Board of Governors of the Federal Reserve System

International Finance Discussion Papers

Number 708

August 2001

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Abstract: We present a readily available monthly measure of the intensity of capital controls across 29 emerging market countries that is based on the degree of restrictions on foreign ownership of equities. The initial opening of a market as given by our measure corresponds well with the liberalization dates of Bekaert and Harvey (2000a). In addition, our measure provides information on the extent of the initial opening as well as the evolution of the liberalization over time. We discuss two versions of the measure. One version provides the better indication of the extent of controls at a point in time, and is thus better suited for cross-sectional analysis. The other version—smoothed of the relative price effects of asymmetric shocks—provides a better indication of changes in controls, and is thus more appropriate for time series work. After describing the measure, we compare it to other existing measures of capital controls and briefly describe some empirical applications.

JEL Classification: F3, G15
Keywords: emerging markets, international financial liberalization, openness, portfolio investment

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I. Introduction

Measuring the degree of capital account liberalization is notoriously difficult. In the economics literature, most measures of capital controls are qualitative, building on the data assembled by the IMF and published in its *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*). The typical measure from this source—constructed as an on/off indicator of the existence of rules or restrictions that inhibit capital flows—does not offer any indication of the intensity of capital controls.[1] In the finance literature, the focus has been on dating financial liberalizations and treating them as one-time events or structural breaks (Bekaert and Harvey, 2000a; Henry 2000a).

In our view both of these approaches can be refined. Treating liberalizations as events or structural breaks presupposes that all liberalizations are similar in their intensity and speed. We show that they are not. In particular, although the experience of each country is different, liberalizations in Latin America were in general much faster and much more complete than in emerging Asia. Moreover, relying on annual measures of capital controls formed from dummy variables gives little indication of the intensity of controls or of changes in restrictions. We show that a monthly measure that is particularly simple to construct provides accurate pictures of the intensity of controls at a point in time as well as their evolution through time.

There is a great need for a measure that captures both the intensity of controls and is available at a frequency higher than annual for a wide range of countries. The monthly measure we propose is the ratio of the market capitalizations underlying a country's Investable and Global indices as computed by the International Finance Corporation (IFC). The idea is simple. For each emerging market country, the IFC computes a Global index (IFCG) that is designed to represent the market. The IFC also computes an Investable index (IFCI), designed to represent that portion of the market available to foreign investors. Hence, the ratio of the market capitalizations of a country's IFCI and IFCG indices is a quantitative measure of the availability of the country's equities to foreigners, and one minus the ratio is a measure of the intensity of capital controls.

We present two versions of our measure. One, based solely on the ratio of market capitalizations of the IFCI and IFCG indices, gives the better indication of the extent of a country's

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[1] Quinn (1997) is the one study that attempts to score the intensity of controls using IMF data. For thorough descriptions of this and other measures of capital controls, see Edison et al. (2001) and the survey of Eichengreen (forthcoming).

capital controls at a point in time—the level of restrictions—and is appropriate for use in cross-sectional analysis. Over time, however, relative price changes may affect the relative market capitalizations of investable and non-investable stocks, even with no change in capital controls. Thus, for time series work, when an accurate picture of changes in capital controls is required, we propose a "changes" version that simply smooths through relative price changes.

The data underlying our measure have been available for a number of years but have not been widely utilized by researchers. A version of our measure has been used in the literature— by Bekaert (1995) and Henry (2000a and 2000b) to date stock market liberalizations, and by Bachetta and van Wincoop (2000) to make the case that liberalizations appear to be gradual—but has not yet been put forth as a viable measure of capital controls that can be used in empirical work.[2]

The investability measure we present is narrow, focusing only on restrictions on foreign ownership of domestic equities. That said, the measure captures the intensity of controls, is readily available at a monthly frequency starting in December 1988 for many emerging market countries, lends itself well to empirical analysis of cross-sectional and time series data sets, and is extremely easy to compile, piggybacking as it were on the hard work of the IFC.[3]

In some sense our measure can be seen as an extension of the liberalization analysis of Bekaert and Harvey (2000a) and Henry (2000a). Indeed, the initial relaxation of controls shown by our measure corresponds quite well with the Bekaert-Harvey liberalization date.[4] Our measure provides additional information, giving an indication of the extent of the liberalization and its evolution over time. It shows, in particular, that financial liberalizations can be gradual, which would argue against the use of an event study approach or structural break analysis.

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[2] Recently, Chari and Henry (2001) use firm-level IFC data to examine characteristics of investable and non-investable firms.

[3] An annual version of the measure can be compiled using information from the annual *Emerging Stock Markets Factbook*, published until 1999 by the IFC and thereafter by Standard & Poors, who took over the maintenance and ownership of the IFC price indices in January 2000. The Emerging Stock Markets Database is required to compile the monthly measure.

[4] The liberalization dates in Henry (2000a) are somewhat earlier for some countries.

Following a detailed description of the methodology in the next section, we will present the country-level measures (Section III), compare ours with other measures of capital controls (Section IV), and briefly discuss some empirical applications (Section V). Finally, Section VI gives concluding remarks and ideas for future research.

II. The Measure

The theory behind our measure of the intensity of capital controls is straightforward: The ratio of the market capitalizations of equities in the IFC Investable and IFC Global indices measures the availability of a country's stocks to foreigners. For a given country, the IFCG index is designed to represent the overall market portfolio. The IFCI index, designed to better represent a portfolio available to foreign investors, excludes from the IFCG those stocks (or portions of stocks) not available to foreigners due to either legal restrictions or low liquidity.

In this section we discuss in further detail the design of the underlying IFC indices and our two measures of foreign ownership restrictions—a "levels" version that gives an indication of the extent of controls at a point in time and a "changes" version that gives a clearer picture of changes in capital controls over time—and minor adjustments that should be made by researchers when replicating our measures.[5]

The IFC Indices

For each emerging market country, the IFC computes two indices: a Global index that is intended to represent the market, and an Investable index, a subset of the Global index that represents the portion of the market available to foreigners. We discuss each of these indices in turn; for a more complete description of the methodology behind the construction of the IFC indices, see Standard & Poors (2000), from which our presentation borrows heavily.

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[5] That we have different measures for cross-sectional and time series work is not unusual. Indices that best represent changes are typically poor indicators of levels. For example, a chain-weighted index, like that used in the computation of U.S. gross domestic product, gives an accurate picture of changes but should not be used to infer levels.

All actively traded stocks of domestic companies are candidates for inclusion in a country's Global index. From the set of candidate stocks, a Global index is constructed to represent a target 60 to 75 percent of the country's total market capitalization and an industrial composition similar to that of the overall market. Once constituents are selected, their market capitalizations are adjusted downward for government ownership and, to avoid double counting, for cross-holdings of other index constituents.[6] Some exceptions to the selection rules are made. For example, if a country's reported market capitalization includes a large amount of shares held by the government, 60 percent market coverage might not be achievable given the other criteria.

Once a Global index is formed, stocks can be added or deleted through the annual November review or, in more significant cases, at other times of the year. For example, if a stock comes to market through an initial public offering and has sufficient size and probable liquidity, it will be added outside the annual review process. Similarly, stocks that are delisted, suspended from trading for a sufficiently long period, or disappear through a corporate merger may be removed immediately.

The Investable indices are comprised of a subset of the Global stocks that are available to foreign institutional investors and pass screens for minimum size and liquidity. Openness is determined first at the market level, based on the ability of foreign investors to buy and sell shares and repatriate capital, capital gains, and dividend income. Next, the extent of industry, corporate by-law, and corporate charter limitations on foreign ownership is determined. Based on the market's openness and the stock- and industry-specific limitations, an overall openness factor is calculated. This openness factor, or the stock's "investability", indicates the portion of the outstanding shares that foreigners may own, and is applied to the stock's market capitalization when calculating its weight in the Investable index.

For example, consider Thailand's overall and industry-specific restrictions on foreign ownership. As of end-1996 Thailand had foreign ownership limits of 25 percent for financial firms and

[6] Adjustments for cross-holdings and government ownership were first implemented in November 1996; see discussion below.

49 percent for other companies.[7] Thus, financial firms, such as Thai Farmers Bank, typically entered Thailand's IFCI index with a 25 percent weight, as opposed to a full weight in its IFCG index. Similarly, Thai firms in other sectors typically entered its IFCI index with a 49 percent weight. Finally, stocks that are closely held and essentially not traded fail the liquidity criterion and have reduced weights in the IFCI index. For example, as of end-1996 Thai Airways was 80 percent owned by the Ministry of Finance.[8] As a consequence, its weighting in Thailand's IFCI index was only 10 percent.

As with the Global indices, some changes are only made at the annual November review, although changes in a market's openness are dealt with as they occur, outside the annual review process. Other changes that can be implemented outside the annual review period include the addition of new large, liquid stocks to the Investable index and changes in an Investable stock's investability. However, a previously non-investable stock that is already in the Global index and has become available to foreign investors will only be added to the Investable index during the November rebalancing.

The "Levels" Version

It follows from the above discussion that one minus the ratio of the market capitalizations of a country's IFCI and IFCG indices is a measure of the intensity of its foreign ownership restrictions. Specifically, the measure of the level of country *i*'s foreign ownership restrictions at time *t*, $FOR_{i,t}$, is

$$FOR_{i,t} = 1 - MC\_IFCI_{i,t} / MC\_IFCG_{i,t} \quad (1)$$

where $MC\_IFCI_{i,t}$ and $MC\_IFCG_{i,t}$ are the market capitalizations at time *t* of country *i*'s IFCI and IFCG indices, respectively. FOR can vary from zero to one, with zero representing a completely open market with no restrictions, and a value of one indicating that the market is completely closed. FOR as

[7] Country-wide and industry-specific foreign ownership restrictions are sometimes reported in the IMF's *AREAER*, but this detail is not used in forming the typical on/off indicator.

[8] Source: Worldscope database.

given by equation (1) is a reasonable indicator of the intensity of a country's capital controls at a point in time, and is therefore suitable for cross-sectional analysis, and over longer periods. From month to month, however, changes in equation (1) can occur for reasons other than changes in actual restrictions, so for time series work the measure should be smoothed, as we do next.

The "Changes" Version

If a country has a uniform country-wide restriction on the amount of foreign ownership of its equities, the above levels version also provides an accurate indication of changes in restrictions. In the more general case, however, of varying restrictions across stocks or sectors, changes in market capitalizations will not necessarily represent changes in restrictions. In this case, asymmetric shocks to investable and non-investable stocks could lead to relative price changes that would result in a change in the ratio of the market capitalizations, even if there were no change in the country's capital controls. If, for example, banking sector stocks were not available to foreigners, a pure banking sector shock would result in a change in the relative price of investable stocks and, hence, a change in the relative market capitalizations.

This issue is easily dealt with by smoothing the measure using the IFCI and IFCG price indices themselves. No knowledge of which sectors are investable or non-investable is needed. Specifically, the following smoothed measure can be used:

$$FOR_{i,t} = 1 - (MC\_IFCI_{i,t}/P\_IFCI_{i,t}) / (MC\_IFCG_{i,t}/P\_IFCG_{i,t}) \quad (2)$$

where $P\_IFCI_{i,t}$ and $P\_IFCG_{i,t}$ are, respectively, the price indices at time *t* of country *i*'s IFCI and IFCG indices, reindexed to be equal at the starting date of $FOR_{i,t}$.

Changes in $FOR_{i,t}$ as given by equation (2) are free of relative price changes arising from asymmetric shocks, and hence give a reasonable picture of changes in capital controls over time. Thus, this smoothed version is appropriate for time series work in which changes are more important than levels.

Necessary Adjustments

In practice it is desirable to make adjustments to the data before smoothing with equation (2). These adjustments fall into four categories: (i) extending back IFCI data, (ii) redistributing changes in investability, (iii) using additional information on controls, reflected in multi-country indices but not a specific country's, and (iv) smoothing over one-period spikes in investability. All adjustments are noted in the appendix. We briefly discuss examples in this subsection.

For example, some countries were fully closed to foreign investment until some time during our sample period. For such countries, no Investable index existed prior to the opening, so we extend back the IFCI index, with zero market capitalization, to December 1988 to coincide with the starting date for most of the other countries. Examples are Korea, India, Taiwan, and Zimbabwe, whose markets opened (slightly) to foreigners in the early 1990s.

Adjustments to the measure were made when an official change was made but the IFC announced it would delay adjusting the IFCI index. For example, in May 1997 the Korean government increased the foreign ownership limit from 20 to 23 percent and announced that another 3 percent increase would take place later in the year. Coinciding with the government's announcement, the IFC announced that it would wait until its annual rebalancing of the indices in November to adjust Korea's investable index. Since half of the actual change in investability occurred in May, not November, we distribute half of the November 1997 change back to May 1997.

Another example of redistributing changes in investability is in Chile. Chilean law LAN18657 set the foreign ownership limit at 25 percent. Chilean law DL600, implemented in January 1992, allowed for 100 percent foreign ownership. On the grounds that little investment went through DL600, the IFC kept the overall ownership limit at 25 percent until January 1996, when it increased it to 100 percent, noting that most inflows were coming through DL600 by 1994/95. Not knowing exactly when to date the switch, we moved the change to 1992, when DL600 was implemented. A reasonable person with more information could put it anywhere between January 1992 and 1994/95, and possibly as a gradual rather than one time reduction in restrictions.

We use information not included in the country-level indices where appropriate. For example, when Malaysia instituted strict capital controls in late 1998, the IFC announced that it would continue to track Malaysia's IFCI index, but that Malaysia's weight in the worldwide Investable index would be zero. Hence, the market capitalization of Malaysia's IFCI index is not an indication of the capital controls of late 1998; a better measure is a market capitalization of zero for October 1998 to October 1999.

Finally, we smooth over the occasional one-period spikes in the ratio of the market capitalizations that almost surely have nothing to do with changes in capital controls. The procedure we use is a simple average of the adjacent months.

Another desirable, but less feasible, adjustment is to redistribute changes implemented at the annual rebalancing to the month the actual change occurred. For example, as noted above, the IFC indices are rebalanced every November to take into account changes in the floats or availability to foreigners of individual stocks. These changes are typically quite small, but show up as upward or downward shifts in the measure of foreign ownership restrictions. These rebalancings reflect changes in the availability of a country's stocks to foreigners, but the changes did not actually occur in November. As will be shown in the graphs presented in the next section, most of the rebalancings amount to fine tuning and have a very small effect on the measure of foreign ownership restrictions. However, in November 1996, larger methodological changes were implemented when the IFC rebalanced its Investable and Global indices to better reflect stocks' free float by removing the effective market capitalization due to government ownership.[9] This lowered the market capitalization of many countries' Global indices, but changes in countries' Investable indices varied. For countries with overriding legal limits on foreign ownership, the reweighting did not affect the Investable index; for such countries the measure of foreign ownership restrictions *decreased*. For more open countries, the market capitalization changes in the Investable and Global indices were similar; in such countries, the measure of foreign ownership restrictions could have increased.

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[9] This adjustment was carried out in two stages—75 percent in November 1996 and 25 percent in November 1997.

III. Foreign Ownership Restrictions Since 1988

In this section we present our monthly measure of foreign ownership restrictions for 29 countries. In each figure, we show the measures given by equation (1) and (2). As discussed above, the levels version, which corresponds to equation (1), is better suited for cross-sectional work, while the smoothed version gives a clearer indication of changes in restrictions and is more appropriate for time series analysis. To interpret these graphs, note that the measure of restrictions ranges from zero to one, with closed markets being closer to one, and relatively open ones being closer to zero. For comparison, we also show liberalization dates from Bekaert and Harvey (2000a) as vertical lines in the graphs.

Asia

Our measures of foreign ownership restrictions for ten Asian countries—China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Sri Lanka, Taiwan, and Thailand—are presented in Figures 1(a) - 1(j). A quick scan of the figures shows two important facts.

First, restrictions in Asia were initially quite high—as we will show in Figure 2, much higher than restrictions in Latin America—but fell over the course of the 1990s in many countries. For example, in the mid-1990s, the only country that was relatively open was Malaysia, which had foreign ownership restrictions only on certain stocks; at that time, other Asian emerging markets had stringent foreign ownership limits on equities ranging from 10 percent in Taiwan to 49 percent in Indonesia and Thailand. And while restrictions have fallen in many Asian countries, Malaysia briefly reinstituted controls in 1998, and the Philippines, India, are Sri Lanka are no more open today than they were in the early 1990s.

Second, the Bekaert-Harvey (henceforth BH) liberalizations (the vertical lines) correspond very well with the initial decrease in our restrictions measure in many markets. In particular, the initial decreases in restrictions in Korea, Taiwan, India, and Pakistan coincide exactly with the BH liberalization date. However, even within Asia, not all liberalizations are equal. For example, the initial openings in Korea and Taiwan were much smaller than in India and Pakistan, which—as we will show in Figure 2—were much smaller than the liberalizations in Latin American countries.

While we have made some general statements, the figures show that each country is different in the timing, extent, and evolution of its liberalization process. Countries like Korea, Taiwan, Indonesia, and Thailand were relatively closed in the early 1990s, gradually relaxed foreign ownership restrictions over the course of the 1990s, then greatly relaxed restrictions during the 1997/98 Asian financial crisis. For these four countries, the initial liberalization was just one relatively small step in the overall liberalization process. For example, Korea's initial liberalization was in January 1992, which corresponds with the Bekaert-Harvey liberalization date but was quite limited—foreigners could own in sum only 10 percent of the outstanding shares. Further relaxations took place in the mid-1990s, such as in July 1995, when the government increased the limits on foreign ownership of Korea Electric and Pohang Steel from 8 to 10 percent, and of most other firms from 12 to 15 percent.[10] Finally, in 1997, in an attempt to attract international investors, Korea greatly reduced restrictions on foreign ownership.

Other countries, like India and Sri Lanka, are no more open today than they were after their initial liberalizations. For these countries, liberalization was, at least to date, truly a one-time event.

As noted, the dashed lines in the figures give the best indications of the extent of controls at a point in time, but are subject to frequent changes due to relative price shocks to investable and non-investable stocks. In contrast, the solid lines, which are adjusted for these asymmetric shocks, change only when restrictions change. For example, for the Philippines, shocks to the banking sector, which is largely unavailable to foreign investors, will result in frequent changes in the ratio of the market capitalizations and frequent movements in the dashed line. By using the IFCG and IFCI price indices to smooth out these changes, we get the solid line, which changes only when restrictions change.

Our measure is not perfect and can be further refined. For example, the sharp decrease in restrictions in China in November 1998 was due to the inclusion of "red chips" and Chinese stocks listed in Hong Kong, all of which are to some extent investable. The effect was a large increase in investability; as the market capitalization of both the IFCI and IFCG indices increased, the investability

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[10] See the time lines discussed in Bekaert and Harvey (2000b) and available on Campbell Harvey's web site, www.duke.edu/~charvey/Country_risk/couindex.htm for details on liberalizations in Korea and many other emerging market countries.

ratio increased. However, the Chinese H-shares—the only example of stocks listed abroad but included in a country's IFCI index—were listed in Hong Kong prior to November 1998, a few as early as 1993. Thus, a more accurate description of the evolution of foreign ownership restrictions in China would be a gradual relaxation from 1993 through 1998, as more companies listed in Hong Kong, rather than the sharp drop at the end of 1998. The interested reader can, using market capitalization and price data on the H-shares, recalculate the restrictions measure from 1993 to 1998. From end-1998 on, the unadjusted measure is still the best indicator of the level of restrictions; the final point suggests the Chinese market is still about 60 percent closed.

Latin America

In contrast to Asian emerging markets, liberalizations in Latin America were much more extensive (Figure 2). It is quickly evident from the figures that the Latin American countries in our sample—Mexico, Argentina, Brazil, Chile, Colombia, Venezuela, and Peru— opened up to foreign investment far earlier and far more extensively than their Asian counterparts. Again, as with the Asian emerging markets, the BH liberalization dates for Latin America correspond quite well with the initial decrease in our restrictions measure. Since the Latin American liberalizations were much greater than the Asian ones, their evolution was also different. In particular, they tended to be followed by smaller subsequent reductions in restrictions.

Of the Latin American countries, Argentina opened first; its equity market was almost completely open to foreign investment before our sample started.[11] Others were not far behind. Mexico liberalized its market by 1990, followed shortly by Brazil and Peru. Brazil did, however, increase restrictions on foreigners in the mid-1990s in an effort to stem the tide of capital inflows, as evident by a multi-year step up in the restrictions measure.[12]

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[11] Argentina's restrictions measure increased for the year 1993 due to the removal of a number of IFCI stocks due to illiquidity. Most of these stocks were reinstalled in 1994.

[12] The initial increase in the restrictions measure for Brazil, in January 1993, arose because of the addition of a number of voting common stocks. These carry full weight in the IFCG but reduced weight in the IFCI because of Brazil's foreign ownership limits on this class of shares.

There are two cases in Latin America that warrant further discussion. One is Chile, which shows a relaxation in the early 1990s, even though the country was at that time instituting capital controls, highlighting the fact that our measure is a narrow one. The controls Chile instituted in the mid-1990s were against short-term flows and favored longer-term flows such as equity purchases, hence there was no associated increase in our (equity) restrictions measure.[13] The other interesting case is the liberalization process in Venezuela, which was slower to start and reversed to some extent in 1996 with the nationalization of the banking sector. Later that year, however, the banks were reprivatized and again available to foreign investors.

Other Countries

We present our measure of foreign ownership restrictions for Eastern Europe, Europe, and Middle East/Africa in Figures 3 - 5. Not surprisingly, the measure for Eastern European countries starts later in the sample period, with the earliest point being 1993 (for Hungary). The most open of this group is Poland.

The measures for three European countries—Greece, Portugal, and Turkey—are shown in Figure 4. Note that, until recently, in Greece and Portugal, restrictions were lower than in Asian emerging markets, but higher than in Latin America. On the other hand Turkey opened its market early on. The measure for Portugal ends in March 1999 when, according to the IFC, it graduated from emerging market status.

The measures for Jordan, Morocco, South Africa, and Zimbabwe are shown in Figure 5. The gradual relaxation of controls in Zimbabwe was partially reversed in 1998, leaving it with the most severe restrictions of this group. Of the others, Jordan, too, has relatively high restrictions, whereas South Africa has been quite open to foreign investment.[14]

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[13] See Edwards (2000) for a description of Chile's recent capital controls.

[14] It might seem surprising that our measure indicates that South Africa has been open to foreign investment, given its dual exchange rate system. However, dual exchange rates affect foreigners' returns, not their ability to invest.

For these countries, as with Asia and Latin America, the BH liberalization dates correspond well with initial openings as given by our measure, with the exception of Jordan. However, as with Asia and Latin America, the extent and evolution of the liberalization processes vary greatly across countries.

IV. Comparisons with Other Measures of Capital Controls

There is no measure of capital controls directly comparable to ours. For example, most other measures are annual, so to make comparisons we must first aggregate our measure up to the annual frequency. Furthermore, most measures reflect only official rules or restrictions, while our measure reflects restrictions as well as quantitative factors. The one exception is the indicator using the underlying cross-border positions data of Lane and Milesi-Ferretti (forthcoming), which can be best thought of as an outcome-based measure.[15] Finally, other measures tend to be much broader than ours, encompassing more parts of the capital account or even the current account.

With those caveats in mind, we proceed to compare our measure with the restrictions-based measures of Quinn (1997) and Miniane (2000), and with the openness measure used in IMF (2001) and O'Donnell (2001), which is derived from the data of Lane and Milesi-Ferretti (forthcoming). Table 1 provides summary statistics for each measure. In each cell of the table, the first line gives the average of the measure from 1989 to 1997; the second line the standard deviation; and the third line (in bold) the correlation with our measure.

The restrictions-based measure of Miniane (2000), derived from the IMF's *AREAER*, is the average of 0/1 dummies of restrictions on 13 items in the capital account.[16] A comparison of the means indicates that this measure is in every case but one (Korea) higher than ours, usually by a very wide margin. The explanation for this is straightforward. As with most measures from the IMF's *AREAER*, if any restriction exists, no matter how important or unimportant, it is entered as a full restriction. Since

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[15] For a comparison of rules- and outcome-based measures, see IMF (2001).

[16] We use Miniane's measure because being compiled from 13 items it is more detailed than the standard 0/1 dummy that indicates only if the capital account is "open". Grilli and Milesi-Ferretti (1995) were the first to use the standard 0/1 dummy.

restrictions exist in most countries across a wide range of items, the standard IMF restrictions-based measure usually indicates the country is more closed than it really is. The other striking feature of this measure is that it changes very infrequently, as can be seen from the very low standard deviations, as well as for some countries the zero correlation with our measure—zero because the IMF restrictions measure did not change at all during the nine-year period. In sum, it appears that measures based on 0/1 dummy variables that give no indication of the intensity of controls provide little information, although it must be said that they are much broader than ours.

Quinn (1997) presents an annual restrictions-based measure that also uses information from the IMF's *AREAER*. However, instead of coding controls based on 0/1 dummy variables, Quinn scores the intensity of enforcement of controls. It is immediately apparent from the table that Quinn's measure is on average much more similar to ours. For example, for many of the countries, the mean level of restrictions is quite close across the two measures; for Mexico the means are 0.15 and 0.20. Differences in the average levels of the two measures likely stem from differences between investment restrictions and broader controls. For Brazil and Chile, our measure suggests greater openness than Quinn's, likely because both countries were relatively open to equity investment but had substantial controls in other areas. For some of the Asian emerging markets, our measure shows greater restrictions, likely because these countries had stricter restrictions on equity investment than elsewhere in their international accounts. Finally, the two measures are highly and positively correlated for most countries, with the exceptions of Malaysia and Thailand.[17]

IMF (2001) and O'Donnell (2001) use the Lane and Milesi-Ferretti (forthcoming) annual measure of portfolio and direct investment assets and liabilities as a percent of GDP as a long-run indicator of financial openness. This measure is analogous to measures of trade openness, and can be thought of in a similar manner. For example, like the level of trade openness, which is typically calculated as the sum of imports and exports over GDP, this financial openness measure is a good

[17] The negative correlations between our measure and Quinn's for these two countries are because Quinn's measure for Malaysia is constant but for one small change (that happens to be in the opposite direction of a small change in our measure for that year) and for Thailand shows an early liberalization and later closing.

indicator of openness at a point in time, but year-to-year changes in the measure are likely due to forces other than changes in openness, such as a stock market boom/crash that results in large valuation adjustments on existing positions. However, changes over longer periods are likely indicative of significant changes in openness. For the measure, a higher number indicates greater openness, so the correlation with our measure should be negative, and it is for six of the eight countries. The exceptions are, as with Quinn's measure, Malaysia and Thailand. The means, while not directly comparable, suggest that there is some agreement in rankings of countries. For example, the measures are in agreement that Korea, Indonesia, and Brazil were relatively closed, and that Malaysia, Chile, and Mexico were relatively open.

In sum, after aggregating our monthly measure up to the annual frequency, it appears to be roughly comparable to the restrictions-based measure of Quinn (1997) as well as the openness measure used in IMF (2001) and O'Donnell (2001), but quite different from a standard IMF restrictions-based measure.

V. Empirical Applications

Our measures of the intensity of foreign ownership restrictions can be used in the analysis of cross-sectional, time series, and panel data sets. In this section we briefly present examples of each.

Ahearne, Griever, and Warnock (2000) use the measure from equation (1) at two points in time in cross-sectional analysis of U.S. holdings of equities in 20 emerging markets. Their results, reproduced in Table 2, indicate that in the earlier sample, 1994, restrictions are an important determinant of U.S. holdings of emerging market stocks. For example, the regression estimates suggest that if by 1994 Korea had lowered its foreign ownership restrictions to the level of Argentina's, U.S. holdings of Korean equities would have been over $12 billion, rather than the $4 billion in holdings that existed at that time.[18]

[18] The coefficient has the expected sign but is not significant in multivariate regressions for 1997.

The above example uses the measure to differentiate the degree of capital controls across countries at a point in time. Edison and Warnock (2001) use the smoothed measure from equation (2) in analyzing time series and panel data sets of capital flows from the United States to emerging markets from 1989 to 1999. Their results, reproduced in Table 3, indicate that relaxing capital controls over this period has effects that differ across countries. For example, for countries like Mexico (or Chile) that relaxed controls on equity inflows early in the sample, the relaxation was associated with increased inflows. But for a country like Korea that relaxed capital controls in very different environments over the decade, the coefficient on the foreign ownership restrictions variable is not significantly different from zero. Overall, the results from panel regressions suggest that countries with lower restrictions experienced greater inflows.

The Korea case is illustrative. Over the full sample the coefficient estimates are insignificant, but the rolling regressions show that relaxing foreign ownership restrictions early in the sample period had a large effect on equity inflows. As noted in Section III and as can be seen in the bottom panel of Figure 6, in the 1990s Korea instituted a series of small relaxations of foreign ownership restrictions, starting in 1992 with its initial opening to foreign investment and culminating with a series of incremental loosenings of restrictions from late 1994 to early 1997. Over those periods, restrictions were binding and one would expect a relaxation to result in increased capital inflows. The top panel shows that this was indeed what occurred. For example, the coefficient estimates suggests that the slight (one percentage point) loosening of restrictions at the end of 1994 resulted in an increase in inflows of about $15 million per month over the subsequent 12-month period.

Later in the sample, Korea greatly increased foreign ownership limits during the Asian financial crisis, but at that time the restrictions were not binding, so the relaxation of controls did not result in greater inflows. Indeed, during the crisis the coefficient estimate becomes insignificantly different from zero. Over the entire sample, hence, the measure does not have a statistically significant effect on equity inflows to Korea. This highlights an important point: Our measure, while it does capture the intensity of controls, does not indicate when the controls are binding.

VI. Conclusion

The existing economics and finance literatures on capital controls is short on high frequency measures of the intensity of controls across many countries. We presented a straightforward, readily available measure that addresses these needs. Two versions were discussed, one that gives the better indication of the level of restrictions and another, smoothed of the effects of asymmetric shocks on relative prices, that gives the clearer picture of changes in restrictions over time. We show that our measure—which can be thought of as an extension of the Bekaert and Harvey (2000a) liberalization dates that also provides information on the extent of the initial liberalization as well as its evolution over time—is roughly comparable to the lower frequency restrictions-based measure of Quinn (1997) and the openness measure used in IMF (2001) and O'Donnell (2001).

Armed with this measure, recent findings on the effects of financial liberalization can be revisited. For example, do the effects on the cost of capital (Bekaert and Harvey, 2000a) and abnormal returns (Henry, 2000a) vary with the extent of the liberalization, or should liberalizations truly be treated as one-off events? Similarly, in the growth literature, our high frequency measure, which gives a clear indication of the intensity of controls, can be used to fine tune our knowledge of the effects of liberalizations on economic growth.

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Appendix: Adjustments to the Underlying Data

Argentina	Smoothed over one-period spikes in December 1990 (due to a one-period decline in MC_IFCI) and December 1991 (catch up).
Chile	In January 1996, IFC decided to apply DL600, not LAN18657 as previously, to determine foreign limits in the IFCI index, and the limits increased from 25% to 100%. We moved the change back to when DL600 was actually implemented, January 1992.
Greece	Smoothed over a one-period spike in December 1990.
India	Set MC_IFCI equal to zero for December 1988 - October 1992.
Indonesia	Smoothed over a one-period spike in December 1990 (due to a one-period spike in MC_IFCG that was partially reversed in January 1991).
Korea	Set MC_IFCI equal to zero for December 1988 - December 1991. Distributed half the November 1997 increase in MC_IFCI to May 1997.
Malaysia	Set MC_IFCI equal to zero for October 1998 - October 1999. Smoothed over a one-period spike in December 1990 (due to a spike in MC_IFCG that was immediately followed by a similar increase in MC_IFCI).
Mexico	Smoothed over a one-period spike in December 1991 (due to a one-period spike in MC_IFCG that was almost completely reversed in January 1992).
Peru	Smoothed over a one-period spike in December 1993.
Taiwan	Set MC_IFCI equal to zero for December 1988 - December 1990.
Thailand	Smoothed over one-period spikes in December of 1990 and 1991 (Catch up).
Turkey	Smoothed over a one-period spike in December 1990.
Zimbabwe	Set MC_IFCI equal to zero for December 1988 - May 1993.

Table 1. Comparison of Capital Controls Measures, Annual 1989 - 1997.

	Openness	Miniane	Quinn	Edison - Warnock
Mexico	0.24	0.86	0.15	0.20
	(0.08)	(0.04)	(0.02)	(0.22)
	-0.60	**0.74**	**0.61**	
Argentina	0.16	0.46	0.18	0.06
	(0.07)	(0.10)	(0.13)	(0.06)
	-0.69	**0.63**	**0.76**	
Brazil	0.14	0.99	0.72	0.45
	(0.04)	(0.03)	(0.02)	(0.24)
	-0.84	**0.45**	**0.71**	
Chile	0.33	1.00	0.38	0.28
	(0.13)	(0.00)	(0.07)	(0.41)
	-0.74	**0.00**	**0.90**	
Korea	0.09	0.85	0.40	0.90
	(0.04)	(0.00)	(0.02)	(0.11)
	-0.35	**0.00**	**0.70**	
Indonesia	0.08	na	0.27	0.54
	(0.04)		(0.02)	(0.12)
	-0.68		**0.82**	
Malaysia	0.50	0.85	0.23	0.21
	(0.04)	(0.00)	(0.02)	(0.08)
	0.42	**0.00**	**-0.73**	
Philippines		0.88	0.37	0.53
	na	(0.04)	(0.22)	(0.04)
		0.26	**0.63**	
Thailand	0.21		0.31	0.70
	(0.04)	na	(0.15)	(0.03)
	0.21		**-0.38**	

Notes. Measures are compared over the period 1989 - 1997 for all countries except Indonesia, which starts in 1990. In each cell, the first line gives the mean, the second line the standard deviation, and the third line (in bold) the correlation with the Edison-Warnock measure. The openness measure is derived from the data of Lane and Milesi-Ferretti (forthcoming).

Table 2. Determinants of U.S. Holdings of Equities in Emerging Markets

	1994	*1997*
USLISTED	-0.40***	-0.50***
	(0.09)	(0.09)
RESTRICT	0.23***	0.07
	(0.06)	(0.06)
TRADE	0.02	-0.28
	(0.26)	(0.15)
REWRISK	-0.28**	0.15
	(0.13)	(0.10)
N	13	20
Adjusted R^2	0.64	0.60

Source: Ahearne, Griever, and Warnock (2000)

Notes. Dependent variable, one minus the relative shares of foreign equities in U.S. and world portfolios, is inversely related to U.S. holdings in a country. Constants are included but not reported. USLISTED is the share of the foreign market that is cross-listed on U.S. exchanges (i.e., has a Level II or III ADR program or a direct listing) or has issued public debt in the United States. RESTRICT is a measure of foreign ownership restrictions. TRADE is expressed as a share of the foreign country's GNP. REWRISK is the mean over standard deviation of monthly returns calculated over a 15-quarter period. White (1980) standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3: Determinants of Equity Flows to Emerging Markets, 1988:12 - 1999:12

	Time Series		Panel	
	Mexico	Korea	Latin America[1]	Asia[2]
EMP	-0.43 (0.98)	-0.92 (1.37)	-0.09 (0.81)	-0.06 (0.17)
EP	2407*** (3.95)	688** (2.44)	14.8 (0.64)	62.8** (2.43)
RET	0.81 (1.24)	-0.32 (1.23)	0.03 (0.11)	0.18 (1.12)
FOR	-265* (1.83)	23.9 (0.23)	-795*** (3.80)	-108*** (11.0)
ADR_{t+1}	239 (0.28)	1048*** (5.15)	296 (1.52)	414* (1.92)
USIP	-22.2*** (4.05)	9.93*** (2.91)	-9.38*** (10.5)	-0.54 (1.41)
USBOND	-30.8 (1.54)	-41.5*** (5.30)	-11.6*** (3.83)	-9.55*** (8.02)
R^2	0.58	0.63	0.25	0.29

Source: Edison and Warnock (2001)

Notes. Dependent variable is average *12*-month ahead net US purchases of the country's equities. All independent variables are at time *t*, except ADR, the relative size of a period *t+1* listing on a US exchange. EMP is an index of exchange market pressure. RET is the difference in rates of return between the country and the US. EP is the earnings-price ratio. FOR is foreign ownership restrictions. USIP is the deviation of US industrial production from a time trend. USBOND is the rate on a US medium-term bond. Constants are included but not reported. The absolute value of t-statistics are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

[1] Latin America consists of Argentina, Brazil, Chile, and Mexico.
[2] Asia consists of Korea, Malaysia, Philippines, and Thailand.

Figure 1. Foreign Ownership Restrictions, Emerging Asia

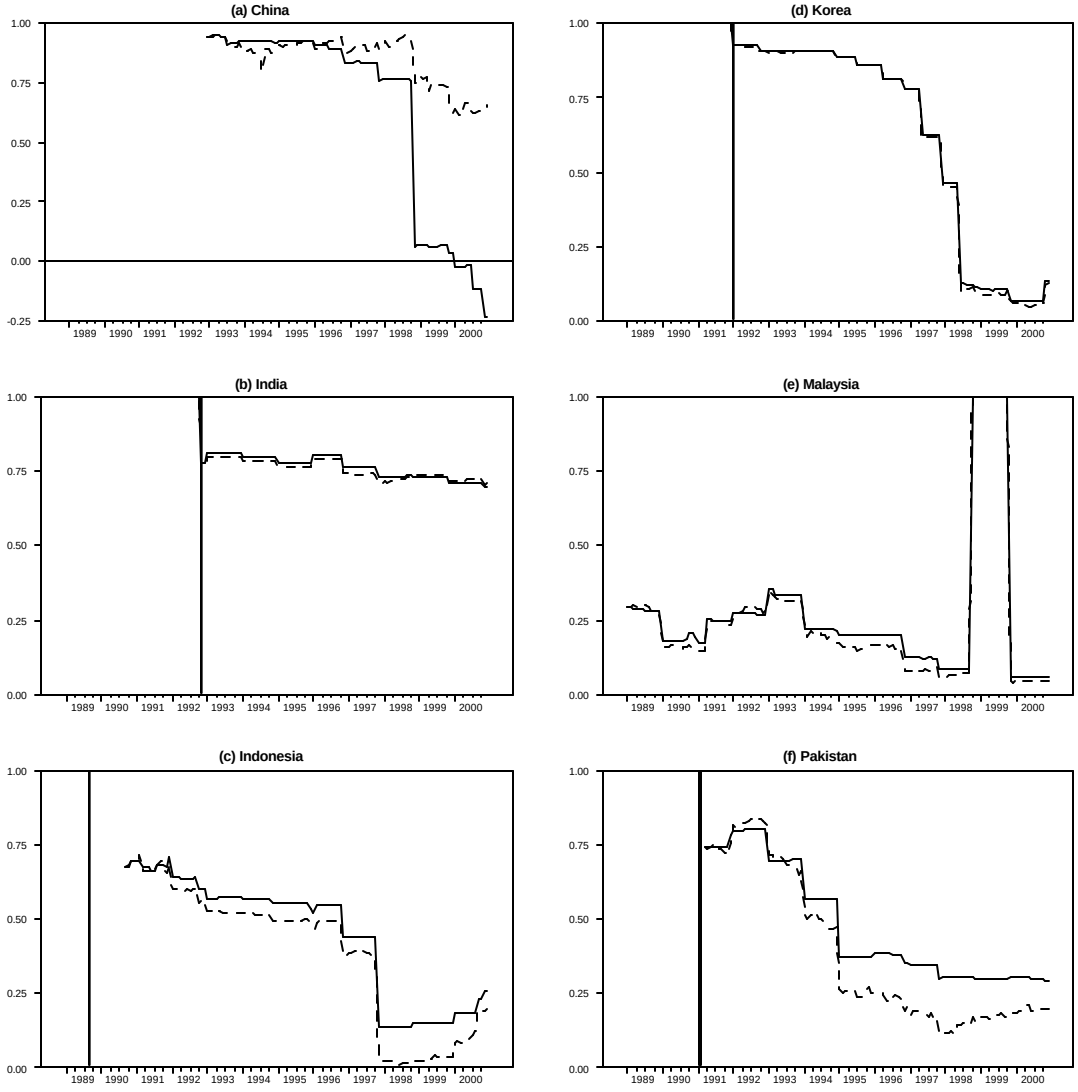
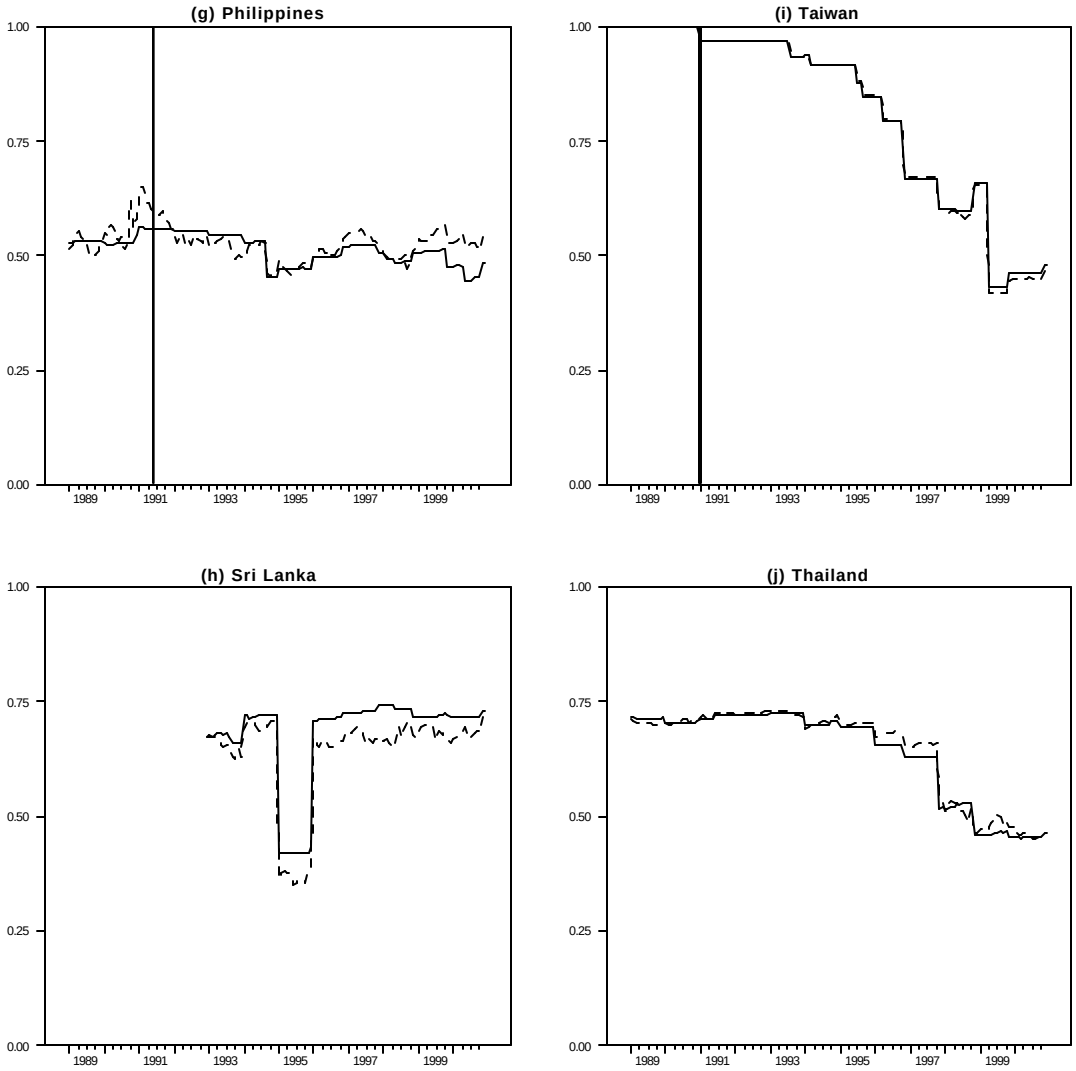


Figure 1. Foreign Ownership Restrictions, Emerging Asia (continued)



Notes: Solid lines, which correspond to equation (2), are corrected for relative price changes and are appropriate for time series work. Dashed lines, which correspond to equation (1), give the better indication of the extent of controls at a point in time. Vertical lines indicate Bekaert and Harvey (2000a) liberalization dates, which are not available for China and Sri Lanka and were prior to 1989 for Thailand and Malaysia.

Figure 2. Foreign Ownership Restrictions, Latin America

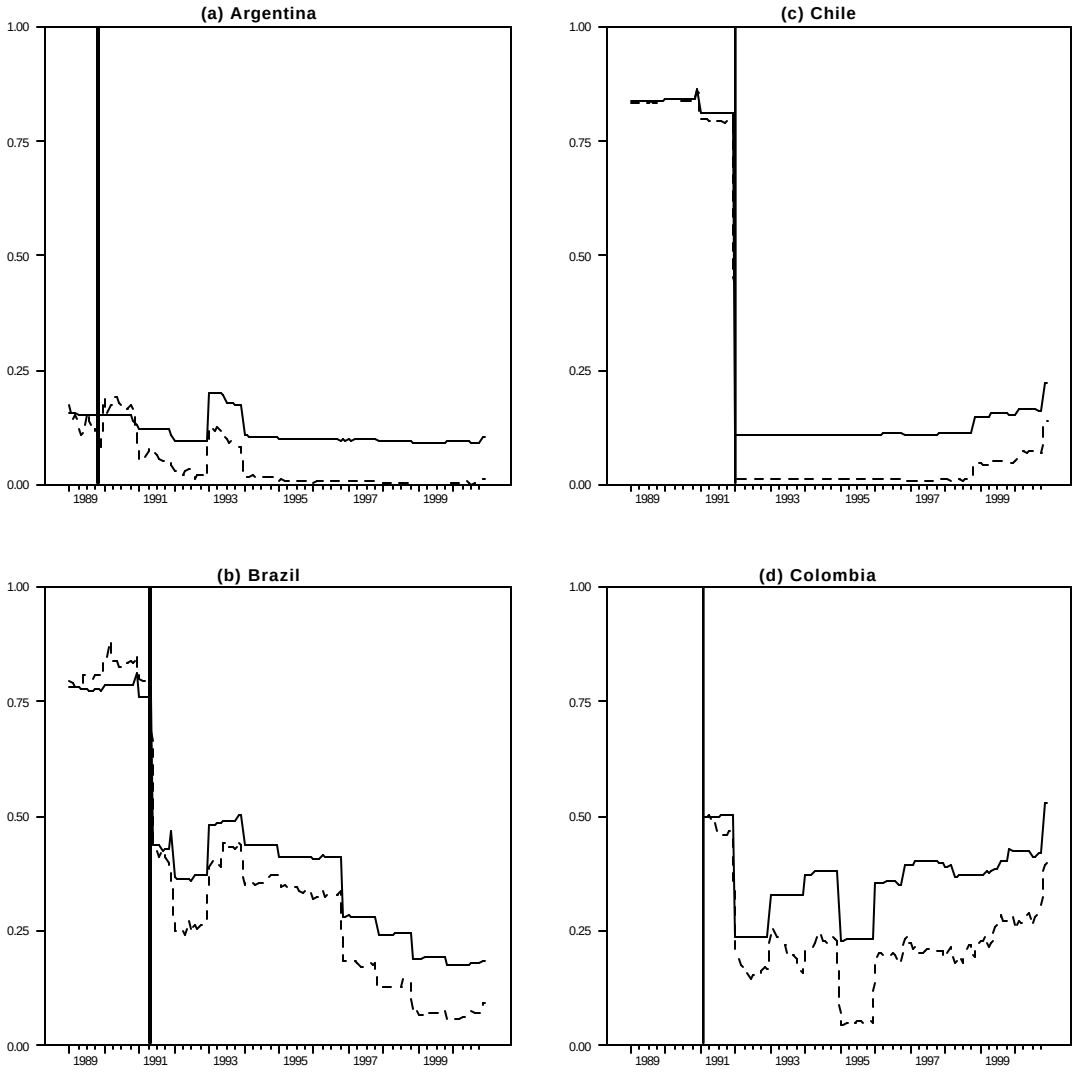
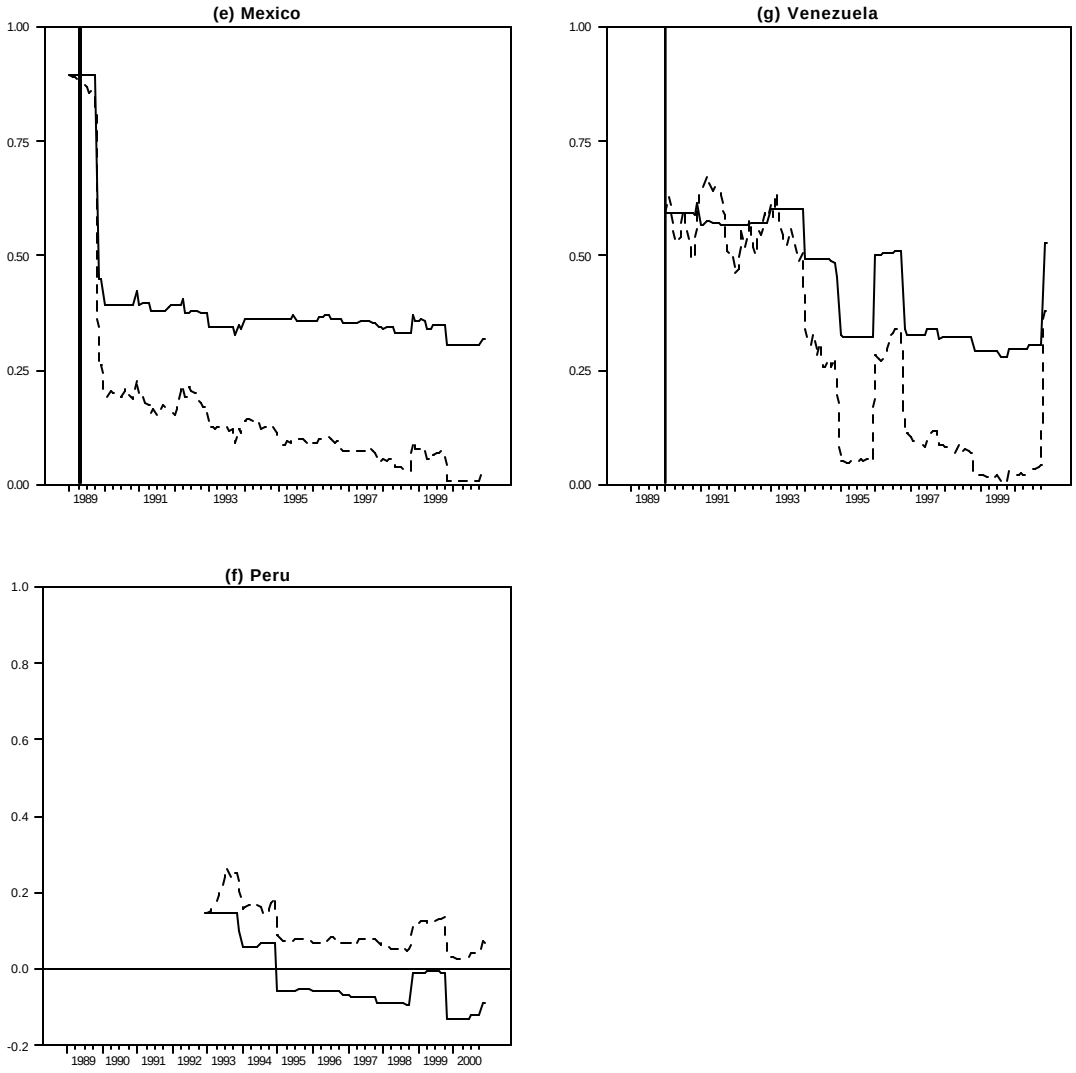
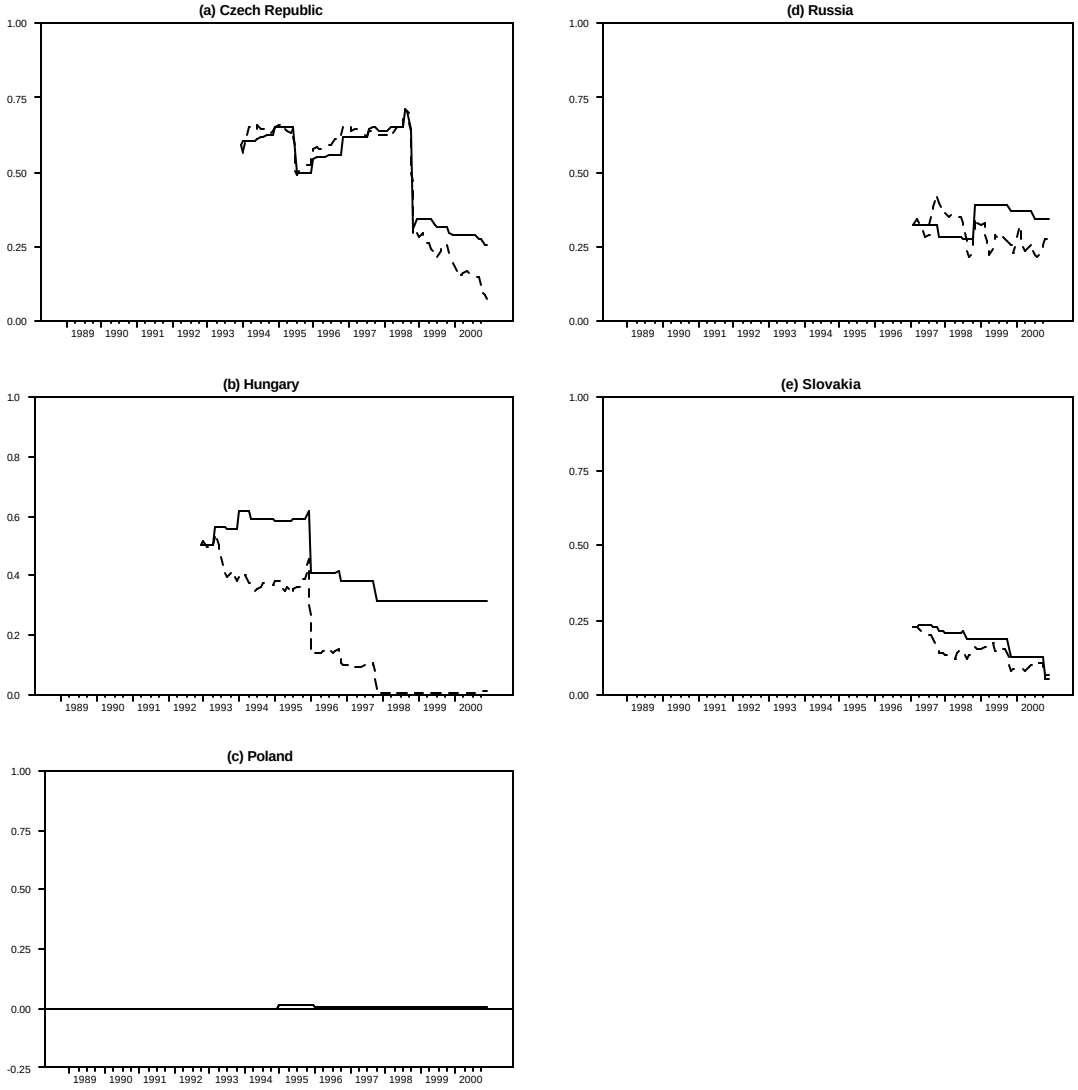


Figure 2. Foreign Ownership Restrictions, Latin America (continued)



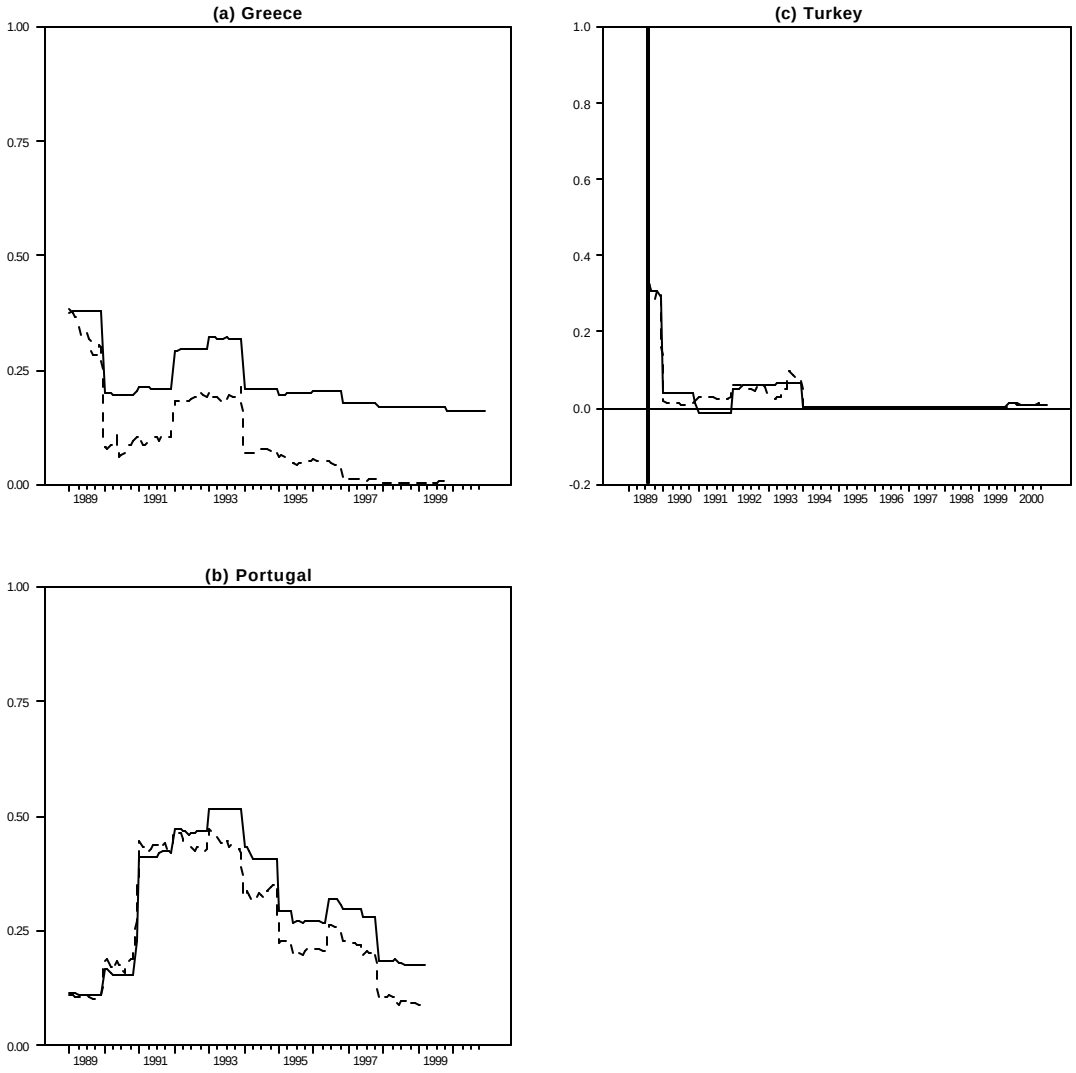
Notes: See Figure 1. Bekaert and Harvey (2000a) liberalization dates are not available for Peru.

Figure 3. Foreign Ownership Restrictions, Eastern Europe



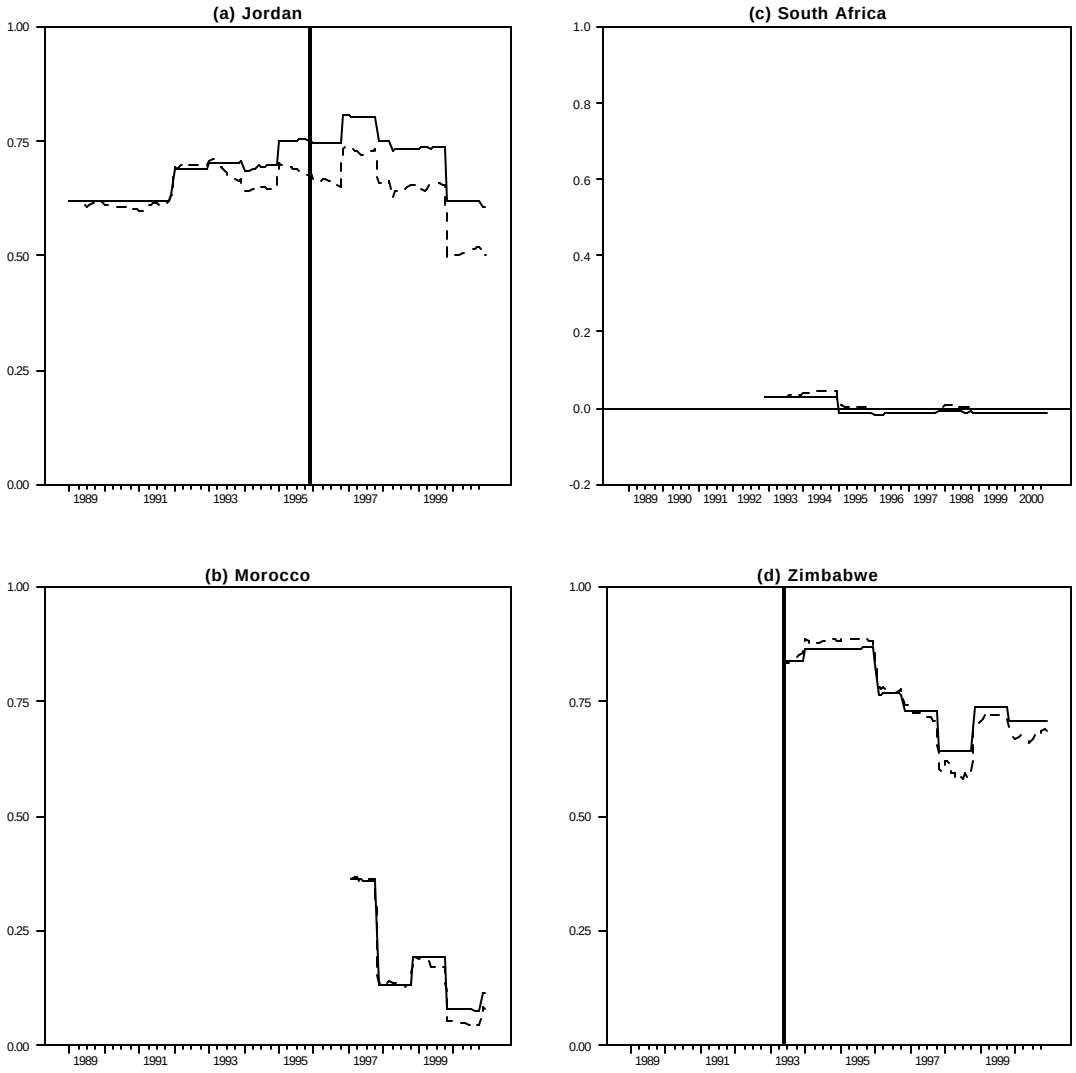
Notes: See Figure 1. Bekaert and Harvey (2000a) liberalization dates are not available for Eastern Europe.

Figure 4. Foreign Ownership Restrictions, Emerging Europe



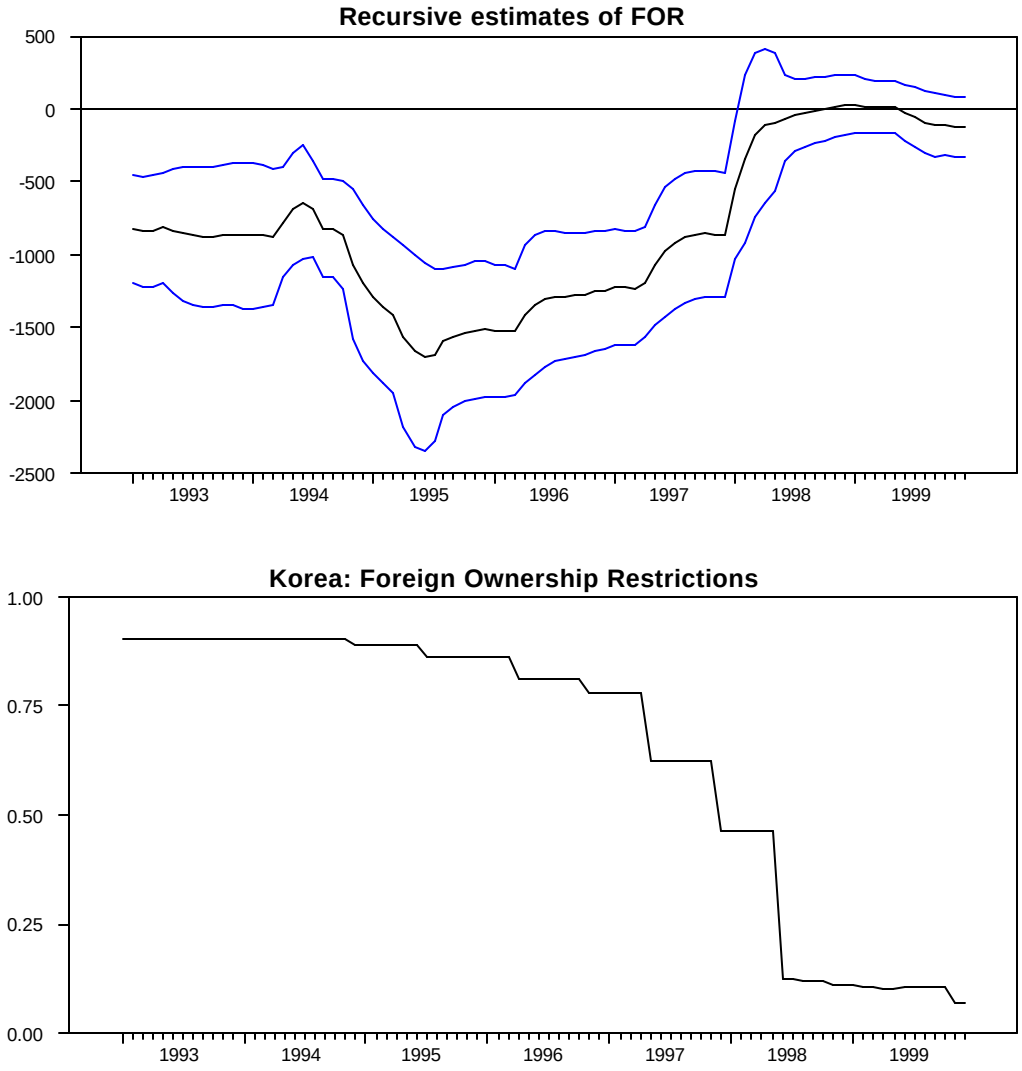
Notes: See Figure 1. Bekaert and Harvey (2000a) liberalization dates are prior to 1989 for Greece and Portugal.

Figure 5. Foreign Ownership Restrictions, Middle East and Africa



Notes: See Figure 1. Bekaert and Harvey (2000a) liberalization dates are not available for Morocco and South Africa.

Figure 6. Twelve-Month Ahead Equity Flows to Korea: Recursive Estimates



Source: Edison and Warnock (2001)

Notes: In the top panel, recursive estimates, which are surrounded by error bands, are from multivariate regressions of 12-month ahead equity flows starting in January 1989 and ending at each date in the graph. The bottom panel shows Korea's restrictions as given by equation (2).