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WHAT HURTS MOST?  
G-3 EXCHANGE RATE OR INTEREST RATE VOLATILITY

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### ABSTRACT

With many emerging market currencies tied to the U.S. dollar either implicitly or explicitly, movements in the exchange values of the currencies of major countries have the potential to influence the competitive position of many developing countries. According to some analysts, establishing target bands to reduce the variability of the G-3 currencies would limit those destabilizing shocks emanating from abroad. This paper examines the argument for such a target zone strictly from an emerging market perspective. Given that sterilized intervention by industrial economies tends to be ineffective and that policy makers show no appetite to return to the controls on international capital flows that helped keep exchange rates stable over the Bretton Woods era, a commitment to damping G-3 exchange rate fluctuations requires a willingness on the part of G-3 authorities to use domestic monetary policy to that end. Under a system of target zones, then, relative prices for emerging market economies may become more stable, but debt-servicing costs may become less predictable. We use a simple trade model to show that the resulting consequences for welfare are ambiguous. Our empirical work supplements the traditional literature on North-South links by examining the importance of the volatilities of G-3 exchange-rates, and U.S. interest rate and consumption on capital flows and economic growth in developing countries over the past thirty years.

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## I. Introduction

While fashions concerning appropriate exchange rate arrangements have shifted over the years, advocacy of establishing a target zone surrounding the world's three major currencies has remained a hardy perennial. Work on target zones (pioneered by McKinnon, 1984 and 1997, and Williamson, 1986, and recently summarized by Clarida, 2000) has mostly emphasized the benefits of exchange rate stability for industrial countries. More recently, though, analysts have apportioned some of the blame for financial crises in emerging markets back on the shoulders of the volatile bilateral exchange rates of industrial countries (as in the dissenting opinions registered in Goldstein, 1999, for instance). With many emerging market currencies tied to the U.S. dollar either implicitly or explicitly, movements in the exchange values of the currencies of major countries—in particular the prolonged appreciation of the U.S. dollar vis-a-vis the yen and the deutsche mark in advance of Asia's troubles—is argued to have worsened the competitive position of many emerging market economies. One solution to reducing destabilizing shocks emanating from abroad, the argument runs, would be to reduce the variability of the G-3 currencies by establishing target bands.<sup>1</sup> This paper examines the argument for such a target zone strictly from an emerging market perspective but will be silent on the costs and benefits for industrial countries.<sup>2</sup>

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<sup>1</sup> Of course, since European monetary union, the G-3 currencies cover at least fourteen industrial countries—the United States, Japan, and the twelve nations that have adopted the euro. In what follows, we splice together the pre-single-currency data on the deutsche mark with the post-1999 data on the exchange value of the euro.

<sup>2</sup> For a cost-benefit analysis from a developed country perspective of the effects of limiting G-3 exchange rate volatility or adopting a common currency, see Rogoff (2001). Of particular relevance here is Rogoff's argument that the strongest case for stabilizing major currency exchange rates may well rest on

Given the reality that sterilized intervention by industrial economies tends to be ineffective and that policy makers show no appetite to return to the kinds of controls on international capital flows that helped keep exchange rates stable over the Bretton Woods era, a commitment to damping G-3 exchange rate fluctuations requires a willingness on the part of G-3 authorities to use domestic monetary policy to that end. This, in turn, may require tolerating more variability in interest rates and potentially spending. Under a system of target zones, then, relative prices for emerging market economies may become more stable in an environment of predictable G-3 exchange rates, but greater interest rate volatility may make debt-servicing costs less predictable and greater G-3 income volatility may make demands for the products of emerging market economies more uncertain. The welfare consequences to an emerging market economy, therefore, are ambiguous, depending on initial conditions, the specification of behavior, and the dynamic nature of the tradeoff between lower G-3 exchange rate volatility and higher G-3 interest rate variability.

The consequences for the developing “South” of interest rate, exchange rate, and income volatility in the “North” is only one particular aspect of myriad North-South links. As such, issues related to G-3 exchange rate variability should be viewed within the much larger panorama (and related literature) of how economic outcomes in developed countries influence those in less developed economies. In this paper, we review and revisit the “traditional” North-South links via trade, commodity markets, and capital flows, and add transmission channels in the form of interest-rate and exchange-rate volatilities.

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the way that their volatility influences developing countries.

In Section II, we discuss the various channels of North-South transmission and use the example of a simple trade model to establish that, for a small open economy with outstanding debt, the welfare effect of damping variations in the exchange rate by making international interest rates more volatile is ambiguous. Section III presents stylized evidence on how the monetary policy and economic cycle in the United States influence capital flows to emerging markets as well as growth. In Section IV, we first examine the contribution of G-3 exchange rate volatility to fluctuations in the exchange rates of emerging markets and proceed to analyze the link between G-3 interest rate and exchange rate volatility and capital flows and economic growth in developing countries. The final section summarizes our main findings and discusses some of the policy implications of our analysis.

## **Section II. North-South Links**

In this section, we discuss the various channels through which economic developments in the major developed economies can potentially affect developing countries. On the developed side, we examine how the exchange-rate arrangements among industrial countries influence the mix of interest-rate and exchange-rate volatility on world financial markets. On the emerging markets side, our focus is on capital flows--their level and composition--and on economic performance, as measured by GDP growth.

### ***1. The Winds from the North: The Role of G-3 Exchange Rate Arrangements in Determining the Mix of Interest-Rate and Exchange-Rate Volatilities***

In principle, G-3 exchange rates could be induced to stay within a target bands through some combination of three tools. First, national authorities could rely on sterilized intervention

to enforce some corridor on bilateral exchange rates. However, except to the extent that such intervention tends to signal future changes in domestic monetary policy, researchers have found little empirical support that sterilized intervention in industrial countries is effective.<sup>3</sup> Second, national authorities could impose some form of exchange or capital control, presumably in the form of a transactions tax or framed as prudential reserve requirements. Opponents of such efforts generally argue that capital controls generate financial innovation that undercuts them over time, implying that the controls either become increasingly complicated or irrelevant. Third, monetary policy makers in the major countries could alter domestic market conditions to keep the foreign exchange value of their currencies in a desired range. This could take the form of allowing intervention in the currency market to affect domestic reserves—that is, not sterilizing intervention—or more directly keying the domestic policy rate to the exchange value of the currency (as discussed in McKinnon, 1997, and Williamson, 1986).

Given the lack of evidence finding any independent effect of sterilized intervention (over and beyond what subsequently happens to domestic monetary policy) and the consensus supporting the free mobility of capital internationally, it would seem that the only instrument available to enforce a target zone would be domestic monetary policy of the G-3 central banks. But this implies some tradeoff, in that G-3 domestic short-term interest rates would have to become more variable to make G-3 exchange rates smoother.

The nature of this tradeoff, of course, depends on many factors, importantly including the width of the target zone. Wider bands would presumably reduce the need of G-3 central banks to

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<sup>3</sup> The signaling channel is addressed by Kaminsky and Lewis (1996); Dominguez and Frankel (1993) examine whether there are any portfolio effects of sterilized intervention.

move their interest rates in response to exchange rate changes. At the same time, though, wider bands would imply a smaller reduction in the volatility of G-3 exchange rates.<sup>4</sup> In addition, it might not be just G-3 interest rates that are affected by the exchange rate policy. Central bank actions taken to damp G-3 exchange rate volatility may also leave their imprint on income in the G-3 countries. Wider swings in industrial country interest rates would presumably make spending in those countries more variable, even as the split of that spending on domestic versus foreign goods and services becomes more predictable under more stable G-3 exchange rates.

To understand the effects of these tradeoffs from an emerging markets perspective, it is important to remember that most developing countries are net debtors to the industrial world and that typically that debt is short-term and denominated in one of the G-3 currencies. As a result, the welfare consequences for an emerging-market economy of G-3 target zones depends on exactly how those zones are enforced and the particulars of the small country's mix of output, trading partners, and debt structure.

## ***2. A Stylized Model of an Emerging Market Economy***

The effects of trading interest-rate for exchange rate volatility can be seen in a basic single-period, two-good model of trade for a small open economy, as in Figure 1. This figure is drawn for a country taking as given the relative price of the two traded goods and receiving an endowment in terms of good A. For simplicity, we assume that its external debt is also

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<sup>4</sup> Some might argue that if G-3 target zones anchor inflation expectations in developed countries, both exchange rates *and* interest rates could become more stable. However, many industrial countries in the past decade have adopted some form of inflation targeting, either explicitly or implicitly, which has worked to stabilize inflation expectations and which would make achieving a credibility bonus from adopting a G-3 target zone less likely.

denominated in terms of good A and its currency is pegged to that of country A.<sup>5</sup> Volatility of the relative price of the traded goods—which might stem solely from nominal changes in exchange rates between the industrial countries if the small country fixes its exchange rate or if it prices to the industrial country market—pivots the budget line and thus alters the desired consumption combination in the small country. Suppose, for instance, that the currency of country A depreciates relative to that of country B, rotating the budget line from EF to GF. All else equal, welfare would decline, representing a cost associated with developments on the foreign exchange market for this small country.

Target zones for the large countries, if effective, would be able to prevent the budget line from rotating as the result of influences emanating from the developed world. However, this reduced major-country exchange rate volatility will only be accomplished if the major central banks change short-term interest rates in response to incipient changes in cross rates. For most emerging-market economies, which are debtors, such coordination of G-3 monetary policy could deliver more stable terms of trade at the expense of a more variable interest service. In this particular case, the central bank of country A would presumably have to raise its domestic short-term interest rate in defense of the currency. So, while the slope of the budget line would be unchanged, its location would shift in, as labeled HI. Regardless of whether the effects of the initial shock were felt through the exchange rate or the interest rate, welfare in this small country would decline. Whether they decline more or less if the large countries allow the cross exchange

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<sup>5</sup> Behind the scenes of this model in the larger industrial world, it is simplest to think of two large countries, A and B, specialized in the production of their namesake good. The net effect of our assumption about the small economy's endowment and debt structure is that the intercept of the budget line depends on the interest rate in country A.



rate or their interest rates to adjust will depend on many factors.

### **3. *Going Beyond the Stylized Model***

In reality, many developing countries send primary commodities onto the world market, there is some substitutability in world demand for those countries that produce manufactured products, and capital markets are far from perfect. In this section, we review the literature on North-South linkages to broaden our understanding of the issues related to G-3 exchange rate arrangements.

As opposed to the simple example, most emerging-market economies face some slope to the demand curve for their exports. As a result, any changes in G-3 income induced by changes in their interest rates will be reflected in the demand for the exports of its trading partners to the extent that imports in the developed economy have a positive income elasticity.<sup>6</sup> The higher the share of exports that are destined for the developed country, the more sizable the consequences for the emerging market economy. On the basis of this channel, for example, Mexico and Canada would be far more affected by an economic downturn in the United States than Argentina. This follows because in 1999 about 88 percent of all Canadian and Mexican exports were shipped to the U.S. market, while only about 11 of Argentina's exports were destined for the United States.<sup>7</sup> Other things equal, the higher the income elasticity of imports in the developed country, the more pronounced will be the contraction in the country's exports when the developed country slows. In this regard, developing countries that export predominantly

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<sup>6</sup> Note that this channel, as it relies on the behavior of the large partner, is present irrespective of the level of development of the smaller trading partners.

<sup>7</sup> The stylized evidence on patterns of trade is discussed in the next session.

manufactured goods (which typically are more sensitive to income) may fare worse than their counterparts exporting primary commodities, which tend to be relatively income-inelastic.<sup>8</sup> The heterogeneity in export structure across developing countries are sufficiently significant to expect, a priori, highly differentiated outcomes. For instance, the contrast between the export structure of East Asian countries (which are heavily weighed to manufactured goods) to that of most African countries (which are predominantly skewed to primary commodities) is particularly striking.<sup>9</sup>

As opposed to the simple example, emerging market economies generally produce a different mix of goods than those of industrial countries. In that case, the business cycle in the world's largest economies may itself exert a significant influence on the terms of trade of their smaller developing trading partners. Perhaps the clearest example of such a North-South link comes from international commodity markets, as argued in Dornbusch (1985). Beginning with that work, the literature on commodity price determination has consistently accorded a significant role to the growth performance of the major industrial countries.<sup>10</sup> In particular, recessions in industrial economies, especially the United States, have historically been associated

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<sup>8</sup> See, for example, Reinhart (1996), who estimates industrial countries' import demand function for various regions and countries with varying degrees of export diversification and primary commodity content.

<sup>9</sup> For example, manufactures account for only 10 percent in Côte D'Ivoire but account for more than 65 percent of Thai exports.

<sup>10</sup> Dornbusch (1985) stresses the role of the demand side in commodity price determination. Borensztein and Reinhart (1995), who incorporate supply-side developments in their analysis, also find a significant and positive relationship between growth in the major economies and world commodity prices.

with weakness in real commodity prices. In our simple example, if the small country's endowment was made up of a commodity, the effects of G-3 monetary policy actions on overall demand for those primary goods could induce a sizable shift in the position *and* rotation of the budget line.

Yet, the impacts of fluctuations in the business cycle on developing economies is likely not limited just to income and relative price effects. There is a well-established, endogenous and countercyclical "monetary policy cycle" in the major developed economies. To damp the amplitude of the business cycle, central banks ease monetary conditions and reduce interest rates during economic downturns and hike interest rates when signs of overheating develop. Calvo, Leiderman, and Reinhart (1993) stressed the importance of U.S. interest rates in driving the international capital flow cycle. They present evidence that, in periods of low interest rates in the United States, central banks in developing countries in Latin America systematically accumulate foreign exchange reserves and the real exchange rate appreciates. Subsequent studies that examined net capital flows and extended the analysis to a variety of their components over various sample periods and that extended the analysis to developing countries in other regions found similar evidence.

This link between the interest rate and capital flow cycle may arise for a variety of reasons. Investors in the developed economies faced with lower interest rates may be inclined to seek higher returns elsewhere (i.e., the demand for developing country assets increases). It also might be the case that the decline in international interest rates makes borrowing less costly for emerging markets and increases the supply of emerging market debt. In that case, the decline in the cost of borrowing for emerging-market countries may be even greater than the decline in

international interest rates if the country risk premia is itself a positive function of international interest rates. The evidence presented in Fernandez-Arias (1996), Frankel et. al. (2000), and Kaminsky and Schmukler (2001) support the notion that country-risk premia in many emerging markets indeed move with international interest rates in a manner that amplifies the interest rate cycle of industrial countries. Thus, a change in G-3 interest rates shifts the budget line by more than given in our simple example, as procyclical capital flows imply that the change in the industrial country interest rate changes the developing country's interest-rate risk premium in the same direction. Moreover, one could posit nonlinearities in the response if large increases in borrowing costs--by inducing balance-sheet strains and credit rationing--have more substantial effects on income prospects than do similar size reductions in borrowing costs.

Table 1 provides a summary of the channels of transmission of how developments in the major industrial countries may influence growth in emerging markets. Taken together, the various cells of the table would suggest that the trade and finance effects that arise from the growth and interest rate cycles, respectively, in developed economies tend to, at least partially offset. However, G-3 exchange rate and interest rate volatility would seem *a priori* to have a negative effect on economic growth in the developing world. Higher interest rate volatility may hamper investment, while higher G-3 exchange rate volatility may retard emerging market trade.<sup>11</sup> While the literature on the impacts on trade of exchange rate volatility for developed economies is inconclusive, the comparable analysis of this issue for emerging markets seems much more convincing in reaching the conclusion that exchange rate volatility tends to reduce trade.

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<sup>11</sup> Of course, G-3 interest rate volatility may also complicate significantly emerging market debt management strategies or make systemic strains more likely.

## **II. The Role of the North's Business and Monetary Policy Cycles: The Stylized Facts**

In this section, we present stylized evidence on the “North-South” links that were discussed in the preceding section. For emerging markets, we examine international capital flows and growth around various measures of the United States growth and interest rate cycle and contrast periods of high interest rate and exchange rate volatility to those where volatility was relatively subdued. We present evidence of the direction of “North-South” trade and on the impact of G-3 developments on international commodity markets.

Our data is annual and spans 1970 to 1999, and the country groupings are those reported in the International Monetary Fund's *World Economic Outlook* (WEO).<sup>12</sup> For capital flows, these groupings include: All emerging markets, Africa, Asia crisis countries, other Asian emerging markets, Middle East and Europe, and the Western Hemisphere. In reporting aggregate real GDP, the WEO groups the Asian countries somewhat differently; the two reported subgroupings are newly industrialized Asia and Asia; all other categories remain the same. We examine the cyclical behavior of net private capital flows and its components: net private direct investment (FDI), private portfolio investment (PI), other net private capital flows (OTF)--which is heavily weighed toward bank lending, and net official flows (OFF).

### ***1. The growth cycle, capital flows, and emerging market growth***

Given its prominent position in the world economy, the United States business cycle (not surprisingly) has important repercussions for the rest of the world. Economic developments in

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<sup>12</sup> The developing country classification in the WEO is comprised on 128 countries. See the WEO for details on the regional breakdown.

the United States echo loudly in many developed economies--most notably Canada; the same holds true for developing economies, especially so those in the Western Hemisphere and newly-industrialized Asia. To examine the behavior of growth and various types of capital flows to emerging markets, we first split the sample into two states of nature according to two criteria. The first parsing separates the sample into recessions and expansions according to the National Bureau of Economic Research's dating of U.S. business cycle turning points. The second cut of the data divides the sample into those periods in which U.S. real GDP growth is above the median growth rate for the sample and those in which growth is below the median.

Figure 2 depicts capital flows to emerging markets (in billions of U.S. dollars in 1970 terms) in recession years versus recovery years for the 1970-1999 period. As is evident, net flows to emerging markets are considerably larger in real terms when the United States is in expansion as when the United States is in recession. Furthermore, this gap between recession and expansion owes primarily to a surge in FDI flows (which nearly go up threefold from recession to expansion) and to portfolio flows (which go up almost fivefold from recession to expansion). The key offsetting category is other net inflows to emerging markets, which evaporate when the United States is in an expansion rather than recession. This disparate behavior between FDI and portfolio flows importantly owes to bank lending, which accounts for a significant part of other flows. Apparently, banks tend to seek lending opportunities abroad when the domestic demand for loans weakens and interest rates fall, as usually occur during recessions. The U.S. bank lending boom to Latin America in the late 1970s and early 1980s and the surge in Japanese bank lending to emerging Asia in the mid-1990s are two clear examples of this phenomena.

However, the surge in FDI flows from the mid-1990s to the present is a significant

departure from FDI's historical behavior that is, no doubt, heavily influenced by the wave of privatization and mergers and acquisitions that took hold in many emerging markets during recent years. It is possible that because this period of privatizations and surging FDI is coincident with the longest economic expansion in U.S. history, the results may be skewed toward finding an exaggerated role for U.S. growth in driving FDI and total net flows. When we ended our sample in 1992 in an exercise not shown, capital flows to emerging markets still diminished during economic downturns in the United States. While FDI flows and portfolio flows continue to be higher in expansions than in recessions, the drop in other flows during expansions more than offsets this.

In sum, from the vantage point of the volume of capital flows to emerging markets--U.S. recessions are not a bad thing. From a compositional standpoint, however, the more stable component of capital flows, FDI, does seem to contract during downturns--suggesting that emerging markets may wind up during these periods relying more heavily on less stable sources of financing--short-term flows.<sup>13</sup>

The analogous exercise was performed for emerging market average annual GDP growth. As shown in Table 2, for all developing countries, growth is somewhat slower during U.S. recessions, averaging 4.8 percent per annum versus 5.2 percent average growth during expansion years. However, the pattern is uneven across regions. For the countries in transition, Asia (including the newly-industrialized economies), and the Middle East and Europe growth tend to slow during U.S. recessions while for Africa and Western Hemisphere, the opposite is true.

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<sup>13</sup> Other flows are mostly short-term.

However, in most instances the differences across regimes are not markedly different--an issue we will explore further later.

## **2. *The growth cycle and trade***

If economic downturns in the United States are not necessarily a bad thing from the vantage point of the availability of international lending to emerging markets, slowdowns are likely to have adverse consequences for countries that rely heavily on exports to the United States. Table 3 reports the percentage of total exports (as of 1999) of various emerging markets in Africa, Asia, and Western Hemisphere that are destined for the United States market. It is evident that bilateral trade links between the United States and the developing world are strongest for Latin America, although there is considerable variation within the region with Mexico and Argentina sitting at the opposite ends of the spectrum. However, trade between the United States and the Asian countries shown in this table is, by no means, trivial, especially if one considers that (as shown in Table 4) the income elasticity in developed economies for Asian exports typically is estimated to be more than twice as large as the income elasticity for African exports; more generally, the income elasticity of the exports of developing countries that are major exporters of manufactured goods is well above that of those whose exports have a higher primary commodity content.

As noted earlier, swings in the economic cycle in the United States and other major industrialized economies typically influence the terms of trade of primary-commodity exporters. According to the various studies reviewed in Table 5, a one percentage point drop in industrial production growth in the developed economies results in a drop in real commodity prices of roughly 0.77 to about 2 percent, depending on the study.



### ***3. The interest rate-monetary policy cycle***

In a world of countercyclical monetary policy in industrial countries, an economic cycle goes hand in hand with an interest-rate cycle. As with the growth cycle, we proceed to describe the stylized evidence by breaking up the sample in two ways. First, we subdivide the 1970-1999 sample into two subsamples, one where monetary policy was “easing”--that is to say that the monetary policy interest rate in the United States, the federal funds rate, was declining--and periods of tightening, where the federal funds rate was rising.<sup>14</sup>

Figure 3 reports the results of this exercise. In years when U.S. monetary policy was easing, emerging markets in all regions (with the exception of Africa, which is almost entirely shut out of international capital markets) receive a markedly higher volume of capital inflows. While FDI and portfolio flows do not change much, other (short-term) flows respond markedly to the interest rate cycle. As shown in the third and fourth columns of Table 2, by and large, average annual GDP growth rates are lower during easings of U.S. monetary policy than during tightening episodes--which may simply attest to the fact that Federal Reserve easings most often coincide with a U.S. economic slowdown. It may also suggest that, to the extent that capital inflows have positive consequences for economic activity (an important issue that has not received much attention in the literature), these effects may not be contemporaneous.

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<sup>14</sup> More specifically, a year was denoted as one of tightening (easing) if the average level of the federal funds rate in December was higher (lower) than that of twelve months earlier. Recognize that this cut of the data does not discriminate between a modest and marked policy changes, as a 50 basis point drop in the federal funds rate during a given year would be lumped together with a 400 basis point drop. To get at this issue, we also broke the sample into periods where real interest rates are above the sample median and those years in which rates are below the median. (Real ex post interest rates are calculated as the nominal yield on a three-month Treasury bill less the annual consumer price inflation rate.) Those results, which are not reported to conserve on space, about match those in the main text.

#### **4. *Stylized evidence on the twin cycles***

Given the synchronization of the economic growth and policy cycles, a finer reading of the data is probably warranted. Table 6 cuts the sample into four states of nature for the United States: recession accompanied by monetary policy tightening, recession accompanied by easing, expansion and tightening, and expansion and monetary policy easing. The role of the business cycle is quite evident in the results. The worst outcome for emerging markets is when the United States is in a deep-enough recession that monetary policy is being systematically eased (the upper left cell in each regional entry). In general, entries along the minor diagonal—representing either a U.S. economy weak enough to be in recession but not so weak as to preclude Federal Reserve tightening or an expansion facilitated by policy easing—contain fast rates of growth in economic activity. But the fastest rates of growth are invariably recorded in the lower right cell, which includes those years in which the U.S. economy is expanding and monetary policy tightening. That is, historically foreign economies grow the fastest in the latter stages of the U.S. business cycle when fast U.S. growth is creating pressures on resources that trigger Federal Reserve tightening.

As to capital flows, the priors are less well defined. On the one hand, the Calvo, Leiderman, and Reinhart (1993) hypothesis would suggest that tighter monetary policy (i.e., rising interest rates) would lead to (other things equal) lower capital flows to emerging markets. On the other hand, while recessions in the North may dampen FDI flows (as these are often linked to trade), economic slowdowns tend to be accompanied by a weakening in the domestic

demand for loans--which, in the past, has often led bank to seek lending opportunities abroad.<sup>15</sup>

The lower panel of Table 6 presents net capital flows and its components to all emerging markets during these four states of nature. For net private flows, the largest entry falls in the lower left cell, suggesting that both lower interest rates and faster growth in the United States are a potential catalyst for capital flows into emerging markets. However, this feature is not even across categories: FDI and portfolio flows thrive when expansions are coupled with falling interest rates. Other flows, which are largely comprised of bank lending do not. Like other flows, these tend to increase in period of falling interest rates but contract during expansions; other flows are highest when the U.S. is in recession and interest rates are falling.

#### **5. *The repercussions of the twin cycles: Basic tests***

The preceding discussion does not shed light on the relative statistical significance of the twin cycles. To address that issue, we next run a variety of simple regressions that attempt to explain capital flows and growth in emerging markets through developments in the developed economies, particularly the United States. Our sample spans 1970-1999 for all regions.

In examining real private flows to all emerging market economies, we use four different measures of real private capital flows: Net capital flows, net direct investment, net portfolio flows, and other capital flows. The regressors in the first set of equations are real U.S. GDP growth and the U.S. short-term nominal interest rate (the yield on the three-month Treasury bill). As neither of these variables pose a potential endogeneity problem, our estimation method is simple ordinary least squares. Table 7 reports the results of this regression for all emerging market

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<sup>15</sup> See Kaminsky and Reinhart (2001).

economies; (Appendix Table 1 reports results for particular regions).

When examining the results for the emerging market aggregate, as well as for most of the regional subgroups, U.S. nominal interest rates seem to play a more dominant and systematic role in explaining capital flows to emerging markets than U.S. economic growth. As a general rule, rising U.S. interest rates are associated with falling capital flows to emerging markets. In effect, in many of the regressions, the coefficient on growth is negative--suggesting that when the U.S. is enjoying rapid growth--capital stays at home. This effect is most pronounced in Other Net Flows, which largely consists of bank lending. Both FDI flows and portfolio flows are consistently interest rate sensitive.<sup>16</sup>

There are, however, various regional differences worth highlighting. First, U.S. nominal interest rates are significant in explaining portfolio and FDI flows in all regions--but the impacts are greatest in Western Hemisphere and lowest in Africa. This result may simply highlight that, among the emerging markets with some extent of access to international capital markets (Asia and Latin America), the latter are more heavily indebted and interconnected with the United States. Second, growth in the United States has a significant and positive influence in explaining FDI to Western Hemisphere--which is not the case for other regions. Third, as the descriptive analysis anticipated, the other capital flow category behaves very differently from FDI and portfolio flows.

We next perform a comparable exercise for growth similar to Dornbusch (1985), who focused on the links between developing debtor countries and their developed counterparts.

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<sup>16</sup> Similar results obtain but are not reported to save space, when developed-country real GDP growth rates are used in lieu of the U.S. growth rate.

Dornbusch regressed developing country GDP growth on a measure of OECD growth and found the coefficient on the OECD growth measure to be statistically significant and in the 0.28-0.76 range.<sup>17</sup> More recently, Frankel and Roubini (2000) regress developing country growth for various regional groupings against the G-7 real interest rate; they found that the coefficients on real interest rates were negative and in most cases statistically significant--with the greatest interest sensitivity in the Western Hemisphere.<sup>18</sup>

Our exercise here combines these two approaches. As shown in Table 8, when GDP growth for the various country groupings is regressed against U.S. growth and the short-term real interest rate, the results tend to be quite intuitive. The sensitivity of growth to U.S. growth is highest (and statistically significant) for the newly industrialized Asian Economies, which depend importantly on trade with the United States and lowest for the remainder of Asia. For all developing countries, both of the regressors have the anticipated signs and are statistically significant. A one percentage point decline in U.S. growth rates reduces GDP growth for the developing countries by 0.2 percent while a one percent increase in U.S. real interest rates reduces it by 0.24 percent. Despite strong trade links with the United States for most countries in the region, U.S. growth is only marginally statistically significant for Western Hemisphere, although the coefficient is positively signed. U.S. growth is also significant for the Middle East and European developing countries. Given its history of relatively high levels of indebtedness and

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<sup>17</sup> Dornbusch used industrial production, real GDP growth, and import volume alternatively; the sample was 1961-84.

<sup>18</sup> The coefficient for Western Hemisphere was -0.77 compared to -0.39 for all market borrowers.

periodic debt-servicing difficulties, it is not surprising that the U.S. real interest rate is significant and growth is the most sensitive to interest rate fluctuations in Western Hemisphere; the coefficient (-0.71) is almost four times as large--in absolute terms--as for all developing countries. Indeed, one cannot reject the hypothesis that a one percent increase in U.S. real interest rates leads to a one percent decline in growth in the region. Real U.S. interest rates are also statistically significant for the Middle East and Europe. At the other end, the newly industrialized Asian economies, with low levels of external debt and considerable access to private capital markets, U.S. interest rates are not significant, although the coefficient has the (expected) negative sign. As far as these regressions are concerned, U.S. developments have no systematic relationship with the rest of developing Asia.<sup>19</sup>

#### **Section IV. The Consequences of Exchange Rate and Interest Rate Volatility in the North**

To examine the issue of whether the volatility of interest rates and G-3 exchange rates have adverse consequences for cross-border capital flows to emerging markets and growth, we split our sample into periods in which volatility is high and periods in which it is low and conduct a comparable set of exercises as those discussed in the preceding section.

##### ***1. Background on exchange rate variability in emerging markets***

The argument that excessive volatility of G-3 exchange rates imposes significant costs on

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<sup>19</sup> An elegant model that broadly supports this pattern of coefficients is provided by Gertler and Rogoff (1990). They offer a framework in which a country's level of wealth influences the extent of agency problems in lending and, therefore, the degree of integration with the world capital market. As a general rule in Table 8, wealthier regions (in per capita terms) tend to be more tightly linked to U.S. interest rates.

emerging markets seems to rely mostly on a spending channel. A large swing in the dollar's value on the foreign exchange market in terms of the yen and the euro translates directly into changes in the competitiveness of countries that link their currencies to the dollar—either through a hard peg or a highly managed float. The evidence in Calvo and Reinhart (2000) suggests many developing countries fall into that group. They report a widespread “fear of floating,” in that many emerging market currencies tend to track the dollar or the euro closely, even in cases that are officially classified as floating.

Some sense of the stakes for emerging-market economies can be gotten from Figures 4 through 6 and Table 9. We calculated simple annual averages of the absolute value of the monthly changes in the logarithms of the real deutsche mark/dollar and real yen/dollar exchange rates from 1970 to 1999, of the percentage point change in the real U.S Treasury bill rate (on the rationale that most developing country borrowing is denominated in U.S. dollars) from 1973 to 1999, and of the monthly changes in the logarithm of U.S. real personal consumption expenditure from 1970 to 1999.

The three figures split the sample into two states of nature, those in which G-3 exchange rate volatility is above and below is sample median (in Figure 4), those in which U.S. interest rate volatility is above and below the sample median (in Figure 5), and those in which the average annual volatility of U.S. personal consumption expenditure is above and below the median (in Figure 6). As before, we report the volume of real capital flows by country grouping and type across the sample split. As is evident from Figure 4, the volatility of G-3 exchange rates has little discernible effect on net real private capital flows to emerging market economies or on any of the major regions reported. Beneath that total, though, there are important compositional effects, in

that both portfolio and other net capital flows step lower when G-3 exchange rate volatility is higher. The unchanged total owes to the fact that private direct investment moves in the opposite direction—from 1970 to 1999, FDI tended to be higher in those years when G-3 exchange rate volatility was on the high side of the median.

Similar offsetting movements of FDI and portfolio and other capital flows are evident when the sample is split according to the volatility of the U.S. short-term real interest rates, as in Figure 5. In this case, on net, real private capital flows are somewhat higher when U.S. rates move more from month to month. This follows because the expansion of portfolio and other flows when interest rates are volatile more than makes up for a contraction in FDI. Apparently, the short-term financial transactions in portfolio and other flows are energized by interest rate volatility even as the longer-term transactions in FDI flag.

The total and major components of private capital flows respond more similarly when the sample is split according to the volatility of U.S. consumption spending, as seen in Exhibit 6. Relatively stable PCE growth in the United States is associated with larger capital flows, on net, to emerging market economies, especially those taking the form of foreign direct and portfolio investment. To an important extent, this may owe to the combination of a secular decline in U.S. consumption volatility and a secular increase in the volume of capital flows. Simply, low-consumption-volatility years predominate later in the sample, when capital flows are also larger.<sup>20</sup>

Table 9 reports the average annual growth rates of real GDP in developing countries for different splits of the data determined by the volatilities, in turn, of G-3 exchange rates, U.S.

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<sup>20</sup> Two-thirds of the observations on PCE variability in the first half of the sample lie above the median calculated over the entire sample.



interest rates, and U.S. consumption. As a general rule, neither G-3 exchange rate volatility nor U.S. consumption volatility appear harmful to growth prospects in emerging market economies. By both cuts of the data, high volatility (when comparing columns 1 and 2 for G-3 exchange rates or columns 5 and 6 for U.S. consumption) is associated with about  $\frac{1}{2}$  to  $\frac{3}{4}$  percentage point faster growth in developing countries. For some regions, particularly newly industrialized Asian economies, the difference is quite large. What is also apparent is that U.S. short-term interest rates, on average, are linked to slower economic growth in the developing world, with differences in growth across the two regimes ranging from  $\frac{3}{8}$  to nearly 2 percentage points.

The insight from the simple model is that enforcing target zones in the G-3 currencies involves choosing a point along the tradeoff between lower exchange rate volatility and higher interest rate volatility. And, to the extent that G-3 spending is sensitive to interest rates, there will be a corresponding tradeoff between lower exchange rate volatility and higher consumption volatility. We parsed our sample along the dimensions of that tradeoff, examining capital flows and GDP growth according to the joint behavior of the relevant volatilities. Table 10 records those results. From an emerging market perspective, G-3 target zones imply moving from the upper right cell of each panel (where G-3 currency volatility is high but U.S. interest rate of PCE volatility is low) to the lower left cell (where G-3 currency volatility is low but U.S. interest rate or PCE volatility is high).

With regard to the upper four panels of the table looking at the comovement of G-3 exchange rate and U.S. interest rate volatility, net private capital flows were almost \$5 billion higher, on average, in those years in which G-3 exchange rates were not volatile and U.S. interest rates were. However, by considering the minor diagonals on the other three panels it become

clear that this holds because a sizable decline in FDI across the two periods was offset by increases in hotter-money flows—portfolio investment and other private flows. Moreover, it would have been a bad bet in emerging market economies over the past twenty-seven years to trade times when G-3 exchange rates were volatile but U.S. PCE growth was stable for times when G-3 exchange rates were stable but U.S. PCE growth was volatile. Across the bottom four panels of Table 10, real private flows uniformly fall in moving from the upper right cell to the bottom right cell. Taken together, Table 10 provides no evidence that the flow of private capital to emerging market economies would benefit from a G-3 target zone.

But attracting financial capital is an intermediate goal relative to the ultimate responsibility of national authorities to foster economic growth. Table 11 presents averages of real GDP growth from 1973 to 1999 for major country groups split according to the joint behavior of G-3 exchange rates and either U.S. interest rates or personal consumption expenditure. Here, the evidence does suggest that trading higher for lower G-3 exchange rate volatility, even at the cost of more volatility in either U.S. interest rates or consumption, would benefit growth.

Table 12 addresses the possibility of nonlinearities in the responses of developing countries by using an indicator approach. In the two left panels, data on the number of currency crises in developing countries by year (out of the total number of years) are sorted according to G-3 exchange rate and U.S. interest rate and PCE volatility (with the crisis indicator defined according to the methodology in Frankel and Rose, 1996, as recently updated and extended to a

larger country set by Reinhart, 2000).<sup>21</sup> The right panels report similar calculations using the number of banking crises from the same source. As can be seen in moving along the minor diagonals of the four panels, years in which G-3 exchange rate volatility was above its median and interest-rate volatility in the United States was below its median over the past eighteen years were associated with relatively more crises in developing countries, especially compared to those years when G-3 currency volatility was low but U.S. interest rate volatility was high. In that sense, advocates of target zones are correct in nothing that crises are more frequent when G-3 exchange rates are more volatile. Moreover, that historical record suggests that the situation can be improved from there by reducing that volatility by incurring more interest rate of PCE volatility in the United States.

## **2. Basic Tests**

The difficulty in interpreting these data, whether on capital flows or GDP growth, is that some of the regularities observed in moving between the cells of these contingency tables may owe to systematic macroeconomic changes rather than unique effects from the various volatilities. But in earlier section, we offered simple regression that helped to explain emerging market economies' capital flows and GDP growth using variables that could be treated as exogenous to the South–U.S. interest rates and economic growth. We now ask whether G-3 indicator variables have any ability to explain the residuals to those “fundamental” regressions, and thereby put confidence bands about the estimates of the effects of interest-rate and exchange-rate volatility on capital flows and GDP growth.

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<sup>21</sup> The results are similar using the methodology of Kaminsky and Reinhart (1999).

Each block of Table 13 corresponds to a specification in which the residual from the equation explaining the capital flow concept in the column head is regressed against two G-3 dummies (with no constant terms, as the dummies are exhaustive). Those dummies are the same we have used to split the data in the various exercises already reported and capture: the U.S. business cycle; U.S. monetary policy; the volatilities of U.S. real short-term rates, G-3 exchange rates, and U.S. consumption growth; currency crises; and banking crises.<sup>22</sup> In general, a statistically significant coefficient would indicate that a G-3 factor exerted an additional influence beyond that contained in U.S. interest rates and income. In the event, there are none to be had. As to G-3 target zones in particular, there appears to be no significant effect on average of episodes of higher volatilities by either measure for topline net capital flows. Taken literally--no doubt too literally--this would indicate there is no particular *cost* to making real interest rates more volatile, but there is also no particular *benefit* in damping G-3 exchange rate volatility. This statistical evidence comes out not much different than the theoretical analysis: From the perspective of emerging market economies, the case for limiting G-3 exchange rate volatility is not proven. A similar analysis across regional aggregates, not shown to conserve on space, provides no reason to question that judgment.

We performed a similar exercise to see if either episodes of volatile G-3 exchange rates or U.S. real interest rates exerted a systematic influence on the growth of output in major emerging market areas. Those results, reported in Table 14, tell a similar story. Across the six areas examined, none of the dummy variables related to the various volatilities differed significantly

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<sup>22</sup> Thus, there are twenty-eight regressions reported in the table corresponding to four measures of capital flows and seven different sets of states of nature.

from zero. Taken together, the evidence suggests that advocates of G-3 target zones have to identify another mechanism by which financial market volatility in the industrial countries impinges on their neighbors to the South beyond that expected through the flows of trade (with their associated effects on income) or capital.

## **V. Concluding Remarks**

In this paper, we have attempted to analyze and quantify how developments the exchange rate arrangements of the G-3 countries influence emerging markets economies. The debate on G-3 target zones should be put into the broader perspective of the ongoing debate on exchange-rate arrangements in emerging market economies, which often hinge on credibility. The advocates for dollarization, for instance, argue that a nation with an uneven history of showing a commitment to low inflation can import the reputation of the central bank of the anchor currency. For the issue at hand, however, there are no obvious bonuses to smaller countries should G-3 central banks damp the fluctuations of their currencies—and, as discussed in Rogoff (2001), the benefits to developed countries are limited at best. This also implies that the direct benefits to emerging market economies should stem only from the lessened volatility of their trade-weighted currencies. But as Rose (1999) points out, the benefits of reduced exchange rate variability on trade flows, at least, are small compared to adopting a common currency.

This is also the place to discuss the limitations to our analysis. In particular, our use of linear—or nearly linear models—may understate the consequences of variability in interest

rates and exchange rates. To the extent that high world interest rates trigger balance sheet problems in emerging markets, the consequences of the tradeoff implied by a target zone may be considerable. Indeed, one repeated message of this paper is that emerging market economies, which have already surrendered a high degree of autonomy in their monetary policies, often price their goods in foreign—not local—currencies, and can be shut out of world financial markets suddenly, are different from their industrial brethren.

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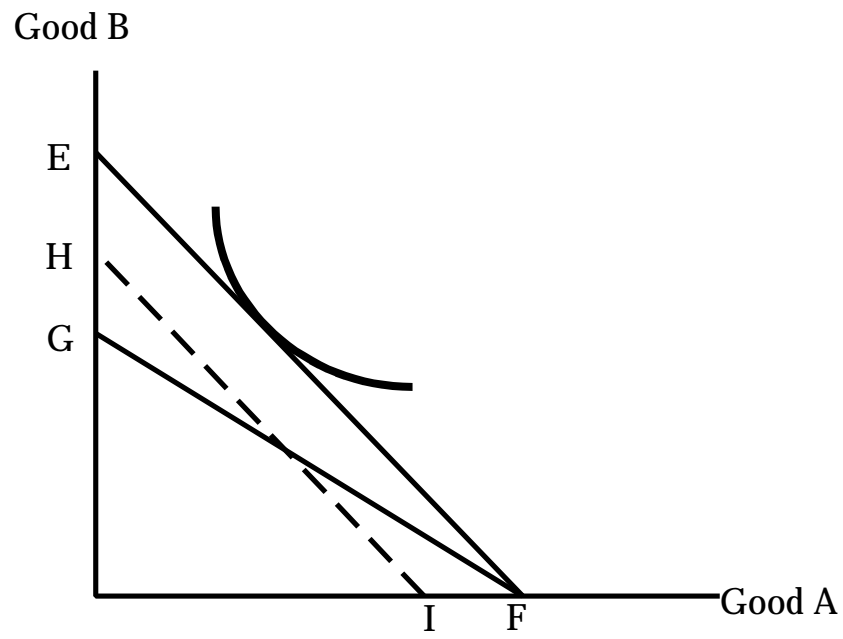
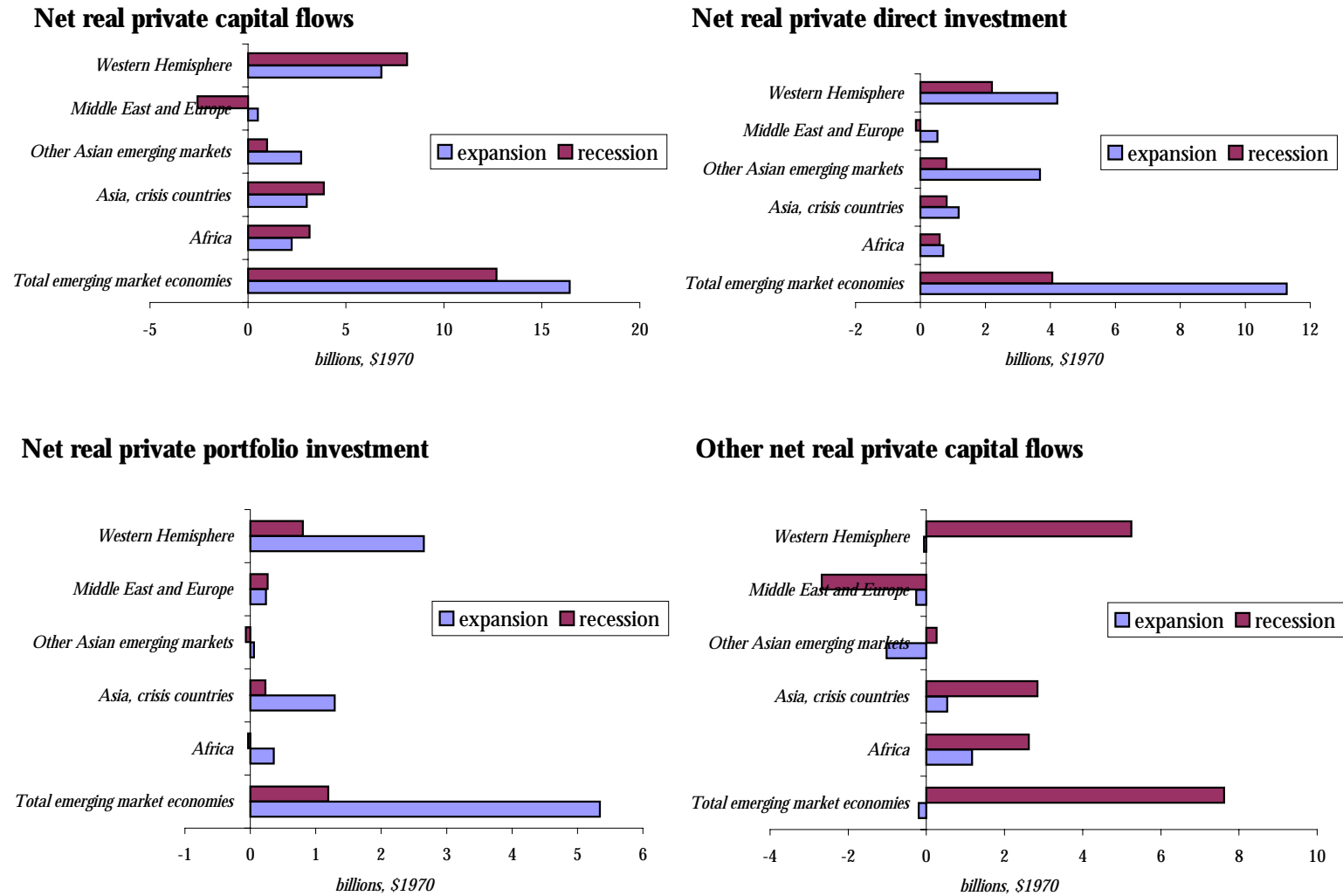


Figure 1: Welfare in a Small Open Economy

Figure 2

## U.S. business cycle and capital flows to emerging market economies

Billions of 1970 U.S. dollars



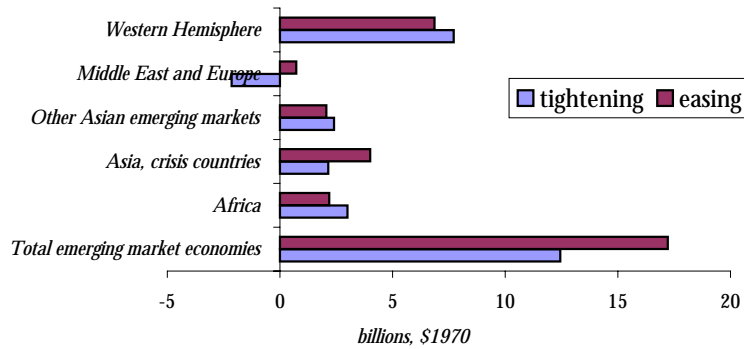
Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Figure 3

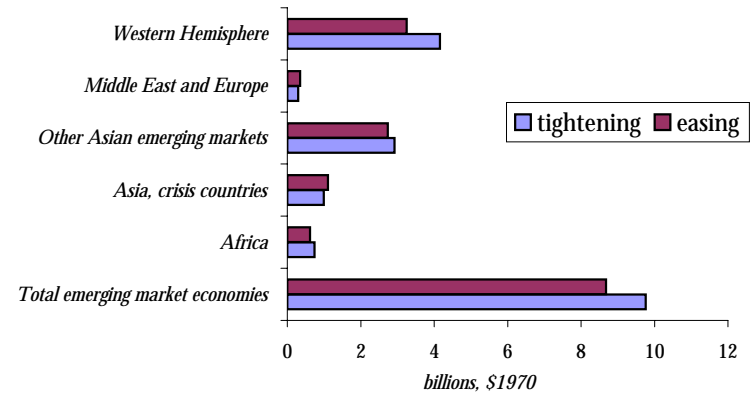
## U.S. monetary policy and capital flows to emerging market economies

Billions of 1970 U.S. dollars

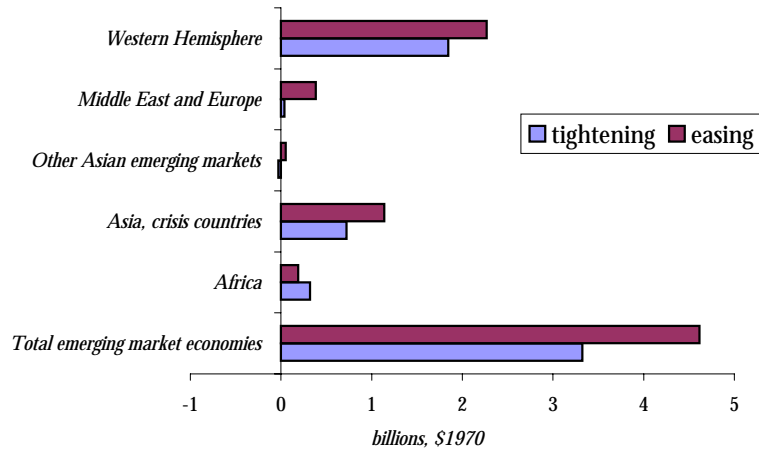
### Net real private capital flows



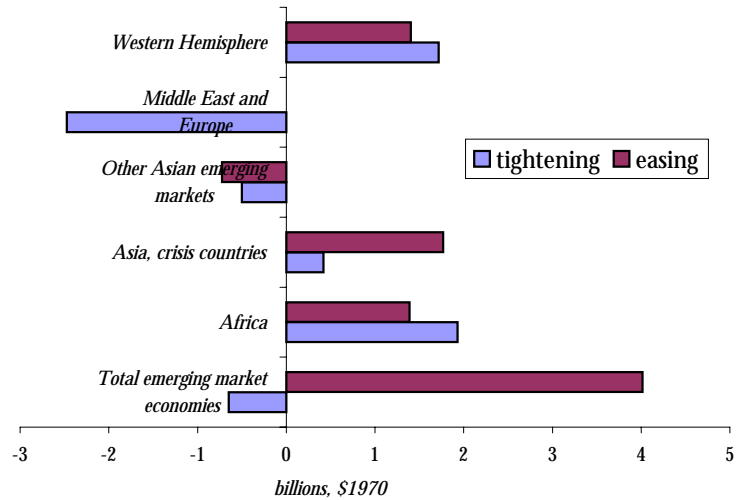
### Net real private direct investment



### Net real private portfolio investment



### Other net real private capital flows



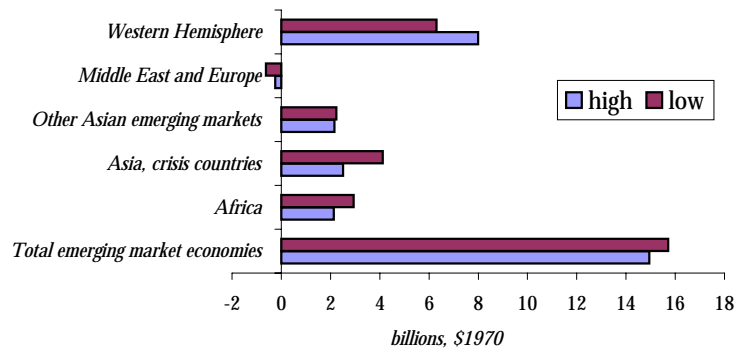
Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Figure 4

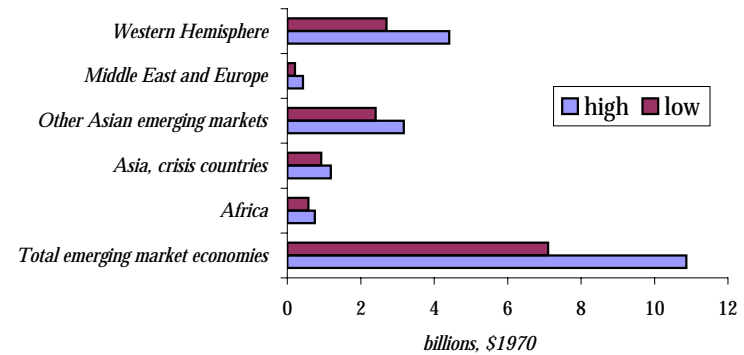
### G-3 real exchange rate volatility and capital flows to emerging market economies

Billions of 1970 U.S. dollars, 1970 to 1999

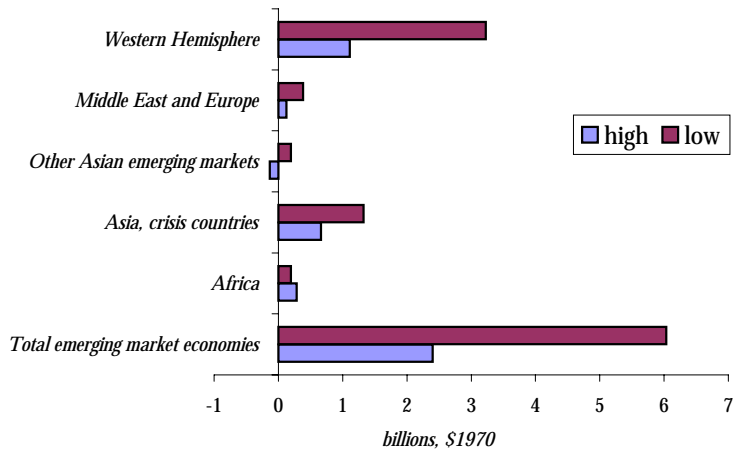
#### Net real private capital flows



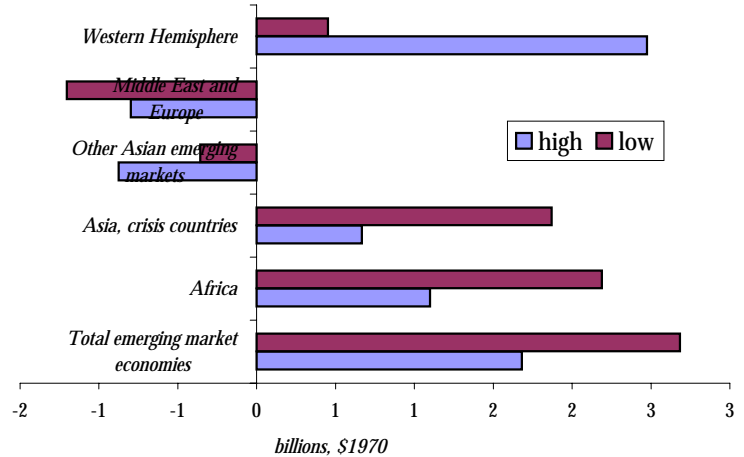
#### Net real private direct investment



#### Net real private portfolio investment



#### Other net real private capital flows

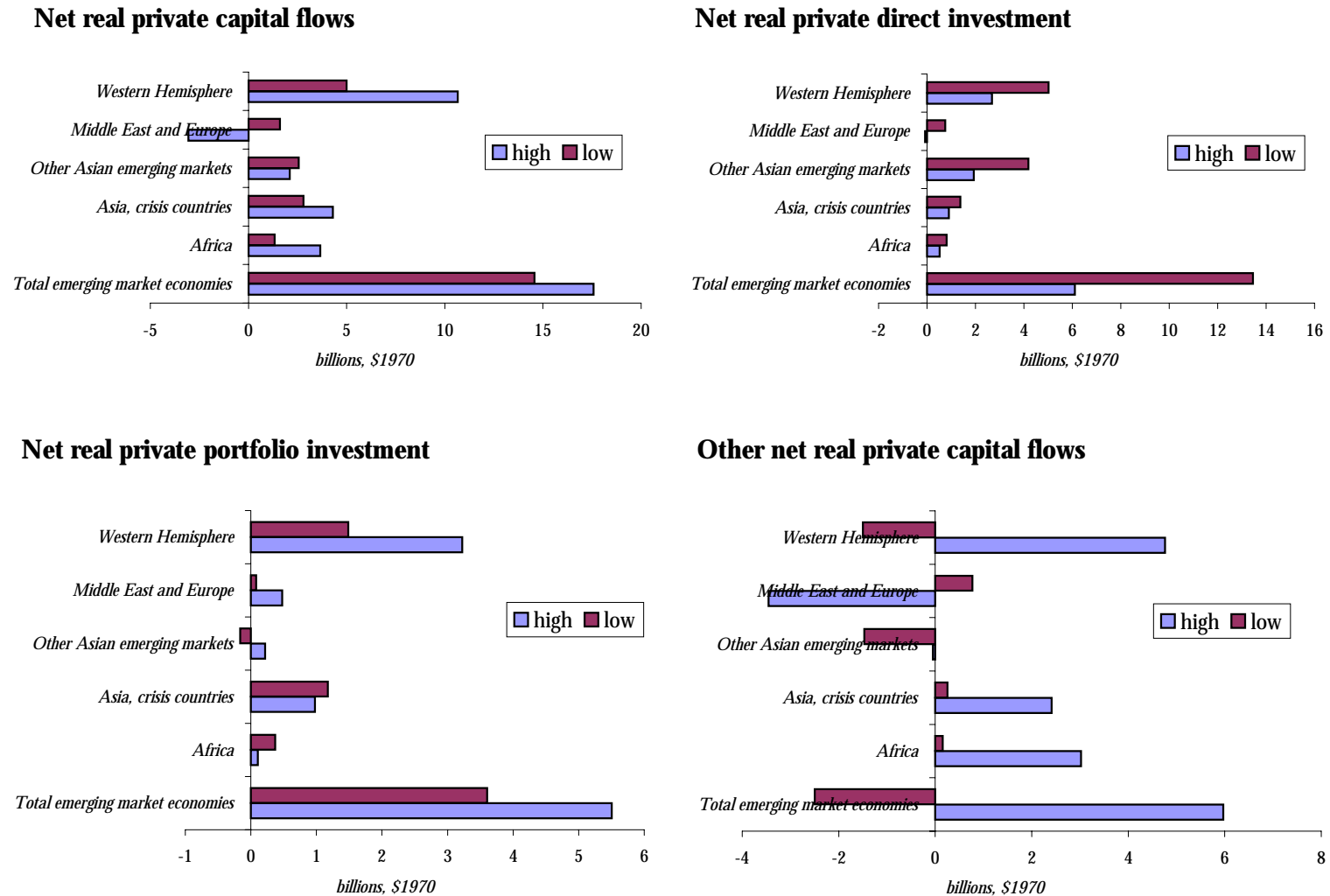


Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Figure 5

## U.S. real short-term interest volatility and capital flows to emerging market economies

Billions of 1970 U.S. dollars, 1973 to 1999



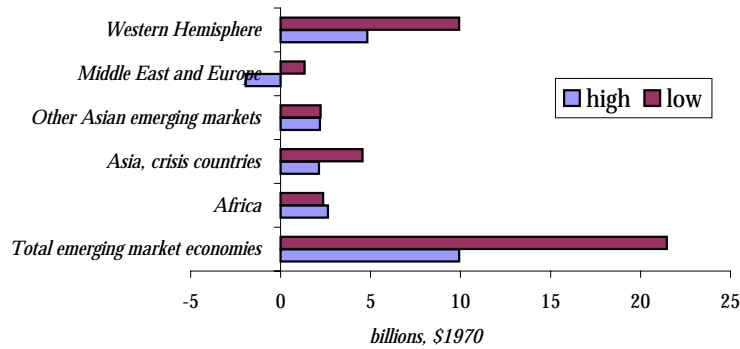
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Figure 6

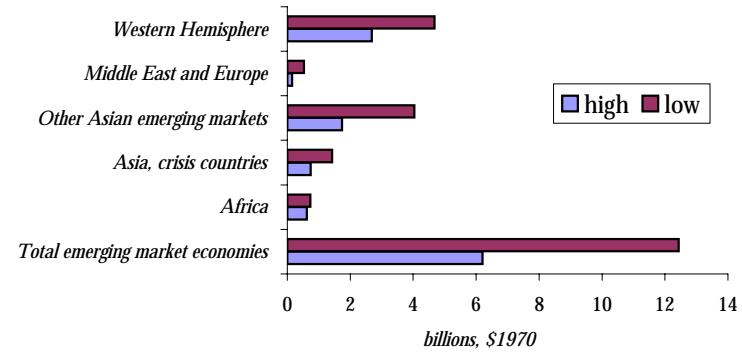
## U.S. real consumption volatility and capital flows to emerging market economies

Billions of 1970 U.S. dollars, 1970 to 1999

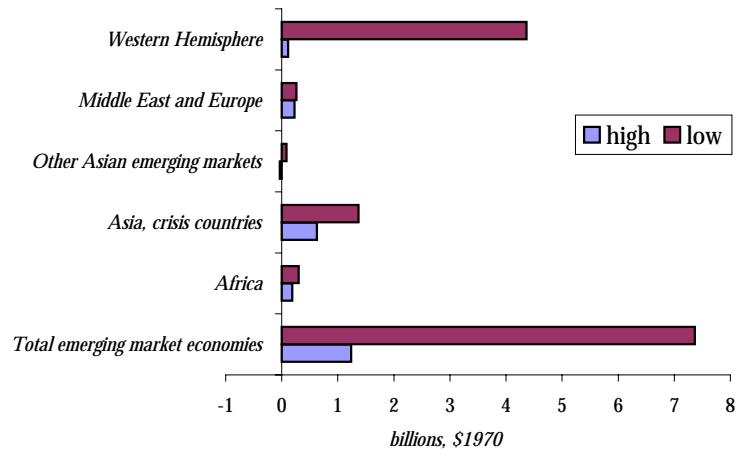
### Net real private capital flows



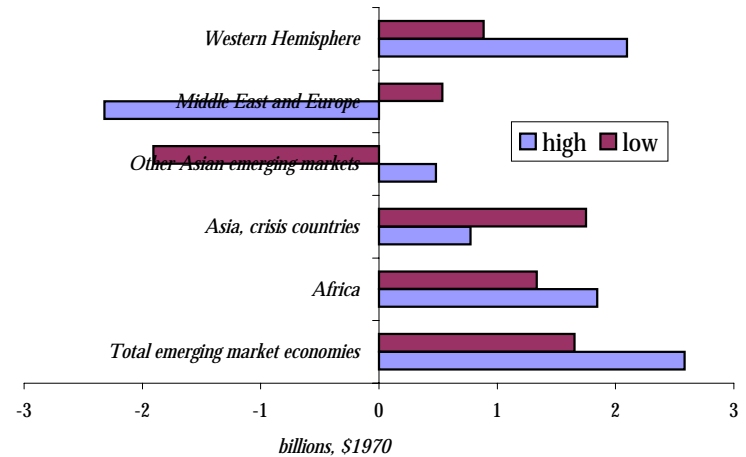
### Net real private direct investment



### Net real private portfolio investment



### Other net real private capital flows



Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Table 1

## Developed and Developing Country Links

Type of shock	Transmission channel	Amplifiers	Expected growth consequences
<b>The growth cycle: Recessions in the G-3</b>			
Income effects	Trade: Lower exports to G-3 Negative	High trade exposure High G-3 income elasticities	Negative
Relative price effects	Trade: Decline in the terms of trade for developing countries	High primary commodity content in exports High exposure to cyclical industries in exports	Negative
International capital flows	Finance: Higher capital flows (primarily bank lending) to emerging markets	Large declines in the domestic demand for bank loans	Positive
<b>The interest rate cycle:</b>			
<b>Monetary easings</b>			
International capital flows	Finance: Higher portfolio capital flows to emerging markets	Developed bond and equity markets. High interest-rate sensitivity of flows.	Positive
Debt servicing	Finance: Lower cost	High levels of debt Sensitive risk premia to international interest rates	Positive
Interest earnings	Finance: Declining interest income	High level of reserves relative to debt	Not obvious
<b>High volatility in G-3:</b>			
Interest rates	Finance: Complicates debt management Investment: Uncertainty tends to reduce investment consequences	High levels of short term debt Large new financing needs An initially high level of FDI	Not obvious Negative
Bilateral exchange rate	Trade: Reduces trade	Pegging to a G-3 currency	Negative?

Table 2

**The condition of the U.S. economy and foreign real GDP growth**

Percent, annual rate, 1970 to 1999

	<b>When the U.S. economy is in:</b>		<b>When U.S. monetary policy is:</b>	
	<u>expansion</u>	<u>recession</u>	<u>tightening</u>	<u>easing</u>
NEWLY INDUSTRIALIZED ASIAN ECONOMIES	7.92	7.11	8.79	6.93
DEVELOPING COUNTRIES	5.19	4.82	5.17	5.02
AFRICA	2.75	3.29	2.63	3.10
ASIA	6.70	6.25	6.72	6.46
MIDDLE EAST AND EUROPE	4.47	4.31	3.87	4.80
WESTERN HEMISPHERE	3.63	3.81	4.21	3.34

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).



Table 3

**North-South trade patterns, 1999**

percent

Region/Country	Exports to the United States (as a share of total exports)	Imports from the United States (as a share of total imports)
<b>Latin America</b>		
Argentina	11.3	19.6
Brazil	22.5	23.8
Chile	19.4	22.9
Colombia	50.3	32.1
Peru	29.3	31.6
Mexico	88.3	74.1
Venezuela	55.4	42
<b>Asia</b>		
China Mainland	21.5	11.8
Indonesia	16.1	7.3
Korea	20.6	20.8
Malaysia	21.9	17.4
Philippines	29.6	20.3
Singapore	19.2	17.1
Thailand	21.5	11.5
<b>Africa</b>		
Chad	7.2	2.1
Congo, Rep of	19	3.5
Ethiopia	8.4	4.9
Kenya	4.6	6.7
Mozambique	4.8	3.7
South Africa	8.2	13.3
Uganda	5.4	3.3
Zimbabwe	5.8	4.8

Source: International Monetary Fund,  
*Direction of Trade Statistics* (2000).

Table 4

**Industrial country demand for developing country exports**

<b>Study and Sample</b>	<b>Importing country</b>	<b>Exporting country</b>	<b>Income Elasticity</b>
Dornbusch (1985), 1960 to 1983		All non-oil developing	1.74
		Major exporters of manufactures	2.67
Marquez (1990)	Canada	Non OPEC developing	2.83
	Germany	Non OPEC developing	2.29
	Japan	Non OPEC developing	1.22
	United Kingdom	Non OPEC developing	1.45
	United States	Non OPEC developing	3.04
	Rest of OECD	Non OPEC developing	2.61
Reinhart (1995), 1970 to 1991	All developed	All developing	2.05
		Africa	1.25
		Asia	2.49
		Latin America	2.07

Table 5

**Commodity prices and economic cycles: a review**

<b>Study</b>	<b>Dependent variable/ sample period</b>	<b>Measure of developed- country growth rate used</b>	<b>Coefficient</b>
Borensztein and Reinhart (1994)	All commodity index/ 1971:1-1992:3, quarterly	Industrial production for developed economies	1.4
	All commodity index/ 1971:1-1992:3, quarterly	Industrial production for developed economies plus GDP for the Former Soviet Union	1.54
Chu and Morrison (1984)	All commodity index/ 1958-1982, quarterly	GDP weighted industrial production-G-7 countries	1.66
Dornbusch (1985)	All commodity index/ 1970:2-1985:1, quarterly	OECD industrial production	2.07
Holtham (1988)	All commodity index/ 1967:2-1982:2, semiannual	GDP growth for the G-7 economies	0.51
		Industrial production for the G-7 economies	0.77

Table 6

**Emerging market economies and U.S. economic and policy cycles****Real GDP growth**

Average annual real GDP growth, percent

## NEWLY INDUSTRIALIZED ASIAN ECONOMIES

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	6.81	8.16
	<b>Expansion</b>	7.01	8.92

## ASIA

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	6.02	7.07
	<b>Expansion</b>	6.75	6.65

**Net private capital flows**

Average, billions \$1970

## Net private capital flows

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	13.86	8.58
	<b>Expansion</b>	19.35	13.21

## Net private portfolio investment

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	1.48	0.19
	<b>Expansion</b>	6.61	3.95

## DEVELOPING COUNTRIES

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	4.44	6.13
	<b>Expansion</b>	5.39	4.98

## WESTERN HEMISPHERE

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	2.78	7.41
	<b>Expansion</b>	3.69	3.57

## Net private direct investment

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	4.24	3.42
	<b>Expansion</b>	11.50	11.03

## Other net private capital flows

U.S. economy		U.S. monetary policy is:	
		Easing	Tightening
is in:	<b>Recession</b>	8.38	4.98
	<b>Expansion</b>	1.24	-1.78

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Table 7

**Determinants of real private capital flows to emerging market economies**

Estimated using annual data from 1970 to 1999

	constant	U.S.		R2
		nominal interest rate	Real GDP growth	
Net private capital flows	34.21 <i>8.38</i>	-2.32 <i>0.96</i>	-1.09 <i>1.11</i>	0.18
Net private direct investment	18.80 <i>6.61</i>	-1.57 <i>0.76</i>	0.26 <i>0.88</i>	0.16
Net private portfolio investment	13.55 <i>4.33</i>	-1.26 <i>0.50</i>	-0.33 <i>0.57</i>	0.19
Other net private capital flows	2.11 <i>6.16</i>	0.50 <i>0.71</i>	-1.06 <i>0.82</i>	0.09

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000) and Council of Economic Advisers *Economic Report to the President* (2001).

Note: Standard errors are in italics.

Table 8

**Determinants of real GDP growth in emerging market economies**

Estimated using annual data from 1970 to 1999

	U.S.			R2
	constant	short real interest rate	Real GDP growth	
NEWLY INDUSTRIALIZED ASIAN ECONOMIES	6.25 <i>0.94</i>	-0.21 <i>0.23</i>	0.56 <i>0.25</i>	0.16
DEVELOPING COUNTRIES	4.83 <i>0.40</i>	-0.24 <i>0.10</i>	0.20 <i>0.11</i>	0.23
AFRICA	2.95 <i>0.60</i>	-0.14 <i>0.15</i>	0.05 <i>0.16</i>	0.03
ASIA	6.30 <i>0.67</i>	0.16 <i>0.16</i>	0.01 <i>0.18</i>	0.04
MIDDLE EAST AND EUROPE	3.84 <i>1.04</i>	-0.52 <i>0.26</i>	0.43 <i>0.28</i>	0.17
WESTERN HEMISPHERE	3.73 <i>0.66</i>	-0.71 <i>0.16</i>	0.32 <i>0.17</i>	0.43

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000) and Council of Economic Advisers *Economic Report to the President* (2001).

Note: Standard errors are in italics.

Table 9

**Volatility and foreign real GDP growth**

Percent, annual rate, 1970 to 1999

	<b>When:</b>					
	<b>G-3 currency volatility is:</b>		<b>U.S. rate volatility is:</b>		<b>U.S. consumption volatility is:</b>	
	<u>high</u>	<u>low</u>	<u>high</u>	<u>low</u>	<u>high</u>	<u>low</u>
NEWLY INDUSTRIALIZED ASIAN ECONOMIES	7.95	7.02	6.96	8.49	8.94	6.23
DEVELOPING COUNTRIES	5.33	4.56	4.68	5.54	5.25	4.88
AFRICA	2.42	2.75	2.73	3.12	3.44	2.30
ASIA	6.53	6.89	6.30	6.87	6.64	6.48
MIDDLE EAST AND EUROPE	4.33	3.37	3.55	5.42	4.90	3.89
WESTERN HEMISPHERE	4.90	1.98	3.33	4.09	3.87	3.47

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Note: Sample period for U.S. rate volatility is 1973 to 1999.

Table 10

**Net private capital flows to emerging market economies and G-3 volatilities**

Average, billions \$1970, 1973 to 1999

**U.S. interest rate and G-3 exchange rate volatilities**

Net private capital flows

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	13.44	15.01
	High	19.91	14.85

Net private direct investment

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	10.01	14.83
	High	7.68	4.25

Net private portfolio investment

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	5.09	3.01
	High	9.03	1.39

Other net private capital flows

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	-1.65	-2.83
	High	3.19	9.21

**U.S. PCE and G-3 exchange rate volatilities**

Net private capital flows

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	28.46	16.20
	High	4.47	13.70

Net private direct investment

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	13.02	12.00
	High	3.14	9.74

Net private portfolio investment

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	13.50	2.76
	High	0.51	2.04

Other net private capital flows

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	1.94	1.44
	High	0.82	1.93

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).



Table 11

**Real GDP growth in emerging market economies and G-3 volatilities**

Average annual rate, percent, 1973 to 1999

**U.S. interest rate and G-3 exchange rate volatilities**

NEWLY INDUSTRIALIZED ASIAN ECONOMIES

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	8.46	6.44
	High	8.06	7.83

ASIA

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	8.10	6.41
	High	6.89	6.12

DEVELOPING COUNTRIES

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	4.93	4.42
	High	5.51	5.11

WESTERN HEMISPHERE

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	9.04	9.93
	High	7.37	6.20

**U.S. PCE and G-3 exchange rate volatilities**

NEWLY INDUSTRIALIZED ASIAN ECONOMIES

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	7.44	5.32
	High	9.13	8.60

ASIA

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	7.91	5.41
	High	6.63	7.19

DEVELOPING COUNTRIES

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	5.92	4.10
	High	4.56	5.25

WESTERN HEMISPHERE

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	6.08	6.04
	High	4.51	5.44

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Table 12

**Likelihood of the twin crises and G-3 volatilities**

Percent of the sample of above-the-median crises, 1980 to 1998

Currency crises

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	0.10	0.25
	High	0.10	0.10

Banking crises

U.S.		G-3 currency volatility is:	
rate vol.		Low	High
is:	Low	0.05	0.20
	High	0.10	0.15

Currency crises

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	0.10	0.25
	High	0.10	0.10

Currency crises

U.S.		G-3 currency volatility is:	
PCE vol.		Low	High
is:	Low	0.10	0.20
	High	0.05	0.15

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000).

Table 13

## Can "excess" real capital flows be explained by G-3 factors?

Relationship of the residual from the capital flow fundamentals equations to G-3 dummy variables from 1970 to 1999.

	Net private capital flows			
	Total	Direct investment	Portfolio	Other
<b>U.S. business cycle</b>				
Expansion	0.44	0.69	0.61	-0.88
	<i>2.72</i>	<i>2.14</i>	<i>1.39</i>	<i>1.98</i>
Recession	-1.03	-1.61	-1.41	2.06
	<i>4.16</i>	<i>2.14</i>	<i>2.13</i>	<i>1.98</i>
<b>U.S. monetary policy</b>				
Tightening	-1.78	0.42	-0.44	-1.78
	<i>3.58</i>	<i>2.85</i>	<i>1.86</i>	<i>2.62</i>
Easing	1.19	-0.28	0.29	1.18
	<i>2.92</i>	<i>2.32</i>	<i>1.52</i>	<i>2.14</i>
<b>Volatility of U.S. real short-term rates (1)</b>				
High	2.40	-2.53	1.58	3.28
	<i>3.49</i>	<i>2.51</i>	<i>1.77</i>	<i>2.37</i>
Low	0.02	4.47	-0.18	-4.30
	<i>3.36</i>	<i>2.42</i>	<i>1.71</i>	<i>2.29</i>
<b>Volatility of G-3 exchange rates</b>				
High	0.85	3.04	-0.92	-1.34
	<i>3.11</i>	<i>2.32</i>	<i>1.59</i>	<i>2.27</i>
Low	-0.97	-3.47	1.05	1.53
	<i>3.33</i>	<i>2.48</i>	<i>1.70</i>	<i>2.42</i>
<b>Volatility of U.S. consumption</b>				
High	-4.93	-3.15	-2.76	1.06
	<i>2.81</i>	<i>2.31</i>	<i>1.42</i>	<i>2.28</i>
Low	5.63	3.61	3.16	-1.21
	<i>3.00</i>	<i>2.47</i>	<i>1.52</i>	<i>2.44</i>
<b>Currency crises (2)</b>				
High	1.44	1.66	3.34	-3.61
	<i>4.37</i>	<i>2.76</i>	<i>2.04</i>	<i>2.55</i>
Low	5.25	4.22	1.38	-3.61
	<i>5.12</i>	<i>3.23</i>	<i>2.39</i>	<i>2.99</i>
<b>Banking crises (3)</b>				
High	2.34	1.99	3.82	-3.55
	<i>4.62</i>	<i>2.91</i>	<i>2.11</i>	<i>2.69</i>
Low	3.83	3.57	1.07	-0.84
	<i>4.87</i>	<i>3.07</i>	<i>2.22</i>	<i>2.83</i>

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000) and Council of Economic Advisers *Economic Report to the President* (2001).

Note: Standard errors are in italics.  
 (1) Estimated from 1973 to 1999.  
 (2) Estimated from 1980 to 1998.  
 (3) Estimated from 1980 to 1998.

Table 14

## Can "excess" real GDP growth be explained by G-3 factors?

Relationship of the residual from the real GDP growth fundamentals equations to G-3 dummy variables from 1970 to 1999.

	<i>Newly Industr. Asia</i>	<i>Developing countries</i>	<i>Africa</i>	<i>Asia</i>	<i>Middle East &amp; Europe</i>	<i>Western Hemisphere</i>
<b>U.S. business cycle</b>						
Expansion	8.24	6.07	2.42	-6.82	-0.23	0.69
	<i>3.02</i>	<i>2.26</i>	<i>1.53</i>	<i>1.97</i>	<i>0.68</i>	<i>0.69</i>
Recession	6.54	-0.17	-0.86	1.46	0.54	0.87
	<i>4.62</i>	<i>3.45</i>	<i>2.34</i>	<i>3.01</i>	<i>1.04</i>	<i>1.06</i>
<b>U.S. monetary policy</b>						
Tightening	4.12	4.37	0.29	-7.14	-1.23	-0.47
	<i>3.91</i>	<i>3.11</i>	<i>2.06</i>	<i>2.76</i>	<i>0.85</i>	<i>0.87</i>
Easing	10.14	4.08	2.20	-2.47	0.82	1.55
	<i>3.19</i>	<i>2.54</i>	<i>1.68</i>	<i>2.25</i>	<i>0.70</i>	<i>0.71</i>
<b>Volatility of U.S. real short-term rates (1)</b>						
High	9.74	0.66	2.36	-0.30	-0.85	-0.50
	<i>4.01</i>	<i>2.86</i>	<i>2.07</i>	<i>2.51</i>	<i>0.77</i>	<i>0.77</i>
Low	7.06	8.76	0.93	-9.37	-0.26	0.88
	<i>3.87</i>	<i>2.76</i>	<i>1.99</i>	<i>2.42</i>	<i>0.74</i>	<i>0.74</i>
<b>Volatility of G-3 exchange rates</b>						
High	7.67	6.03	-0.40	-4.98	-0.34	0.46
	<i>3.47</i>	<i>2.64</i>	<i>1.73</i>	<i>2.46</i>	<i>0.78</i>	<i>0.79</i>
Low	7.80	2.10	3.54	-3.60	0.39	1.05
	<i>3.71</i>	<i>2.82</i>	<i>1.84</i>	<i>2.63</i>	<i>0.83</i>	<i>0.85</i>
<b>Volatility of U.S. consumption</b>						
High	2.12	1.31	-1.24	-3.83	0.19	0.98
	<i>3.10</i>	<i>2.57</i>	<i>1.64</i>	<i>2.46</i>	<i>0.78</i>	<i>0.79</i>
Low	14.15	7.50	4.50	-4.92	-0.22	0.46
	<i>3.32</i>	<i>2.75</i>	<i>1.75</i>	<i>2.63</i>	<i>0.84</i>	<i>0.85</i>
<b>Currency crises (2)</b>						
High	6.44	3.83	3.03	-7.35	-0.89	0.09
	<i>4.93</i>	<i>3.10</i>	<i>2.49</i>	<i>2.95</i>	<i>0.76</i>	<i>0.83</i>
Low	15.99	10.33	4.23	-5.47	-0.48	0.40
	<i>5.78</i>	<i>3.64</i>	<i>2.92</i>	<i>3.46</i>	<i>0.89</i>	<i>0.97</i>
<b>Banking crises (3)</b>						
High	9.30	4.70	4.24	-6.76	-0.71	0.12
	<i>5.39</i>	<i>3.36</i>	<i>2.61</i>	<i>3.11</i>	<i>0.80</i>	<i>0.87</i>
Low	11.75	8.64	2.76	-6.33	-0.73	0.34
	<i>5.68</i>	<i>3.55</i>	<i>2.75</i>	<i>3.28</i>	<i>0.84</i>	<i>0.92</i>

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000) and Council of Economic Advisers *Economic Report to the President* (2001).

Note: Standard errors are in italics.

(1) Estimated from 1973 to 1999.

(2) Estimated from 1980 to 1998.

(3) Estimated from 1980 to 1998.

Appendix Table 1

## Determinants of real private capital flows to emerging market economies

Estimated using annual data from 1970 to 1999

	U.S.		R2
	nominal interest rate	Real GDP growth	
<b>Africa</b>			
<i>Net private capital flows</i>	0.21 <i>0.17</i>	0.04 <i>0.19</i>	0.06
<i>Net private direct investment</i>	-0.07 <i>0.03</i>	0.00 <i>0.04</i>	0.15
<i>Net private portfolio investment</i>	-0.09 <i>0.04</i>	0.04 <i>0.05</i>	0.21
<i>Other net private capital flows</i>	0.37 <i>0.18</i>	0.00 <i>0.20</i>	0.15
<b>Asia, crisis countries</b>			
<i>Net private capital flows</i>	0.05 <i>0.34</i>	-0.42 <i>0.39</i>	0.05
<i>Net private direct investment</i>	-0.12 <i>0.06</i>	-0.02 <i>0.06</i>	0.15
<i>Net private portfolio investment</i>	-0.25 <i>0.13</i>	-0.05 <i>0.15</i>	0.13
<i>Other net private capital flows</i>	0.43 <i>0.25</i>	-0.35 <i>0.29</i>	0.18
<b>Other Asian emerging markets</b>			
<i>Net private capital flows</i>	-0.26 <i>0.27</i>	-0.06 <i>0.31</i>	0.03
<i>Net private direct investment</i>	-0.64 <i>0.27</i>	0.07 <i>0.31</i>	0.19
<i>Net private portfolio investment</i>	-0.04 <i>0.05</i>	-0.04 <i>0.06</i>	0.03
<i>Other net private capital flows</i>	0.42 <i>0.25</i>	-0.09 <i>0.28</i>	0.11
<b>Middle East and Europe</b>			
<i>Net private capital flows</i>	-1.68 <i>0.46</i>	-0.25 <i>0.54</i>	0.33
<i>Net private direct investment</i>	-0.08 <i>0.07</i>	0.08 <i>0.08</i>	0.11
<i>Net private portfolio investment</i>	0.02 <i>0.12</i>	-0.06 <i>0.14</i>	0.01
<i>Other net private capital flows</i>	-1.63 <i>0.40</i>	-0.27 <i>0.46</i>	0.39
<b>Western Hemisphere</b>			
<i>Net private capital flows</i>	0.04 <i>0.47</i>	-0.29 <i>0.54</i>	0.01
<i>Net private direct investment</i>	-0.41 <i>0.27</i>	0.10 <i>0.32</i>	0.09
<i>Net private portfolio investment</i>	-0.73 <i>0.28</i>	-0.21 <i>0.32</i>	0.20
<i>Other net private capital flows</i>	1.18 <i>0.40</i>	-0.21 <i>0.46</i>	0.27

Source: Authors' calculations using International Monetary Fund *World Economic Outlook* (October 2000) and Council of Economic Advisers *Economic Report to the President* (2001).

Note: Standard errors are in italics.