around 0.135, which is much higher than the monthly persistence implied by Froot et al.'s daily model.

The second coefficient is the coefficient on returns in the flows equation. Positive coefficients suggest feedback trading or may be the result of returns anticipating positive news about future market reforms that will bring in foreign capital. Whereas the country by country results showed little significance (and are not reported), the coefficients are predominantly positive as they are in Froot et al. (2001). One country for which a gradual liberalization story would have much appeal, Korea, records a negative coefficient.

Finally, we report the flow coefficient in the return equation. As in Froot et al. (2001), we find predominantly positive and large coefficients. A 1% increase in foreign holdings leads on average to a 4.74% increase in returns next month (see Table 7). Froot et al. argue that this is not inconsistent with the price pressure hypothesis (which would require a positive contemporaneous effect and negative long-run effect) given that flows are persistent. The response could also reflect a return to integration, as we discussed before, although one would expect much of the increase in foreign holdings to be anticipated and, hence, not induce large ex post price changes. In the impulse response analysis in the next section, we look at the dynamic effects of unexpected shocks, including the contemporaneous relations between variables.

6. Tests of the main hypotheses

The impulse response analysis of the quadravariate VAR is presented in Figs. 4–6. For each country, we estimate the VAR on three samples: full sample, pre-break and post-break. We then aggregate the impulse responses across various country groups using equal weights. To help interpret the evidence, in light of the hypotheses formulated in Section 2, we provide two additional tables. Table 8 presents an analysis of impulse responses on changes in equity holdings and long-run returns, whereas Table 9 reports some important contemporaneous betas. When rescaled, these betas constitute the impulse responses at time 0 and they also appear in Figs. 4–6. Both tables focus exclusively on the post-break period.

Table 7
Analysis of VAR coefficients (post-break estimation)

VAR equation	Equal weighted	Value weighted	Asian	Latin	Rely on equity	Rely on bonds	Top external financing	Bottom external financing	Residual weights	3rd coefficient	15th coefficient
Equity flows on lagged flows	0.1320	0.1360	0.1133	0.1249	0.0781	0.1571	0.1280	0.2084	0.1351	−0.0245	0.2902
Equity flows on lagged returns	0.0019	0.0023	0.0009	0.0035	0.0012	0.0036	0.0034	0.0004	0.0016	−0.0005	0.0049
Returns on lagged equity flows	4.7378	6.6746	9.1445	1.9215	8.2919	1.2816	5.1814	4.5166	6.5033	−0.9226	10.6367

We report the VAR coefficient denoted in the first column from country specific estimations based in the post-break sample. Equal weighted is an equal weighting of all 117 countries. Value weighted represents 17 countries weighted by their market capitalization in December 1991. Asia represents six Asian countries. Latin represents six Latin American countries. Rely on stocks are the six countries that tend to rely on stocks more than bonds for external financing since 1989. Rely on bonds are the six countries which tend to rely more on bonds for external financing. Top external are the six countries which have the largest proportion of cumulative net bond plus equity flows to GDP. Bottom external are the six countries with the smallest proportion of cumulative net bond plus equity flows to GDP. For the 3rd and 15th coefficient, we rank the coefficients across countries, eliminate “outliers”, that is the smallest and highest two and report the range from the remainder (min and max), (the 3rd and 15th coefficient given there are 17 countries).

Table 8
Cumulative impulse response analysis on post break sample

Country group	k=12	k=36	k=60
A. Interest rate shock on cumulative flows			
Equally weighted	0.00020	0.00069	0.00158
Value weighted	0.00011	0.00010	0.00026
Asia	0.00031	0.00040	0.00041
Latin	0.00003	0.00033	0.00044
Rely on stocks	0.00033	0.00048	0.00054
Rely on bonds	0.00006	0.00108	0.00340
Top external	0.00008	0.00024	0.00028
Bottom external	0.00036	0.00143	0.00388
3rd coefficient	−0.00022	−0.00045	−0.00063
15th coefficient	0.00101	0.00145	0.00172
B. Dividend yield shock on cumulative flows			
Equally weighted	0.00004	0.00077	0.00253
Value weighted	0.00042	0.00074	0.00112
Asia	−0.00012	−0.00003	0.00003
Latin	−0.00037	−0.00032	−0.00025
Rely on stocks	−0.00014	−0.00001	0.00008
Rely on bonds	0.00014	0.00189	0.00667
Top external	−0.00019	−0.00021	−0.00017
Bottom external	0.00013	0.00197	0.00680
3rd coefficient	−0.00077	−0.00133	−0.00155
15th coefficient	0.00100	0.00184	0.00216
C. Return shock on cumulative flows			
Equally weighted	0.00012	0.00002	−0.00010
Value weighted	0.00012	0.00002	−0.00001
Asia	0.00011	0.00011	0.00011
Latin	0.00022	0.00004	0.00000
Rely on stocks	0.00011	0.00011	0.00010
Rely on bonds	0.00020	−0.00004	−0.00031
Top external	0.00014	−0.00002	−0.00004
Bottom external	0.00009	−0.00001	−0.00029
3rd coefficient	−0.00015	−0.00021	−0.00028
15th coefficient	0.00044	0.00045	0.00046
D. Interest rate shock on average long-run returns			
Equally weighted	0.00054	−0.00018	−0.00061
Value weighted	0.00071	0.00007	−0.00008
Asia	0.00079	0.00016	0.00002
Latin	0.00125	0.00035	0.00015
Rely on stocks	−0.00017	−0.00046	−0.00042
Rely on bonds	0.00137	−0.00031	−0.00147
Top external	0.00156	0.00049	0.00027
Bottom external	0.00009	−0.00084	−0.00183
3rd coefficient	−0.00220	−0.00130	−0.00102
15th coefficient	0.00284	0.00130	0.00084

(*continued on next page*)

Table 8 (*continued*)

Country group	k=12	k=36	k=60
E. Net equity flows shock on average long-run returns			
Equally weighted	0.00097	0.00040	0.00030
Value weighted	0.00127	0.00049	0.00033
Asia	0.00080	0.00038	0.00028
Latin	0.00122	0.00041	0.00025
Rely on stocks	0.00144	0.00061	0.00043
Rely on bonds	0.00086	0.00036	0.00034
Top external	0.00182	0.00072	0.00047
Bottom external	0.00053	0.00027	0.00030
3rd coefficient	−0.00079	−0.00032	−0.00019
15th coefficient	0.00189	0.00091	0.00071

Notes to the table: We analyze cumulative impulse response functions for two variables: average long run returns and change in equity holdings. The change in equity holdings is simply the cumulative sum of net equity capital flows. For the average long-run returns we examine shocks in capital flows and world interest rates. For the change in equity holdings we measure the effect of a shock in world interest rates, returns and dividend yields. The effects are calculated by summing the impulse response until k (in months) not including the contemporaneous effect. Equal weighting is an equal weighting of all 17 countries. Value weighting represents 17 countries weighted by their market capitalization in December 1991. Asia represents six Asian countries. Latin represents six Latin American countries. Rely on stocks are the six countries that tend to rely on stocks more than bonds for external financing since 1989. Rely on bonds are the six countries which tend to rely more on bonds for external financing. Top external are the six countries which have the largest proportion of cumulative net bond plus equity flows to GDP. Bottom external are the six countries with the smallest proportion of cumulative net bond plus equity flows to GDP. For the 3rd and 15th coefficient, we rank the coefficients across countries, eliminate "outliers", that is the smallest two and highest two and report the range from the remainder (min and max), (the 3rd and 15th coefficient given there are 17 countries). The VARs are estimated on the post-break sample. The break dates are detailed in Table 2.

6.1. The effects of world interest rate shocks

The effects of a negative world interest rate shock differ greatly between the pre-break and the post-break periods. Given that we should only expect any effect post-liberalization, we only consider the post-break period. The contemporaneous effects of a shock in world interest rates on capital flows are mixed with positive covariances dominating (see Table 9) but after one period a negative shock generally leads to small increases in net equity flows (Fig. 4 panel (a)). This is definitely the case for Asia but less so for Latin America. The countries that benefit the most are those with the highest degree of external financing. In all cases, the effects die out quickly. From Table 8, we see that a negative interest rate shock is associated with increased holdings at five year horizons for all groupings. The impact is greatest for countries that rely on bonds rather than stocks. While there is a large positive increase in holdings for Asian countries up to one year out compared to Latin American countries, by five years, the impact is very similar across the regions. A 0.3% decrease in world interest rates leads to an 0.04% increase in the proportion of the equity market held by US investors.

Table 9
Important contemporaneous effects

Coefficient	Equal weighted	Value weighted	Asian	Latin	Rely on equity	Rely on bonds	Top external financing	Bottom external financing	Residual weights
nf on i	0.0623	−0.0571	0.0595	0.0322	0.0453	0.0793	−0.0216	0.1394	0.0761
dy on i	12.1828	14.4512	18.5580	13.3682	14.1802	14.6054	18.7088	4.2519	11.1440
r on i	−8.6653	−12.9565	−10.7128	−11.9839	−8.2843	−14.3773	−15.5770	−3.4362	−7.6166
dy on nf	−4.5355	−5.5996	−10.0817	−1.6151	−11.6468	−0.9537	−7.2108	−3.5636	−5.8819
r on nf	3.7190	5.3209	6.5492	2.3367	8.4707	−0.3618	7.7257	3.8889	5.6144
r on dy	−0.2945	−0.2724	−0.2988	−0.2985	−0.3070	−0.2928	−0.3091	−0.2753	−0.3225

The coefficients reported are based on the contemporaneous betas implied by the causal ordering of our VAR in the post-break estimation. That is, they are taken from the matrix B, where $\Sigma = BHB'$, where B is lower triangle and H has the variances of the structural shocks along its diagonal. Equal weighted is an equal weighting of all 117 countries. Value weighted represents 17 countries weighted by their market capitalization in December 1991. Asia represents six Asian countries. Latin represents six Latin American countries. Rely on stocks are the six countries that tend to rely on stocks more than bonds for external financing since 1989. Rely on bonds are the six countries which tend to rely more on bonds for external financing. Top external are the six countries which have the largest proportion of cumulative net bond plus equity flows to GDP. Bottom external are the six countries with the smallest proportion of cumulative net bond plus equity flows to GDP. The variables are: the world interest rate (i), net equity flows (nf), dividend yields (dy) and returns (r).

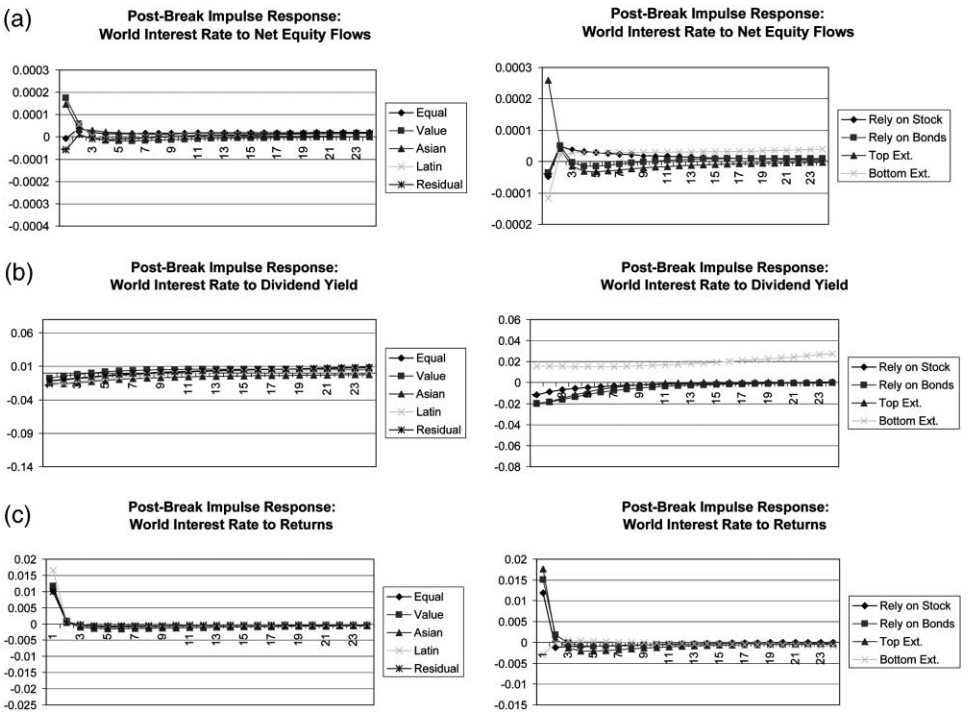

Fig. 4. The impact of world interest rate shocks on equity flows, dividend yields and returns.

The analysis of dividend yields in Fig. 4 panel (b) reveals that a negative shock in the interest rate is associated with lower dividend yields in Asian and Latin American countries. The only incidence of higher dividend yields is for countries that use little external financing. In terms of magnitude, Table 9 is informative. The contemporaneous beta is over 10.0, meaning that a 1% decrease in the world interest rate leads to a drop in the level of the dividend yield of about 10 times the average dividend yield, that is 35 bp. The effect persists for quite a long time, especially in Asia.

The analysis of returns in Fig. 4 panel (c) suggests a positive effect only contemporaneously in all countries except those that do not rely on external financing. This is consistent with a portfolio effect (higher capital flows to emerging markets) being induced by a low world interest rate. It may reflect a pure short-term price pressure effect or the return to integration (see above) if market liberalizations happen to coincide with periods of lower world interest rates.

Our analysis of long-run returns in Table 8 suggests that negative interest rate shocks increase long-run returns over a one-year horizon but the effect is often eliminated by three years. Generally, both the dividend yield effects and the expected return effects do not show clear enough results to distinguish between long-term beneficial effects (lower cost of capital) or short-term price pressure effects that might reverse themselves.

6.2. The effects of equity flow shocks

We examine the impact of positive equity flows shocks on dividend yields and returns in Fig. 5. We use this figure to illustrate the dramatic differences between the pre- and post-break analysis. Perhaps the most powerful graph that we present is the impulse response of a positive shock in equity flows on dividend yields. In the pre-break period, it is hard to see any consistent effect. However, in the post break period, there is a sharply lower dividend yield. Contemporaneously (see Table 9), the effect is on the order of about 20 basis points per 1% increase in foreign holdings (recall that because of the log-transformation, the coefficients must be multiplied by 0.035, the mean dividend yield, to obtain the effect on the level). In addition, the effect is very persistent. Dividend yields drop the most for Asian countries but also drop for Latin American countries. The drop in dividend yields is very strong for those countries that rely on external financing. Interestingly, the countries that actively use bond financing have a larger drop in dividend yields than those countries that rely more on equity financing. Following Bekaert and Harvey's (2000a) argument that changes in dividend yields closely follow changes in the cost of equity capital, this analysis suggests that increased capital flows decrease the cost of equity capital. It is important to realize that the shock to capital flows is net of the result of world interest rate changes.

The impulse response analysis of capital flows on returns in Fig. 5 is consistent with the portfolio rebalancing hypothesis. In the post-break period, returns increase only in the very short term. These results are consistent with the dividend yield results. A shock in equity capital flows increases the price level which leads to higher returns in the short-term and permanently lower dividend yields. The contemporaneous beta is around 6. This is of the same order of magnitude as the estimate for Mexico in Clark and Berko (1997), but much smaller than the estimate in the daily flow/return model in Froot et al. (2001). None of these studies separate the interest rate effect from the capital flows effect. The cumulative effect (see Table 8) remains positive, but becomes significantly smaller at the 60-month horizon suggesting some, but incomplete, reversal of prices. The largest impact is on countries that have a relatively large reliance on external financing.

6.3. The effects of return and dividend yield shocks

We now turn to the return chasing hypothesis. Bohn and Tesar (1996) distinguish two hypotheses. The "return updating" hypothesis links expected returns to capital flows. The "momentum" hypothesis predicts positive capital flows after positive returns. We revisit this last hypothesis by looking at realized returns and measuring the impact of a positive shock in returns on the capital flows (see Fig. 6 panel A). In our framework, the VAR ordering implies that the return shock omits the contemporaneous correlation with both capital flows and dividend yields and hence reflects an unusual unexpected high return, not contemporaneously correlated with foreign capital shocks or permanent cost of capital changes. We find a positive response of flows to returns in all regions but it is most dramatic for Latin American

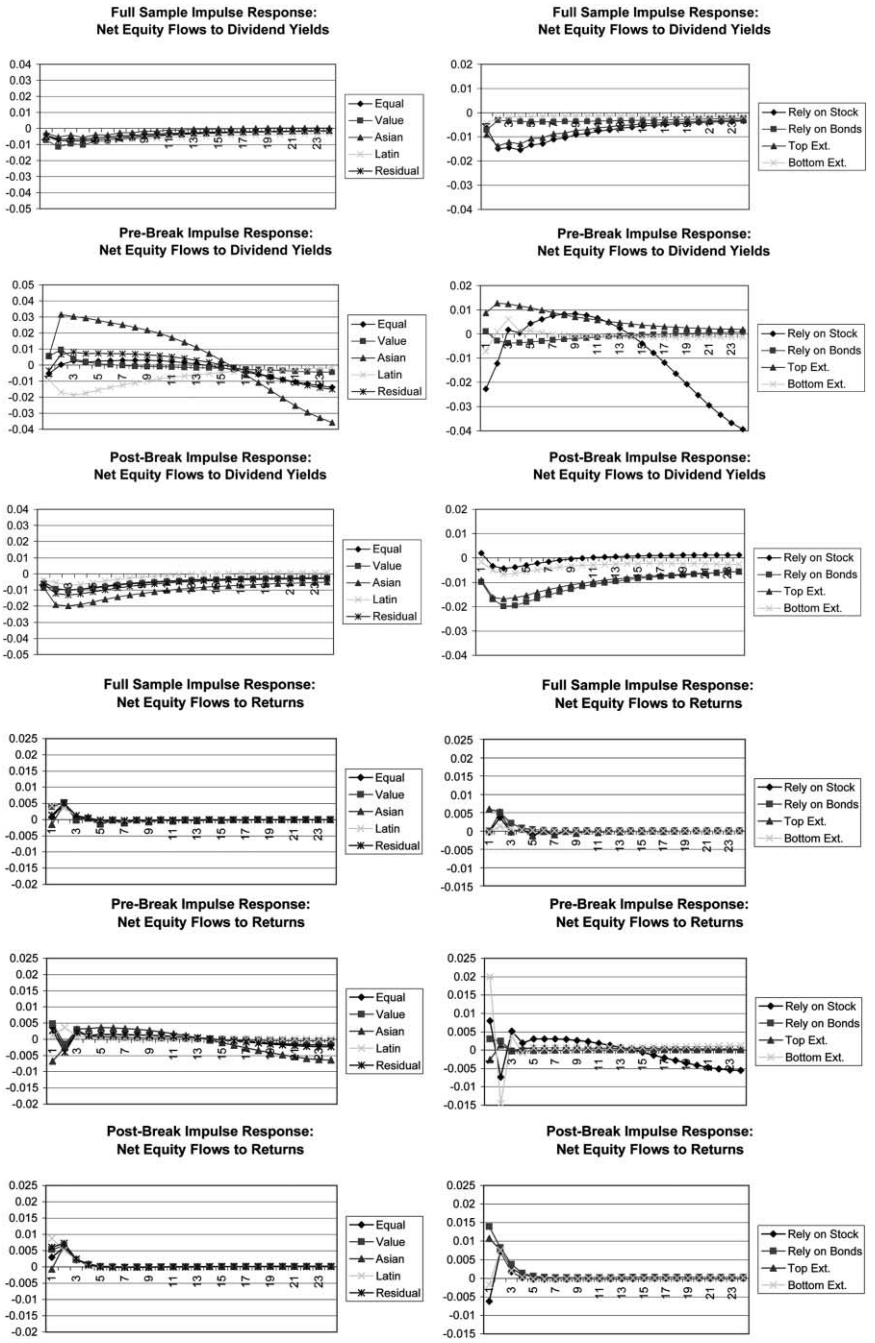

Fig. 5. The impact of equity flow shocks on dividend yields and returns in three samples.

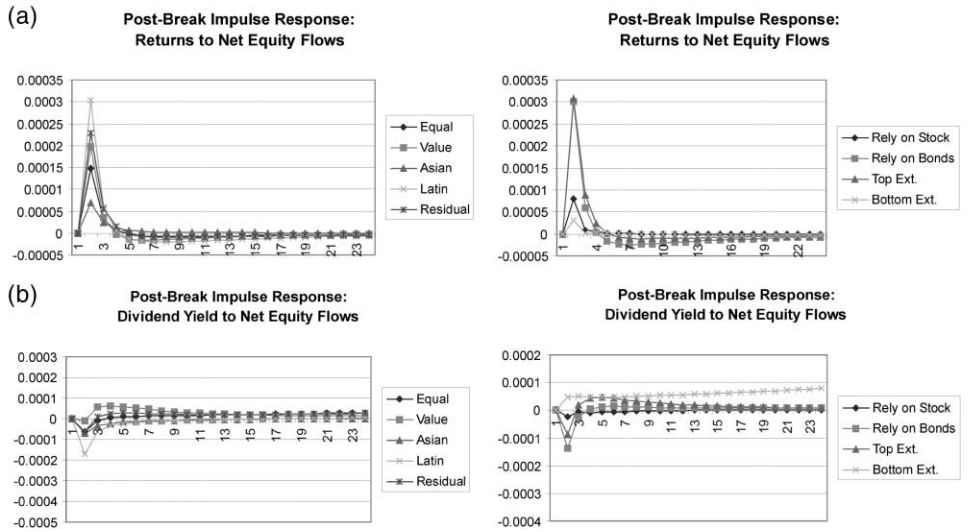

Fig. 6. The impact of returns and dividend yield shocks on equity flows.

countries. We find little or no impact on capital flows for those countries that have small external financing. The impulse response analysis supports the hypothesis that capital flows are, in part, momentum driven. That this is an entirely short-run effect is confirmed by the cumulative responses reported in Table 8, Panel C. The positive return shocks lead to higher holdings in the short-term but not in the long term.

Fig. 6 Panel (b) reports the effects of dividend yields on capital flows, where the dividend yield shock is net of a contemporaneous capital flow effect. A positive shock in the dividend yield is associated with higher flows after a few periods for the volatility-weighted, equally-weighted and the value-weighted set of countries after an initial negative response. For the Latin American and the Asian set, the impulse responses basically become zero. The former results may be consistent with the short-run momentum results and a longer term "expected return"-chasing effect. In the very short term, a higher dividend yield may simply reflect a negative unexpected return, which leads to reduced short-term capital flows. However, higher dividend yields may be associated with higher expected returns in the future. Positive effects on capital flows are only visible after two periods and then only for a subset of our groupings. The countries not relying on external finance display a consistently positive effect. Table 8, Panel B cumulates these effects to measure the total change in holdings. The cumulative effects, for example, show that the positive long-run effects on capital flows in South-East Asia suffice to overturn the initial negative effect. For Latin American and stock reliant countries, the cumulative effect is slightly negative.

7. Conclusions

The goal of this paper is to develop a better understanding of the relation between capital flows and asset prices. We apply the latest structural break econometrics to identify liberalizations in 20 emerging markets and then examine a VAR in pre- and post-break periods on four variables: the world interest rate, net equity capital flows, ex post returns and a proxy for expected returns, the dividend yield.

Our results can be grouped into two main categories. Our first set of findings concern the break dynamics. We find that after a liberalization equity capital flows increase by 1.4% of market capitalization on an annual basis. However, three years post-liberalization, the equity flows are reduced. This is consistent with a model whereby investors rebalance their portfolios towards emerging markets. Also, comparing the pre with post-break dynamics, we document that in almost all the countries we examine, when capital leaves it leaves much faster than it came. These intriguing results may shed light on the recent crises in Latin America and Asia and the role of capital flight.

Our second set of results revisits a number of important hypotheses in a structural VAR framework. The fundamental nonstationarity in the data — structural breaks induced by liberalizations — ignored by previous research, is not without consequences. We illuminate significant differences between the pre-break analysis and the post-break analysis.

Our analysis yields three main findings. First, the "push effect" from world interest rates to capital flows appears consistently when we cumulate impulse responses whereas contemporaneously interest rates and capital flows show no consistent correlation pattern. A 0.3% decrease in interest rates eventually increases foreign holdings by about 0.04% of market capitalization, a small effect. Interest rate decreases do generate strong but very short-lived increases in returns.

Second, unexpected shocks to equity flows have a strongly positive contemporaneous effect on returns, in line with the findings of Clark and Berko (1997) and Froot et al. (2001). The effect immediately dies out but there is only incomplete reversal suggesting some of the effect is permanent. This is consistent with our finding that positive shocks in net equity capital flows lead to lower dividend yields — our proxy for expected returns. Following Bekaert and Harvey's (2000a) argument that dividend yield changes reveal information about the cost of equity capital, the equity capital flow shocks lead to a lower cost of capital in many countries. We find that this relation is dramatically strengthened if we estimate our VARs on the post-break sample. Although part of the initial effect may be due to "price pressure", our results suggest part of the response is near permanent and beneficial.

Third, we revisit the Bohn and Tesar (1996) argument that capital flows can be driven by expected 'return chasing' and by momentum investing. We find evidence that positive returns shocks are followed by increased short-term equity capital flows, indicating a momentum effect. Using the dividend yield as a proxy for long-run expected returns, we find only weak evidence for the expected return chasing hypothesis.

There are, of course, many caveats to our analysis. Ideally, we need an economic

theory that captures the evolution from segmented to integrated financial markets. In the absence of such a theory, we rely on vector autoregressions to characterize the behavior of important financial aggregates. In addition, the break methodology implicitly assumes that every break is permanent and hence theoretically ignores that the next break may be rationally anticipated by market participants. If this is the case, a regime switching model, such as the one presented in Bekaert and Harvey (1995) may be a superior modeling approach. Although we have not studied this issue in detail, we believe that structural break tests can probably be used to detect persistent changes in regime and so are less incompatible with a regime-switching model than theory may lead one to believe.

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Technical appendix

BLS (Testing for a single break with multiple time-series that break at the same time)

The techniques in Bai et al. (1998) (BLS) enable us to investigate structural breaks in the relationship between capital flows, returns, and dividends and to construct confidence intervals around an estimated break date. For this part of the analysis, we assume that the data are generated by a stationary vector autoregression and there is at most one structural break. One of the key results in BLS is that the precision with which a potential break date is estimated (as given by the width of the associated confidence interval) is a function not of the number of observations but of the number of series in a multivariate framework that experience the same break date. In addition, they show that including series that have no break in the VAR, such as the world interest rate in our application, while reducing the power of the tests to detect a common break, will not increase the width of the confidence intervals. In an earlier paper (Bekaert et al., 2002, hereafter BHL), we provide empirical examples of how these techniques can be used to draw inference.

Appendix Table 1
Univariate break tests

Country	Statistic	5th %ile	Median	95th %ile	# of lags	Statistic	5th %ile	Median	95th %ile	# of lags
	Log returns					**Log dividend yield**				
Argentina	8.00	Jun 84	Jul 89	Aug 94	1	8.84	Oct 90	May 92	Dec 93	1
Brazil	8.17	Sep 82	Apr 87	Nov 91	1	9.25	May 88	Nov 90	May 93	3
Chile	24.75***	May 81	Feb 83	Nov 84	2	20.48***	Jan 81	Sep 82	May 84	3
Colombia	14.17**	Apr 90	Feb 92	Dec 93	1	14.98**	Jun 92	Feb 94	Oct 95	2
Greece	8.38*	Feb 81	Nov 85	Aug 90	0	15.29**	Dec 83	Jun 86	Dec 88	1
India	6.23	Oct 86	Apr 92	Oct 97	0	12.67	Jul 89	Jan 92	Jul 94	3
Indonesia	21.75***	Dec 96	Apr 97	Aug 97	2	20.68***	Apr 92	May 92	Jun 92	2
Jordan	5.94	Feb 79	Apr 82	Jun 85	0	30.18***	Nov 91	Apr 92	Sep 92	1
Korea	10.62**	Sep 92	Nov 94	Jan 97	0	92.49***	Dec 90	Feb 91	Apr 91	1
Malaysia	12.53**	Jun 95	Jul 96	Aug 97	0	10.32*	May 90	Feb 91	Nov 91	1
Mexico	22.69***	Jan 86	Oct 87	Jul 89	3	11.92**	Oct 84	May 86	Dec 87	1
Nigeria	2.56		Jun 87	Aug 97	3	5.55	Feb 94	Jun 95	Oct 96	1
Pakistan	13.01*	Jan 92	Dec 93	Nov 95	2	29.77***	Jan 96	Mar 96	May 96	2
Philippines	13.10**	Nov 86	Aug 87	May 88	1	10.49	Aug 90	Oct 91	Dec 92	3
Portugal	17.19*	Feb 87	May 88	Aug 89	4	19.49***	Jan 89	Apr 89	Jul 89	2
Taiwan	7.94*	Feb 87	Feb 90	Feb 93	0	18.26	Jul 87	Apr 88	Jan 89	4
Thailand	21.38	Oct 93	Nov 94	Dec 95	4	15.33**	Mar 89	Jan 90	Nov 90	1
Turkey	2.70		Aug 90	Jan 97	0	20.23	Aug 89	Oct 89	Dec 89	1
Venezuela	8.96	Apr 89	Feb 92	Dec 94	1	12.04	Jul 90	Mar 92	Nov 93	2
Zimbabwe	7.17	May 91	Mar 95		3	6.59	Feb 92	Jun 93	Oct 94	1

(*continued on next page*)

Appendix Table 1 (*continued*)

Country	Statistic	5th %ile	Median	95th %ile	# of lags	Statistic	5th %ile	Median	95th %ile	# of lags
	Net equity flows to equity capitalization					**Net bond flows to GDP**				
Argentina	37.50***	Jan 95	Jul 95	Jan 96	2	44.00***	Jul 92	Apr 93	Jan 94	0
Brazil	30.74***	Dec 88	Jan 90	Feb 91	1	9.44	May 89	Nov 92	May 96	0
Chile	11.31*	Feb 85	Jan 88	Dec 90	1	2.08		May 84		0
Colombia	24.12***	Nov 92	Jul 93	Mar 94	0	55.08***	Sep 93	Feb 94	Jul 94	3
Greece	18.89***	Feb 90	Mar 92	Apr 94	1	15.29**	Apr 93	Nov 94	Jun 96	0
India	82.20***	Feb 93	May 93	Aug 93	0	23.48***	Aug 94	May 95	Feb 96	2
Indonesia	5.40	May 93	Dec 95		0	29.62***	Jul 94	Jun 95	May 96	2
Jordan										
Korea	34.89***	Jun 95	Jan 96	Aug 96	2	24.42***	May 89	Dec 90	Jul 92	0
Malaysia	18.68**	Feb 93	Feb 94	Feb 95	3	15.03**	Jul 91	Jul 93	Jul 95	0
Mexico	7.77	Nov 87	Jul 90	Mar 93	1	13.59**	Mar 87	Mar 90	Mar 93	0
Nigeria										
Pakistan	6.10	May 95	Dec 96		1	n.a.				
Philippines	26.62***	Sep 87	Jul 90	Mar 93	0	54.72***	Sep 95	Nov 95	Jan 96	4
Portugal	4.67	Sep 91	Jun 95		0	31.13***	Sep 94	May 95	Jan 96	4
Taiwan	5.31	Feb 92	Jun 95		1	21.93**	Jun 91	Nov 91	Apr 92	4
Thailand	34.91***	Jan 96	Jul 96	Jan 97	4	29.07***	Aug 94	May 95	Feb 96	0
Turkey	5.05	Sep 94	Nov 96		0	39.70***	May 92	Jul 92	Sep 92	4
Venezuela	3.34	Dec 92	Aug 96		0	1.62		Dec 90		0
Zimbabwe										

Univariate break tests based on the methods of Bai et al. (1998). Test is computed from an autoregression, where the number of lags is chosen by the BIC, and is the maximum over all possible break dates $k^*+1 \leq k \leq T-k^*$ of an F-statistic testing the hypothesis that all coefficients in the autoregression break at date k. k^* is the trimming value, taken to be $0.15T$, where T is the sample size. Critical values for the statistics are given in BHL (1999). The estimated break date is given by the column labeled "Median", with corresponding 90% confidence interval given by the columns labeled "5th %ile" and "95th %ile". Blanks in these latter two columns indicate that the estimated confidence interval exceeded the sample size. Significance of the break tests at the 10, 5 and 1% levels are denoted by *, **, and ***, respectively.

Appendix Table 2
Multivariate break tests

	Trivariate tests:					Quadravariate tests:					Quintravariate tests:				
	Equity flows, dividend yields, returns					World interest rates, equity flows, dividend yields, returns					World interest rates, bond flows, equity flows, div. yields, returns				
Country	Statistic	5th %ile	Median	95th %ile	# of lags	Statistic	5th %ile	Median	95th %ile	# of lags	Statistic	5th %ile	Median	95th %ile	# of lags
Argentina	38.25***	Mar 95	Apr 95	May 95	1	40.42**	Aug 94	Sep 94	Oct 94	1	126.84**	May 94	Jun 94	Jul 94	3
Brazil	175.7***	Feb 90	Mar 90	Apr 90	3	198.68***	Feb 90	Mar 90	Apr 90	3	257.1***	Feb 90	Mar 90	Apr 90	3
Chile	84.35***	Mar 85	Apr 85	May 85	3	91.15***	Feb 85	Mar 85	Apr 85	3	149.24***	Dec 85	Jan 86	Feb 86	3
Colombia	79.43***	Apr 94	May 94	Jun 94	2	90.77***	Apr 94	May 94	Jun 94	2	128.07***	Apr 94	May 94	Jun 94	2
Greece	50.35***	Jun 88	Jul 88	Aug 88	2	70.8**	Jun 88	Jul 88	Aug 88	3	99.86**	Jun 88	Jul 88	Aug 88	3
India	78.6***	Feb 93	Mar 93	Apr 93	3	73.44**	Mar 92	Apr 92	May 92	3	117.68**	Mar 93	Apr 93	May 93	2
Indonesia	140.72***	Apr 97	May 97	Jun 97	2	191.93***	Apr 97	May 97	Jun 97	3	203.82***	Apr 97	May 97	Jun 97	3
Jordan															
Korea	96.6***	Dec 95	Jan 96	Feb 96	3	122.89***	Aug 95	Sep 95	Oct 95	3	591.9***	Mar 96	Apr 96	May 96	3
Malaysia	70.25***	May 96	Jun 96	Jul 96	3	81.97***	Jun 96	Jul 96	Aug 96	3	136.14***	Jul 96	Aug 96	Sep 96	3
Mexico	67.53***	Aug 87	Sep 87	Oct 87	3	106.13***	Aug 87	Sep 87	Oct 87	3	140.33***	Sep 87	Oct 87	Nov 87	3
Nigeria															
Pakistan	31.52**	Nov 96	Dec 96	Jan 97	1	53.77***	Nov 96	Dec 96	Jan 97	1	135.36***	Jul 97	Aug 97	Sep 97	1
Philippines	52.46	Jul 88	Aug 88	Sep 88	3	99.4***	Feb 88	Mar 88	Apr 88	3	163.4***	Nov 88	Dec 88	Jan 89	3
Portugal	89.84***	Apr 89	May 89	Jun 89	3	106.07***	Jan 89	Feb 89	Mar 89	3	172.18***	May 96	Jun 96	Jul 96	3
Taiwan	59.13**	Mar 88	Apr 88	May 88	3	109.69***	Mar 88	Apr 88	May 88	3	178.77***	Mar 88	Apr 88	May 88	3
Thailand	117.18***	May 96	Jun 96	Jul 96	3	132.3***	May 96	Jun 96	Jul 96	3	180.52***	May 96	Jun 96	Jul 96	3
Turkey	144.53***	Dec 96	Jan 97	Feb 97	3	182.85***	Dec 96	Jan 97	Feb 97	3	229.4***	Dec 96	Jan 97	Feb 97	3
Venezuela	128.14***	Jul 96	Aug 96	Sep 96	3	152.34***	Jul 96	Aug 96	Sep 96	3	183.38***	Aug 96	Sep 96	Oct 96	3
Zimbabwe															

Multivariate break tests based on the methods of Bai et al. (1998), testing the null hypothesis of no structural change against the alternative of a single break. The test is computed from a VAR, where the number of lags is chosen by the BIC, and is analogous to the univariate tests in Table 2. In the quadravariate and quintravariate tests, only the returns, dividend yields, and flows are allowed to break, that is, the test does not let the variables in the world interest rate equation break. See also notes to Table 2.

Appendix Table 3
Tests that allow for multiple breaks

	Log returns				Log dividend yield				Net equity flows to equity capitalization				Net bond flows to GDP			
Country	5th %ile	Median	95th %ile	Signif	5th %ile	Median	95th %ile	Signif	5th %ile	Median	95th %ile	Signif	5th %ile	Median	95th %ile	Signif
Argentina 1		NB		not	Mar 92	May 92	Nov 93	1.0%	Mar 92	Dec 92	Feb 93	2.5%	Aug 80	May 81	Sep 81	10.0%
Argentina 2									Oct 94	Aug 95	Dec 95	2.5%	Feb 93	Mar 93	Apr 93	10.0%
Brazil 1	Feb 84	May 87	Jun 90	10.0%		Jan 91		not		NB		not		NB		not
Brazil 2						Feb 95		not		NB		not		NB		not
Chile 1	Oct 81	Mar 83	Jan 85	1.0%		Nov 90		not		NB		not		NB		not
Chile 2						Nov 94		not		NB		not		NB		not
Columbia 1	Feb 90	Feb 92	Jun 93	2.5%	Jan 91	Oct 91	Dec 91	5.0%		NB		not		NB		not
Colombia 2					Oct 93	Feb 94	Jun 95	2.5%		NB		not		NB		not
Greece		NB		not	Dec 86	Jul 88	Sep 90	1.0%	Feb 90	Mar 92	May 92	10.0%		NB		not
India		NB		not		NB		not	Apr 93	May 93	Jun 93	1.0%		NB		not
Indonesia		NB		not	Feb 92	Apr 92	Jun 92	1.0%		NB		not	Mar 94	Feb 96	Oct 96	10.0%
Jordan 1				not	Oct 91	Apr 92	Jul 92	1.0%		No data				No data		
Jordan 2				not	Aug 94	Feb 95	Nov 95	1.0%		No data				No data		
Korea 1		NB		not	Sep 89	Feb 91	Apr 91	1.0%	Sep 95	Jul 96	Oct 96	1.0%	Oct 90	Nov 90	Dec 90	1.0%
Korea 2									Aug 86	Dec 86	Aug 87	10.0%		NB		10.0%
Korea 3									Aug 91	Oct 92	Dec 92	10.0%		NB		10.0%
Malaysia		NB		not	Jul 90	Jan 91	Feb 93	5.0%		NB		not		NB		not
Mexico 1	Apr 84	Mar 86	Oct 87	5.0%	Jan 82	Jan 83	Jul 83	5.0%		NB		not		NB		not
Mexico 2	Sep 94	May 95	Jun 96	5.0%	Apr 86	Jul 86	Dec 86	5.0%		NB		not		NB		not
Mexico 3					Aug 90	Mar 91	Feb 92	5.0%		NB		not		NB		not
Nigeria	Mar 95	May 95	Oct 96	1.0%		NB		not		No data				No data		
Pakistan 1		NB		not	Oct 90	Dec 90	Apr 91	5.0%		NB		not		NB		not
Pakistan 2					Apr 95	Mar 96	Jun 96	5.0%		NB		not		NB		not

(*continued on next page*)

Appendix Table 3 (*continued*)

Country	Log returns				Log dividend yield				Net equity flows to equity capitalization				Net bond flows to GDP			
	5th %ile	Median	95th %ile	Signif	5th %ile	Median	95th %ile	Signif	5th %ile	Median	95th %ile	Signif	5th %ile	Median	95th %ile	Signif
Philippines 1	May 87	Aug 87	Jun 88	10.0%		NB		not		NB		not		NB		not
Philippines 2	Jan 88	Jul 89	Jan 90	10.0%		NB		not		NB		not		NB		not
Portugal		NB		not		NB		not		NB		not	Sep 90	Jan 92	Aug 92	1.0%
Taiwan 1	Apr 86	Oct 87	Oct 88	10.0%		NB		not		NB		not	Mar 90	Apr 90	May 90	2.5%
Taiwan 2													Nov 90	Oct 91	May 93	2.5%
Thailand 1		NB		not	Feb 89	Jan 90	Mar 90	2.5%	Jul 87	Aug 88	Mar 89	1.0%		NB		not
Thailand 2					Sep 92	Apr 93	Sep 94	10.0%								
Turkey	Feb 93	May 94	May 96	10.0%	Jun 89	Sep 89	Sep 90	10.0%		Dec 91		not	Mar 92	Jun 92	Jul 96	not
Venezuela		NB		not		NB		not		NB		not		NB		not
Zimbabwe		NB		not		NB		not		No data		not		no data		

Multiple break tests use the repartition methods of Bai and Perron (1998a,b) which allow for a maximum of 5 breaks with 15% trimming. All tests are performed assuming 2 lags in the autoregression. Estimated break dates are given in the column labelled “median”, along with corresponding confidence intervals in the columns labelled “5th %ile” and “95th %ile”. The significance level reports the lowest significance level for which the repartition procedure found each specific date to be significant. NB = No Break.

For this part of the analysis, it is assumed that there is at most one break. It is also assumed that the errors in the VAR have $4+\kappa$ moments for some $\kappa > 0$. The general form of the regression is (equation 2.2 from BLS):

$$Y_t = (G'_t \otimes I_n)\theta + d_t(k)(G'_t \otimes I_n)S'S\delta + \varepsilon_t, \tag{A1}$$

where Y_t is $n\times 1$ (defined earlier), G'_t is a row vector containing a constant and p lags of Y_t, I_n is an $n\times n$ identity matrix, $d_t(k) = 0$ for $t < k$ and $d_t(k) = 1$ for $t \geq k$. θ and δ are parameter vectors with dimension $r = n(np+1)$. S is a selection matrix containing zeros and ones and having column dimension r and row dimension equal to the number of coefficients which are allowed to change ($\leq r$; i.e., S is full row rank).

The procedure for determining when a potential break occurred involves estimating (A1) for all possible break dates $k^*+1 \leq k \leq T-k^*$, where k^* represents a trimming value, often taken to be 15% of the sample size, T. At each possible break date, an F-statistic is computed, testing the significance of $S\delta$, and is denoted $F(k)$. Then the statistic testing for structural change is equal to

$$\max_{k^*+1 \leq k \leq T-k^*} F(k).$$

BLS show that this statistic converges via the functional central limit theorem to $\max F^*$, a (known) function of Brownian motion. More details and critical values are provided in BHL and BLS.

A confidence interval with asymptotic coverage of at least 95% is given by (eq. 2.19 in BLS):

$$CI = (\hat{k} - [\Delta k] - 1, \hat{k} + [\Delta k] + 1),$$

where $\hat{k}$ is the estimated break date, $[\cdot]$ denotes the "greatest least integer", and

$$\Delta k = c[(S\hat{\delta})'S(\hat{Q}_1 \otimes \hat{\Sigma}_{\hat{k}}^{-1})S'(S\hat{\delta})]^{-1},$$

where c=7.63, $\hat{\Sigma}_{\hat{k}}$ is the estimator of the variance-covariance matrix of the OLS residuals under the alternative, given $\hat{k}$, and $\hat{Q}_1 = \frac{1}{T}\sum_{t=1}^{T} G_t G'_t$.

BP (Testing for multiple breaks in a single series)

The assumption of a single structural change seems less palatable in light of the Asian crisis. In addition, as we indicated above, some theoretical models of the dynamics of capital flows [see, e.g. Bachetta and van Wincoop (2000)] may also lead to multiple breaks in the net flows as a percentage of market capitalization. Therefore, we investigate whether returns, dividend yields, and capital flows experienced multiple structural breaks, using techniques recently developed by Bai and Perron (1998a,b). Because multiple break analogs to the VAR framework of BLS have not yet been developed, we consider each series separately.

Rather than assuming the number of breaks is known a priori, Bai and Perron provide econometric tests to determine the number of breaks. The necessary assump-

tions in Bai and Perron are not particularly restrictive and admit a wide variety of linear specifications to identify the break dates, and construct confidence intervals around the estimated break dates. We use one of their set-ups that has serially uncorrelated errors but allows for lagged dependent variables. As in Lumsdaine and Papell (1997), it is also assumed that the breaks are asymptotically distinct (intuitively, if a large downward spike is immediately followed by a large upward one, this would be considered one break, rather than two). Bai and Perron also show that the estimation of a single break when the underlying series has two breaks in its data-generating process results in consistent estimation of the break fraction for one of the breaks. In fact, the procedure consistently estimates the break of the larger magnitude. Hence, our work assuming single breaks may still detect useful dates.

To implement the procedure for investigating multiple breaks, we follow the recommendations in Bai and Perron (1998b).[6] First, we use their double maximum tests to test the null hypothesis that there is no break versus the alternative that there is at least one break. The statistic is given by

$$\max_{1 \le m \le M} F_T^*,$$

where F_T^* is a modified F-statistic given by equation (A2) in the technical appendix below and M is the upper bound on the number of breaks. Critical values are given in Bai and Perron (1998a,b), for various values of M and k^*, the trimming value.[7] Second, if there is evidence of at least one break, we implement their repartition procedure, which is based on comparing the sum of squared residuals from estimation of the 'best' (in a minimum sum of squared residuals sense) l-break model to the best l+1-break model, beginning with $l = 1$. The number of breaks m is the first value of l for which the test fails to reject the null hypothesis of l breaks in favor of the alternative of l+1 breaks. Finally, confidence intervals are then computed around the break dates estimated using the m-break model (formulas are given in Bai and Perron (1998b)).

We consider the full structural change model of Bai and Perron (that is, where all coefficients are allowed to change). Using notation analogous to (A1), the model can be written as

$$Y_t = \sum_{i=1}^{m+1} d_t(k_i) G_t' \delta_i + \varepsilon_t,$$

where m is the number of breaks and, as in model (A1), G_t consists of a constant and lags of Y_t, and $d_t(k_i)$ is an indicator variable equal to 0 when $t < k_i$ and 1 otherwise.

A maximal F-test is used to test the hypothesis of no structural change versus the alternative of m breaks. The null hypothesis is thus

[6] We are grateful to Pierre Perron for supplying us with the Bai-Perron programs.

[7] The trimming value refers to the number of observations at either end of the sample where it is assumed that no break has occurred; in earlier literature this was most often chosen to be $0.15T$ or $0.01T$ where T is the sample size.

$$H_0\colon \delta_1 = \ldots = \delta_{m+1}$$

and can be expressed as $R\delta = 0$ where

$$R = \begin{pmatrix} 1 & -1 & 0 & \ldots & 0 & 0 & 0 \\ 0 & 1 & -1 & \ldots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \ldots & 1 & -1 & 0 \\ 0 & 0 & 0 & \ldots & 0 & 1 & -1 \end{pmatrix}.$$

Then the F-statistic is (this corresponds to equation (12) in Bai and Perron (1998a))

$$\sup_{(\lambda_1,\ldots,\lambda_m)\in\mathbf{\Lambda}} F_T^*(\lambda_{1,\ldots},\lambda_m;r) = \frac{1}{T}\left[\frac{T-(m+1)r}{mr}\right]\hat{\delta}' R'(R\hat{V}(\hat{\delta})R')^{-1}R\hat{\delta}, \tag{A2}$$

where $\hat{\delta}$ is an estimate of δ, and $\delta = (\delta'_1,\ldots,\delta'_{m+1})'$, $\hat{V}$ is the estimate of its covariance matrix, λ_i is the fraction of the sample at which break i occurs, $\mathbf{\Lambda}$ is the space of all possible m-partitions and r is the number of columns in G.

One drawback of this approach is that the choice of how many lags to include must now be determined exogenously, rather than by using an information criterion. However, the BP procedures do allow for robust (heteroskedasticity and autocorrelation consistent) covariance estimation and for different variances of the errors in each of the break periods, something the BLS test theory permits but is not allowed in current implementation. There is a cost associated with this flexibility, however; in general the BP tests appear to have less power to detect breaks than the BLS tests. Thus it is important to consider both sets of results together when identifying possible break dates.[8]

Data appendix

Dividend yields

There are a few instances of zeros in the 12-month moving sum of dividends that the IFC reports. We investigated these zeros by looking at each individual firm's dividends. There seems to be an issue of when the IFC recorded dividends. For example, in Korea, there are dividends paid in January 1988 and no dividends appear in the individual company files until March 1989. After that, there is no dividend

[8] When we restrict the BP test to at most use one break, the number of lags of the BLS tests, and do not allow for robust covariance estimation or different variances, we replicate the break dates, confidence intervals, and significance levels of the BLS tests, except for Indonesia and Portugal, two countries with very short samples, where the break dates differ slightly.

paid by an individual company until April 1990. It is not surprising that we find zero entries in January and February 1989 and in March 1990. In order to avoid zero entries which appear to be a result of the timing of the recording of dividends, rather than a canceling of dividends, we carried forward some past dividends to replace these holes in the data.

For Korea, we calculate the dividend on the index in December 1988 and use that value as the numerator for the dividend yield calculation for January and February 1989. The values (in percent) for these two months are 0.5511 and 0.5273, respectively. In February 1990, we calculate the dividend on the index and use that value in the numerator for March 1990. The value is 1.0919.

For Indonesia, we calculate the value of the dividend in June 1991. That value is used in the numerator for July 1991 through February 1992. The dividend yields are: 0.1200, 0.1380, 0.1745, 0.1936, 0.1799, 0.1718, 0.1496 and 0.1311.

For Taiwan, we calculate the value of the dividend in February 1990 and use that in the numerator for March 1990 through April 1991. The dividend yields for this period are: 0.2250, 0.2600, 0.3340, 0.4545, 0.4186, 0.6355, 0.8307, 0.6825, 0.5314, 0.5037, 0.5831, 0.4703, 0.4677 and 0.4048.

World interest rates

The nominal interest rate for the G-7 countries is calculated by aggregating individual countries' short-term interest rates weighted by using countries' previous quarter's share in G-7 GDP. The following interest rates are employed: Canada 90-day Treasury bill (IFS 60C), France 90-day bill (IFS 60C), Germany 90-day bill (IFS 60C), Italy 180-day bill (IFS 60B), Japan commercial paper from 1975–1976 (IFS 60B) and the Gensaki rate from 1977–1997 (IFS GBD3M), United Kingdom 90-day bill (IFS 60C), and the United States 90-day bill (IFS 60C).

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