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What Hurts Emerging Markets Most?
G3 Exchange Rate or Interest Rate Volatility?

Carmen M. Reinhart and Vincent Raymond Reinhart

3.1 Introduction

Although fashions concerning appropriate exchange rate arrangements have shifted over the years, advocacy for establishing a target zone surrounding the world's three major currencies has remained a hardy perennial. Work on target zones (pioneered by McKinnon 1984, 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 to 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, movement in the exchange values of the currencies of major countries—in particular the prolonged appreciation of the U.S. dollar in relation to 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 method for reducing destabilizing shocks emanating from abroad, the argument runs, would be to reduce the variability of the Group of Three (G3) currencies by estab-

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lishing target bands.[1] This paper examines the argument for such a target zone strictly from an emerging-market perspective and will be silent on the costs and benefits for industrial countries.[2]

Given the reality that sterilized intervention by industrial economies tends to be ineffective and that policy makers show no inclination 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 G3 exchange rate fluctuations requires a willingness on the part of G3 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 G3 exchange rates, but greater interest rate volatility may make debt-servicing costs less predictable, and greater G3 income volatility may render 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 trade-off between lower G3 exchange rate volatility and higher G3 interest rate variability.

The consequences for the developing South of interest rate, exchange rate, and income volatility in the North comprise only one part of myriad North-South links. Consequently, issues related to G3 exchange rate variability should be viewed within the much larger context (and related literature) of the influence of economic outcomes in developed countries on 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.

In section 3.2, 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 3.3 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 3.4, we first examine the contribution of G3 exchange rate volatility to fluctuations in the exchange rates of emerging markets and proceed to analyze the link between

1. Of course, since European monetary union, the G3 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.

2. For a cost-benefit analysis from a developed country's perspective on the effects of limiting G3 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 in the way that their volatility influences developing countries.

G3 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.

3.2 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 gross domestic product (GDP) growth.

3.2.1 The Winds from the North: The Role of G3 Exchange Rate Arrangements in Determining the Mix of Interest Rate and Exchange Rate Volatilities

In principle, G3 exchange rates could be induced to stay within a target band 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.[3] Second, national authorities could impose some form of exchange or capital control, presumably in the form of a transactions tax or prudential reserve requirements. Opponents of such efforts generally argue that capital controls generate financial innovation that undercuts them over time, implying that the controls become either 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 interest rate to the exchange value of the currency (as discussed in McKinnon 1997 and Williamson 1986).

Given the lack of evidence of any independent effect of sterilized intervention (over and beyond what subsequently happens to domestic monetary policy), and given the consensus supporting the free international mobility of capital, it would seem that the only instrument available to enforce a target zone would be the domestic monetary policy of the G3 central

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

banks. However, this implies some trade-off, in that G3 domestic short-term interest rates would have to become more variable to make G3 exchange rates smoother.

The nature of this trade-off, of course, depends on many factors, particularly the width of the target zone. Wider bands would presumably reduce the need of G3 central banks to move their interest rates in response to exchange rate changes. At the same time, however, wider bands would imply a smaller reduction in the volatility of G3 exchange rates.[4] In addition, G3 interest rates might not be all that is affected by the exchange rate policy. Central bank actions taken to damp G3 exchange rate volatility might also leave their imprint on income in the G3 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 G3 exchange rates.

To understand the effects of these trade-offs 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 G3 currencies. As a result, the welfare consequences for an emerging-market economy of G3 target zones depend on exactly how those zones are enforced and the particulars of the small country's mix of output, trading partners, and debt structure.

3.2.2 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 3.1. This figure represents a country that takes as given the relative price of the two traded goods and receives an endowment in terms of good A. For the sake of simplicity, we assume that its external debt is also denominated in terms of good A and its currency is pegged to that of country A.[5] 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

4. Some might argue that if G3 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 G3 target zone less likely.

5. 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.

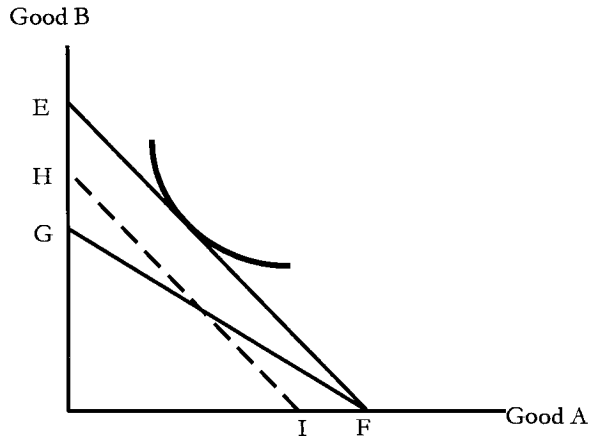

Fig. 3.1 Welfare in a small open economy

the budget line from EF to GF. All else being 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 G3 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. Thus, while the slope of the budget line would be unchanged, its location would shift inward, as labeled HI. Regardless of whether the effects of the initial shock were felt through the exchange rate of the interest rate, welfare in this small country would decline. The degree to which it declines if the large countries allow the cross-exchange rate or their interest rates to adjust will depend on many factors.

3.2.3 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 G3 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 G3 income induced by changes in their interest rates will be reflected in the demand for the exports of their trading partners to the extent that imports in the developed economy have a positive income elasticity.[6] 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 affected far more than Argentina by an economic downturn in the United States. We see evidence of this in the fact that in 1999 about 88 percent of all Canadian and Mexican exports were shipped to the U.S. market, whereas only about 11 percent of Argentina's exports were destined for the United States.[7] Other things being 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 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.[8] The heterogeneity in export structure across developing countries is sufficiently significant to expect, a priori, highly differentiated outcomes. For instance, the contrast between the export structure of East Asian countries (which are heavily skewed to manufactured goods) to that of most African countries (which are predominantly skewed to primary commodities) is particularly striking.[9]

As opposed to the simple example, emerging-market economies generally produce a different mix of goods from 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.[10] In particular, recessions in industrial economies, especially the United States, have historically been associated with weakness in real commodity prices. In our simple example,

6. 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.

7. The stylized evidence on patterns of trade is discussed in the next session.

8. See, for example, Reinhart (1995), who estimates industrial countries' import demand function for various regions and countries with varying degrees of export diversification and primary commodity content.

9. For example, manufactures account for only 10 percent in the Côte D'Ivoire (the Ivory Coast) but account for more than 65 percent of Thai exports.

10. Dornbusch (1985) stresses the role of the demand side in commodity price determination. Borensztein and Reinhart (1994), 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.

if the small country's endowment was made up of a commodity, the effects of G3 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 impact of fluctuations in the business cycle on developing economies is probably not limited merely 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) stress 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, extending the analysis to a variety of their components over various sample periods and 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 may 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 premium is itself a positive function of international interest rates. The evidence presented in Fernandez-Arias (1996), Frankel, Schmukler, and Servén (2001), and Kaminsky and Schmukler (2001) support the notion that country-risk premiums 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 G3 interest rates shifts the budget line by more than is shown 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—from balance-sheet strains and credit rationing—have more substantial effects on income prospects than do similar size reductions in borrowing costs.

Table 3.1 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 in developed economies from the growth and interest rate cycles, respectively, tend to at least par-

Table 3.1 **Developed and Developing Country Links**

Type of Shock	Transmission Channel	Amplifiers	Expected Growth Consequences
	The Growth Cycle: Recessions in the G3		
Income effects	Trade: Lower exports to G3; negative	High trade exposure; high G3 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
	The Interest Rate Cycle: Monetary Easings		
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 premiums to international interest rates	Positive
Interest earnings	Finance: Declining interest income	High level of reserves relative to debt	Not obvious
	High Volatility in G3		
Interest rates	Finance: Complicates debt management	High levels of short-term debt; large new financing needs; an initially high level of FDI	Not obvious
	Investment: Uncertainty tends to reduce investment consequences		Negative
Bilateral exchange rate	Trade: Reduces trade	Pegging to a G3 currency	Negative?

tially offset one another. However, G3 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 G3 exchange rate volatility may retard emerging market trade.[11] 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 concluding that exchange rate volatility tends to reduce trade.

11. Of course, G3 interest rate volatility may also complicate significantly emerging market debt management strategies or make systemic strains more likely.

3.3 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 U.S. growth and interest rate cycle and contrast periods of high interest rate and exchange rate volatility to those in which volatility was relatively subdued. We present evidence of the direction of North-South trade and on the impact of G3 developments on international commodity markets.

Our data are annual and span the years 1970 to 1999, and the country groupings are those reported in the International Monetary Fund's *World Economic Outlook* (WEO).[12] For capital flows, these groupings include all emerging markets, Africa, Asia crisis countries, other Asian emerging markets, the 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 Asia and newly industrialized Asia, but all other categories remain the same. We examine the cyclical behavior of net private capital flow and its components: net private direct investment (i.e., foreign direct investment [FDI]), private portfolio investment (PI), other net private capital flow (OCF)—which is heavily weighted toward bank lending—and net official flow (OFF).

3.3.1 The Growth Cycle, Capital Flows, and Emerging Market Growth

Given its prominent position in the world economy, the U.S. business cycle (not surprisingly) has important repercussions for the rest of the world. Economic developments in the United States echo loudly in many developed economies, most notably that of Canada; the same holds true for developing economies, especially 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 periods in which U.S. real GDP growth is above the median growth rate for the sample and periods in which growth is below the median.

Figure 3.2 depicts capital flows to emerging markets (in billions of 1970 U.S. dollars) in recession years versus recovery years for the 1970–99 period. As is evident, net flows to emerging markets are considerably larger in

12. The developing country classification in the WEO is comprised of 128 countries. See the WEO for details on the regional breakdown.

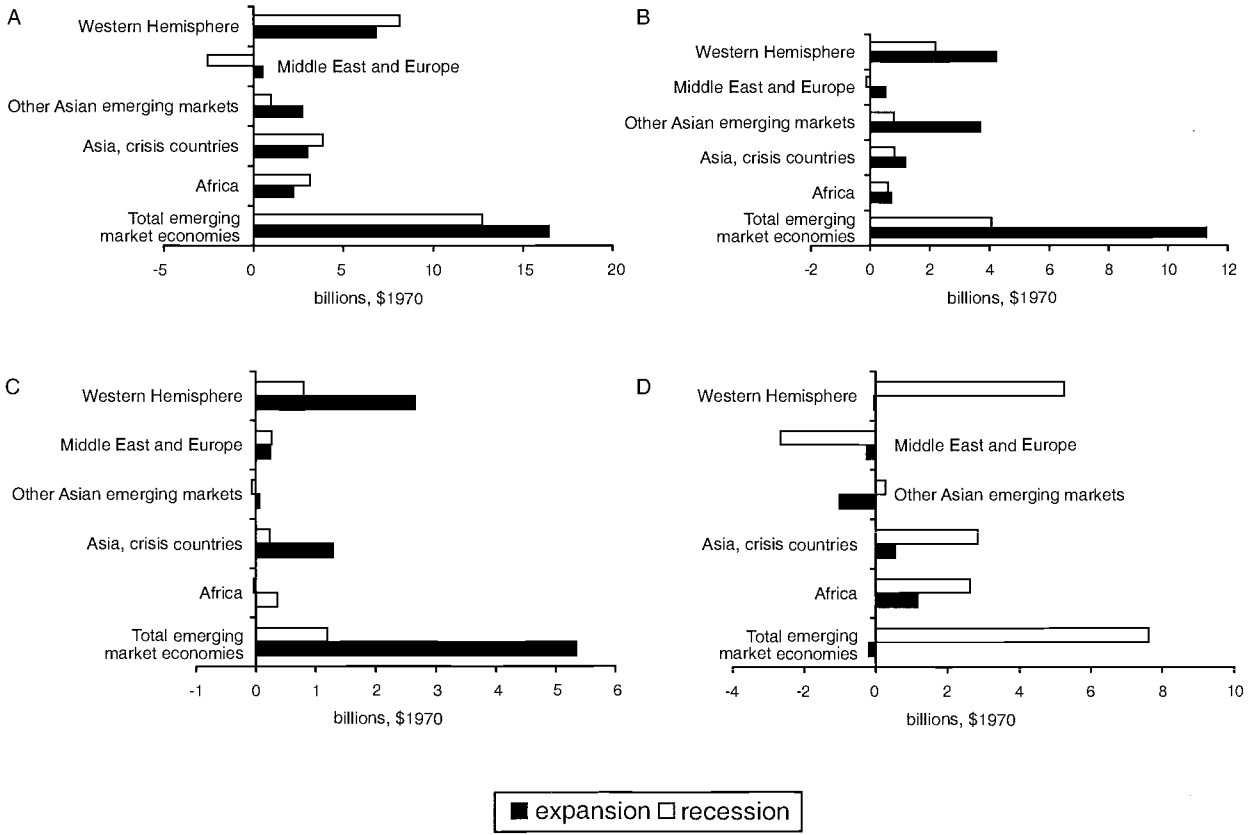

Fig. 3.2 U.S. business cycle and capital flows to emerging market economies (billions of 1970 U.S. dollars): *A*, Net real private capital flows; *B*, Net real private direct investment; *C*, Net real private portfolio investment; *D*, Other Net real private capital flows

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

real terms when the United States is in expansion than when the United States is in recession. Furthermore, this gap between recession and expansion owes itself primarily to a surge in FDI flows (which increase almost threefold from recession to expansion) and to portfolio flows (which increase 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 is primarily due 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 phenomenon.

However, the surge in FDI flows from the mid-1990s to the present is a significant departure from FDI's historical behavior, which is, no doubt, heavily influenced by the wave of privatization and mergers and acquisitions that took place in many emerging markets during recent years. It is possible that because this period of privatizations and surging FDI coincides with the longest economic expansion in U.S. history, the results may imply an exaggerated role for U.S. growth in driving FDI and total net flows. When we ended our sample in 1992, capital flows to emerging markets still diminished during economic downturns in the United States (this exercise is not reproduced here). 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 tendency.

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.[13]

The analogous exercise was performed for emerging-market average annual GDP growth. As shown in table 3.2, 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 tends to slow during U.S. recessions, while the opposite is true for Africa and the Western Hemisphere. However, in most instances the differences across regions are not markedly different—an issue we will explore further later.

13. Other flows are mostly short term.

Table 3.2 **The Condition of the U.S. Economy and Foreign Real GDP Growth: Annual Rate (%) 1970–99**

	Condition of U.S. Economy:		Condition of U.S. Monetary Policy:	
Region/Country	Expansion	Recession	Tightening	Easing
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).

3.3.2 The Growth Cycle and Trade

If economic downturns in the United States are not necessarily bad for 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 3.3 reports the percentage of total exports (as of 1999) of various emerging markets in Africa, Asia, and the Western Hemisphere that are destined for the U.S. 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 3.4) the income elasticity in developed economies for Asian exports is typically 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 countries 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 3.5, a 1 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 2.00 percent, depending on the study.

3.3.3 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

Table 3.3 North-South Trade Patterns, 1999

Region/Country	Exports to the U.S. (% of Total Exports)	Imports from the U.S. (% of Total Imports)
Latin America		
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	42.0
Asia		
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
Africa		
Chad	7.2	2.1
Congo, Republic of	19.0	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 3.4 Industrial Country Demand for Developing Country Exports

Study and Sample	Importing Country	Exporting Country	Income Elasticity
Dornbusch (1985), 1960 to 1983	Major exporters of manufactures	All non–oil-developing	1.74
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	1.28
		Asia	2.49
		Latin America	2.07

Table 3.5 **Commodity Prices and Economic Cycles: A Review**

Study	Dependent Variable/Sample Period	Measure of Developed-Country Growth Rate Used	Coefficient
Borensztein and Reinhart (1994)	All commodity index/ 1971:1–1992:3, quarterly	Industrial production for developed economies	1.40
	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/ 1958–82, quarterly	GDP weighted industrial production-G7 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 G7 economies	0.51
		Industrial production for the G7 economies	0.77

growth cycle, we proceed to describe the stylized evidence by breaking up the sample in two ways. First, we subdivide the 1970–99 sample into two subsamples, periods in which monetary policy was easing—that is, the monetary policy interest rate in the United States, the federal funds rate, was declining—and periods of tightening, when the federal funds rate was rising.[14]

Figure 3.3 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 3.2, average annual GDP growth rates are generally 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. This tendency 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.

14. 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 modest and marked policy changes: 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 when real interest rates are above the sample median and periods 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 here due to consideration of space, approximate those in the main text.

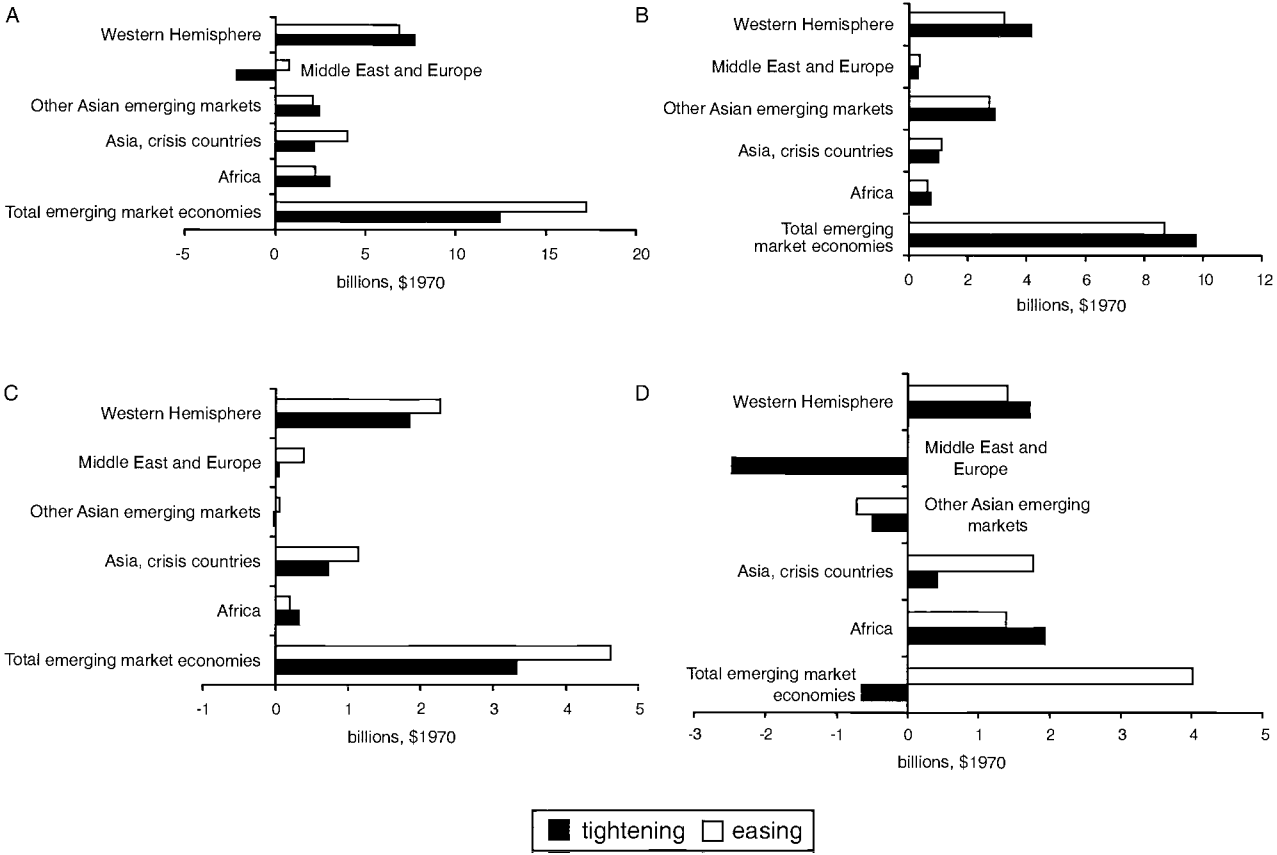

Fig. 3.3 U.S. monetary policy and capital flows to emerging market economies (billions of 1970 U.S. dollars): *A*, Net real private capital flows; *B*, Net real private direct investment; *C*, Net real private portfolio investment; *D*, Other net real private capital flows

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

3.3.4 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 3.6 divides 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 occurs 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 an expansion facilitated by policy easing or a U.S. economy weak enough to be in recession but not so weak as to preclude Federal Reserve tightening—contain fast rates of growth in economic activity. The fastest rates of growth are invariably recorded in the lower right cell, which

Table 3.6 Emerging Market Economies and U.S. Economic and Policy Cycles

	Condition of U.S. Economy	Condition of U.S. Monetary Policy	
		Easing	Tightening
	Real GDP Growth[a]		
Region/country			
Newly industrialized Asian economies	Recession	6.81	8.16
	Expansion	7.01	8.92
Asia	Recession	6.02	7.07
	Expansion	6.75	6.65
Developing countries	Recession	4.44	6.13
	Expansion	5.39	4.98
Western Hemisphere	Recession	2.78	7.41
	Expansion	3.69	3.57
	Net Private Capital Flows[b]		
Source of capital			
Net private capital flows	Recession	13.86	8.58
	Expansion	19.35	13.21
Net private portfolio investment	Recession	1.48	0.19
	Expansion	6.61	3.95
Net private direct investment	Recession	4.24	3.42
	Expansion	11.50	11.03
Other net private capital flows	Recession	8.38	4.98
	Expansion	1.24	–1.78

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

[a]Average annual real GDP growth, percent.

[b]Average, billions $1970.

includes those years in which the U.S. economy is expanding and monetary policy tightening. That is, foreign economies historically 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, other things being equal, tighter monetary policy (i.e., rising interest rates) would lead to 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 banks to seek lending opportunities abroad (see Kaminsky and Reinhart 2001).

The lower panel of table 3.6 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 potential catalysts for capital flows into emerging markets. However, this feature is not consistent across categories: FDI and portfolio flows thrive when expansions are coupled with falling interest rates, but other flows, which are largely composed of bank lending, do not. Like other flows, these tend to increase in periods of falling interest rates but contract during expansions; other flows are highest when the United States is in recession and interest rates are falling.

3.3.5 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 the period 1970–99 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). Because neither of these variables poses a potential endogeneity problem, our estimation method is simple ordinary least squares. Table 3.7 reports the results of this regression for all emerging market economies; the appendix reports results for particular regions.

When we examine 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 does 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

Table 3.7 **Determinants of Real Private Capital Flows to Emerging Market Economies**

		United States		
Type of Capital Flow	Constant	Nominal Interest Rate	Real GDP Growth	R^2
Net private capital flows	34.21	–2.32	–1.09	0.18
	(8.38)	(0.96)	(1.11)	
Net private direct investment	18.80	–1.57	0.26	0.16
	(6.61)	(0.76)	(0.88)	
Net private portfolio investment	13.55	–1.26	–0.33	0.19
	(4.33)	(0.50)	(0.57)	
Other net private capital flows	2.11	0.50	–1.06	0.09
	(6.16)	(0.71)	(0.82)	

Source: Authors' calculations using International Monetary Fund, *World Economic Outlook* (October 2000) and Council of Economic Advisers, *Economic Report to the President* (2001).
Notes: Estimated using annual data from 1970 to 1999. Standard errors are in parentheses.

negative, suggesting that when the United States is enjoying rapid growth, capital stays at home. This effect is most pronounced in the category of other net flows, consisting largely of bank lending. Both FDI flows and portfolio flows are consistently interest rate–sensitive.[15]

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 the Western Hemisphere and lowest in Africa. This result may simply emphasize that, among the emerging markets with some 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 the 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 that of Dornbusch (1985), who focused on the links between developing debtor countries and their developed counterparts. Dornbusch regressed developing country GDP growth on a measure of Organization for Economic Cooperation and Development (OECD) growth and found the coefficient on the OECD growth measure to be statistically significant, in the 0.28–0.76 range.[16] More recently, Frankel and Roubini (2000) regressed developing

15. Similar results obtain when developed-country real GDP growth rates are used in lieu of the U.S. growth rate, but these results are not reported here due to considerations of space.

16. Dornbusch used industrial production, real GDP growth, and import volume; the sample was taken from 1961 to 1984.

Table 3.8 Determinants of Real GDP Growth in Emerging Market Economies

Region/Country	Constant	United States: Short Real Interest Rate	United States: Real GDP Growth	R^2
Newly industrialized Asian economies	6.25	–0.21	0.56	0.16
	(0.94)	(0.23)	(0.25)	
Developing countries	4.83	–0.24	0.20	0.23
	(0.40)	(0.10)	(0.11)	
Africa	2.95	–0.14	0.05	0.03
	(0.60)	(0.15)	(0.16)	
Asia	6.30	0.16	0.01	0.04
	(0.67)	(0.16)	(0.18)	
Middle East and Europe	3.84	–0.52	0.43	0.17
	(1.04)	(0.26)	(0.28)	
Western Hemisphere	3.73	–0.71	0.32	0.43
	(0.66)	(0.16)	(0.17)	

Source: Authors' calculations using International Monetary Fund, *World Economic Outlook* (October 2000) and Council of Economic Advisers, *Economic Report to the President* (2001).
Notes: Estimated using annual data from 1970 to 1999. Standard errors are in parentheses.

country growth for various regional groupings against the G7 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.[17]

Our exercise here combines these two approaches. As shown in table 3.8, 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 greatly 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 1 percentage point decline in U.S. growth rates reduces GDP growth for the developing countries by 0.2 percent, while a 1 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 the 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 periodic debt-servicing difficulties, it is not surprising that the U.S. real interest rate is significant and that growth is most sensitive to interest rate fluctuations in the Western

17. The coefficient for the Western Hemisphere was –0.77, compared to –0.39 for all market borrowers.

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 1 percent increase in U.S. real interest rates leads to a 1 percent decline in growth in the region. Real U.S. interest rates are also statistically significant for the Middle East and Europe. For countries at the other end of the spectrum—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.[18]

3.4 The Consequences of Exchange Rate and Interest Rate Volatility in the North

To examine the issue of whether the volatility of interest rates and G3 exchange rates has adverse consequences for cross-border capital flows to emerging markets and growth, we split our sample into high- and low-volatility periods and conduct a set of exercises comparable to those discussed in the preceeding section.

3.4.1 Background on Exchange Rate Variability in Emerging Markets

The argument that excessive volatility of G3 exchange rates imposes significant costs on 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 (2002) suggests that 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 had from figures 3.4 through 3.6 and table 3.9. 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.

18. 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 3.8, regions with greater per capita wealth tend to be more tightly linked to U.S. interest rates.

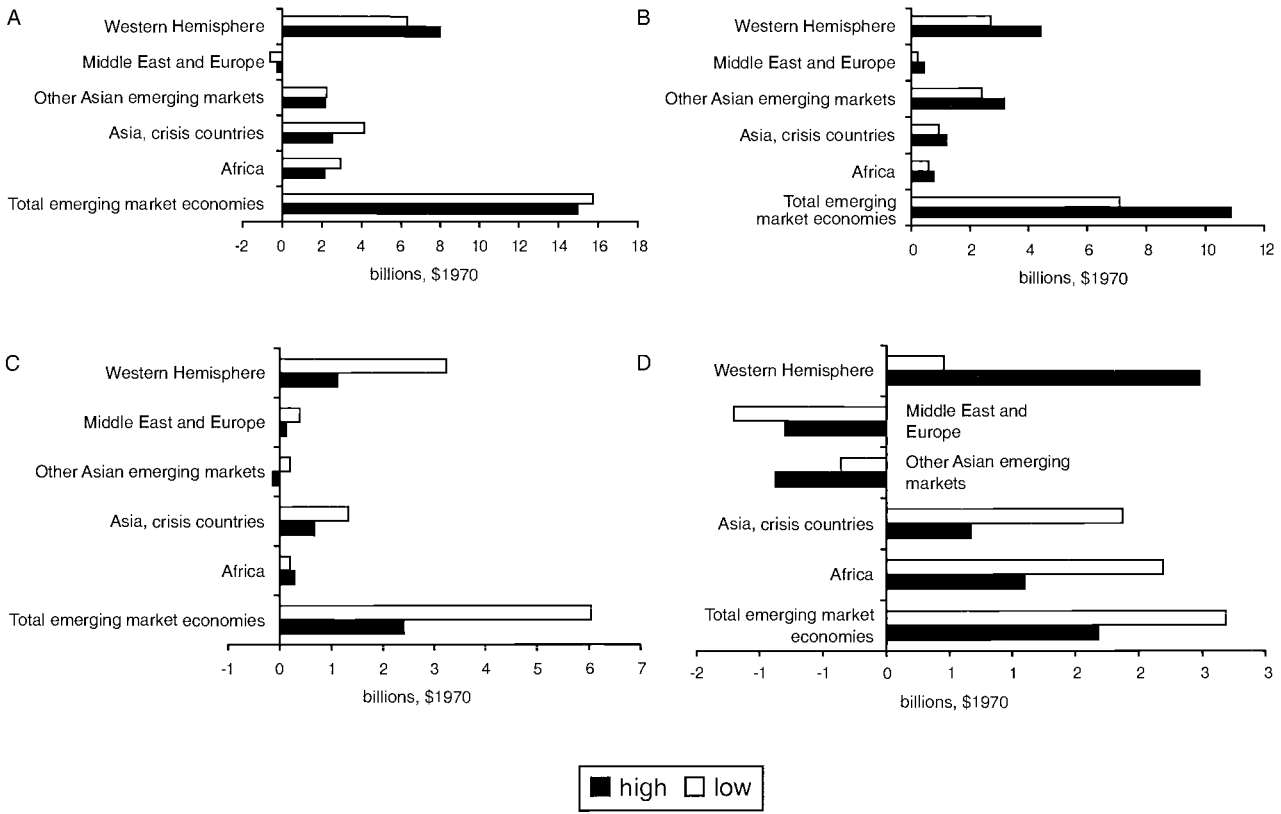

Fig. 3.4 G3 real exchange rate volatility and capital flows to emerging market economies (billions of 1970 U.S. dollars, 1970–99): *A*, Net real private capital flows; *B*, Net real private direct investment; *C*, Net real private portfolio investment; *D*, Other net real private capital flows

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

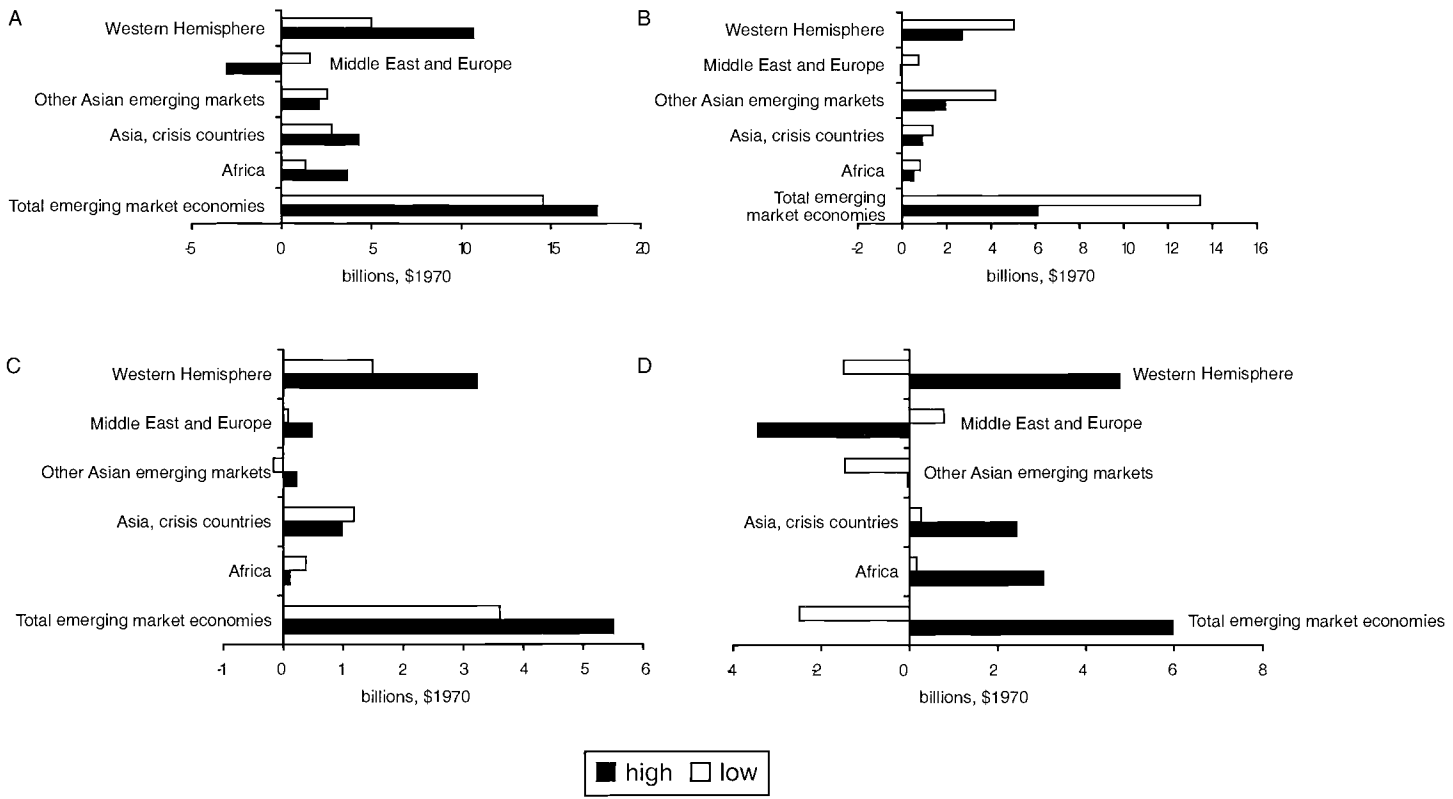

Fig. 3.5 U.S. real short-term interest volatility and capital flows to emerging market economies (billions of 1970 U.S. dollars, 1973–99): *A*, Net real private capital flows; *B*, Net real private direct investment; *C*, Net real private portfolio investment; *D*, Other net real private capital flows

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

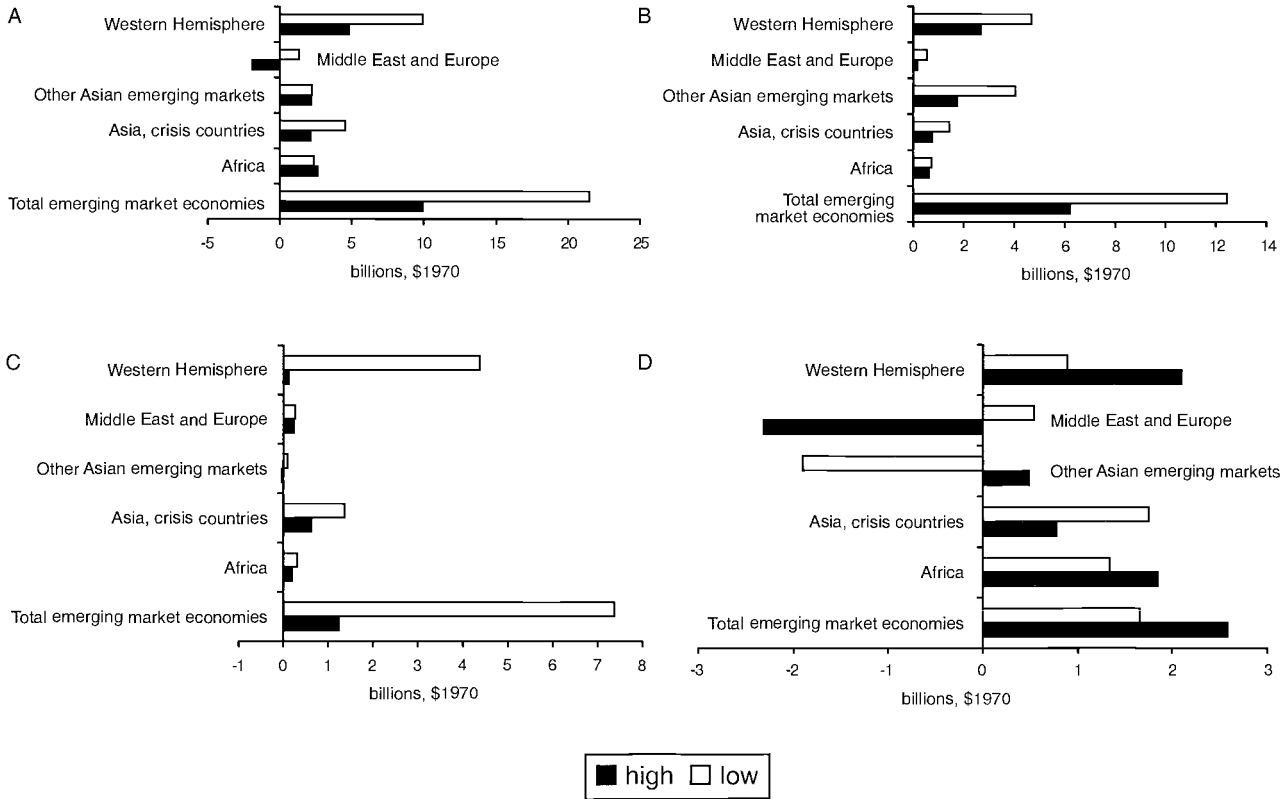

Fig. 3.6 U.S. real consumption volatility and capital flows to emerging market economies (billions of 1970 U.S. dollars, 1970–99): *A,* Net real private capital flows; *B,* Net real private direct investment; *C,* Net real private portfolio investment; *D,* Other net real private capital flows

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

Table 3.9 **Volatility and Foreign Real GDP Growth: Annual Rate (%), 1970–99**

	Degree of G3 Currency Volatility		Degree of U.S. Rate Volatility		Degree of U.S. Consumption Volatility	
Region/Country	High	Low	High	Low	High	Low
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.

The three figures split the sample into two states of nature: those in which G3 exchange rate volatility is above and below the sample median (in fig. 3.4), those in which U.S. interest rate volatility is above and below the sample median (in fig. 3.5), and those in which the average annual volatility of U.S. personal consumption expenditure is above and below the median (in figure 3.6). As before, we report the volume of real capital flows by country grouping and type across the sample split. As is evident from figure 3.4, the volatility of G3 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 G3 exchange rate volatility is higher. The unchanged total is due 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 G3 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 3.5. In this case, on net, real private capital flows are somewhat higher when U.S. rates move more from month to 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 figure 3.6. Relatively stable personal consumption expenditure (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 be due 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.[19]

Table 3.9 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 G3 exchange rates, U.S. interest rates, and U.S. consumption. As a general rule, neither G3 exchange rate volatility nor U.S. consumption volatility appears harmful to growth prospects in emerging market economies. In both cuts of the data, high volatility is associated with about 1/2 to 3/4 percentage point faster growth in developing countries, as we see when comparing columns (1) and (2) for G3 exchange rates or columns (5) and (6) for U.S. consumption. 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 3/8 to nearly 2 percentage points.

The insight that emerges from the simple model is that enforcing target zones in the G3 currencies involves choosing a point along the trade-off between lower exchange rate volatility and higher interest rate volatility. Moreover, to the extent that G3 spending is sensitive to interest rates, there will be a corresponding trade-off between lower exchange rate volatility and higher consumption volatility. We parsed our sample along the dimensions of that trade-off, examining capital flows and GDP growth according to the joint behavior of the relevant volatilities. Table 3.10 records those results. From an emerging-market perspective, G3 target zones imply moving from the upper right cell of each panel, where G3 currency volatility is high but U.S. interest rate of PCE volatility is low, to the lower left cell, where G3 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 G3 exchange rate and U.S. interest rate volatility, net private capital flows were almost $5 billion higher, on average, in those years in which G3 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 is the case 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 unwise in emerging-market economies over the past twenty-seven years to trade times when G3 exchange rates were volatile but U.S. PCE growth was stable for times when G3 exchange rates were stable but U.S. PCE growth was volatile. Across the

19. Two-thirds of the observations on PCE variability in the first half of the sample lie above the median calculated over the entire sample.

Table 3.10 **Net Private Capital Flows to Emerging Market Economies and G3 Volatilities**

Source of Capital	U.S. Volatility[a]	Condition of G3 Currency Volatility: Low	Condition of G3 Currency Volatility: High
U.S. Interest Rate and G3 Exchange Rate Volatilities			
Net private capital flows	Low	13.44	15.01
	High	19.91	14.85
Net private portfolio investment	Low	5.09	3.01
	High	9.03	1.39
Net private direct investment	Low	10.01	14.83
	High	7.68	4.25
Other net private capital flows	Low	–1.65	–2.83
	High	3.19	9.21
U.S. PCE and G3 Exchange Rate Volatilities			
Net private capital flows	Low	28.46	16.20
	High	4.47	13.70
Net private portfolio investment	Low	13.50	2.76
	High	0.51	2.04
Net private direct investment	Low	13.02	12.00
	High	3.14	9.74
Other net private capital flows	Low	1.94	1.44
	High	0.82	1.93

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

Note: Average, billions $1970, 1973 to 1999.

[a]Column refers to U.S. rate volatility in first half of table and to PCE volatility in second half of table.

bottom four panels of table 3.10, real private flows uniformly fall as they move from the upper right cell to the bottom right cell. Taken together, the results given in table 3.10 provide no evidence that the flow of private capital to emerging market economies would benefit from a G3 target zone.

However, attracting financial capital is only an intermediate goal relative to the ultimate responsibility of national authorities to foster economic growth. Table 3.11 presents averages of real GDP growth from 1973 to 1999 for major country groups split according to the joint behavior of G3 exchange rates and either U.S. interest rates or PCE. Here, the evidence does suggest that trading higher for lower G3 exchange rate volatility, even at the cost of more volatility in either U.S. interest rates or consumption, would benefit growth.

Table 3.12 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 G3 exchange rate, U.S.

Table 3.11 Real GDP Growth in Emerging Market Economies and G3 Volatilities

Region	U.S. Volatility[a]	Condition of G3 Currency Volatility: Low	Condition of G3 Currency Volatility: High
U.S. Interest Rate and G3 Exchange Rate Volatilities			
Newly industrialized Asian economies	Low	8.46	6.44
	High	8.06	7.83
Asia	Low	8.10	6.41
	High	6.89	6.12
Developing countries	Low	4.93	4.42
	High	5.51	5.11
Western Hemisphere	Low	9.04	9.93
	High	7.37	6.20
U.S. PCE and G3 Exchange Rate Volatilities			
Newly industrialized Asian economies	Low	7.44	5.32
	High	9.13	8.60
Asia	Low	7.91	5.41
	High	6.63	7.19
Developing countries	Low	5.92	4.10
	High	4.56	5.25
Western Hemisphere	Low	6.08	6.04
	High	4.51	5.44

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

Note: Average annual rate, percent, 1973 to 1999.

[a]Column refers to U.S. rate volatility in first half of table and to U.S. PCE volatility in second half of table.

Table 3.12 Likelihood of the Twin Crises and G3 Volatilities

Type of Crises	U.S. Volatility	Condition of G3 Currency Volatility: Low	Condition of G3 Currency Volatility: High
Currency crises	Low[a]	0.10	0.25
	High[a]	0.10	0.10
Banking crises	Low[a]	0.05	0.20
	High[a]	0.10	0.15
Currency crises	Low[b]	0.10	0.25
	High[b]	0.10	0.10
Banking crises	Low[b]	0.10	0.20
	High[b]	0.05	0.15

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

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

[a]Column refers to U.S. rate volatility.

[b]Column refers to U.S. PCE volatility.

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).[20] The right panels report similar calculations using the number of banking crises from the same source. As can be seen along the minor diagonals of the four panels, years in which G3 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 G3 currency volatility was low but U.S. interest rate volatility was high. In that sense, advocates of target zones are correct in noting that crises are more frequent when G3 exchange rates are more volatile. Moreover, that historical record suggests that the situation can be improved upon by reducing that volatility by incurring more interest rate of PCE volatility in the United States.

3.4.2 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 result from systematic macroeconomic changes rather than unique effects from the various volatilities. However, in an earlier section, we offered a 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 G3 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.

Each block of table 3.13 corresponds to a specification in which the residual from the equation explaining the capital flow concept in the column head is regressed against two G3 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, G3 exchange rates, and U.S. consumption growth; currency crises; and banking crises.[21] In general, a statistically significant coefficient would indicate that a G3 factor exerted an additional influence beyond that contained in U.S. interest rates and income. As to G3 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

20. The results are similar when one employs the methodology of Kaminsky and Reinhart (1999).

21. 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.

Table 3.13 Can "Excess" Real Capital Flows Be Explained by G3 Factors?

	Net Private Capital Flows			
Type of Factor	Total	Direct Investment	Portfolio	Other
U.S. business cycle				
Expansion	0.44	0.69	0.61	–0.88
	(2.72)	(2.14)	(1.39)	(1.98)
Recession	–1.03	–1.61	–1.41	2.06
	(4.16)	(2.14)	(2.13)	(1.98)
U.S. monetary policy				
Tightening	–1.78	0.42	–0.44	–1.78
	(3.58)	(2.85)	(1.86)	(2.62)
Easing	1.19	–0.28	0.29	1.18
	(2.92)	(2.32)	(1.52)	(2.14)
Volatility of U.S. real short-term rates[a]				
High	2.40	–2.53	1.58	3.28
	(3.49)	(2.51)	(1.77)	(2.37)
Low	0.02	4.47	–0.18	–4.30
	(3.36)	(2.42)	(1.71)	(2.29)
Volatility of G3 exchange rates				
High	0.85	3.04	–0.92	–1.34
	(3.11)	(2.32)	(1.59)	(2.27)
Low	–0.97	–3.47	1.05	1.53
	(3.33)	(2.48)	(1.70)	(2.42)
Volatility of U.S. consumption				
High	–4.93	–3.15	–2.76	1.06
	(2.81)	(2.31)	(1.42)	(2.28)
Low	5.63	3.61	3.16	–1.21
	(3.00)	(2.47)	(1.52)	(2.44)
Currency crises[b]				
High	1.44	1.66	3.34	–3.61
	(4.37)	(2.76)	(2.04)	(2.55)
Low	5.25	4.22	1.38	–3.61
	(5.12)	(3.23)	(2.39)	(2.99)
Banking crises[c]				
High	2.34	1.99	3.82	–3.55
	(4.62)	(2.91)	(2.11)	(2.69)
Low	3.83	3.57	1.07	–0.84
	(4.87)	(3.07)	(2.22)	(2.83)

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

Notes: Relationship of the residual from the capital flow fundamentals equations to G3 dummy variables from 1970 to 1999. Standard errors are in parentheses.

[a]Estimated from 1973 to 1999.

[b]Estimated from 1980 to 1998.

[c]Estimated from 1980 to 1998.

making real interest rates more volatile, but there is also no particular *benefit* in damping G3 exchange rate volatility. This statistical evidence ultimately differs little from the theoretical analysis; from the perspective of emerging-market economies, the case for limiting G3 exchange rate volatility is not proven. A similar analysis across regional aggregates, not included here due to considerations of space, provides no reason to question that judgment.

We performed a similar exercise to see if episodes of either volatile G3 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 3.14, tell a similar story. Across the six areas examined, none of the dummy variables related to the various volatilities differed significantly from zero. Taken together, the evidence suggests that advocates of G3 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.

3.5 Concluding Remarks

In this paper, we have attempted to analyze and quantify how developments in the exchange rate arrangements of the G3 countries influence emerging market economies. The debate on G3 target zones should be placed in the broader context 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 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 G3 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. However, as Rose (2000) points out, the benefits of reduced exchange rate variability on trade flows, at least, are small compared to those of 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 trade-off implied by a target zone may be considerable. Indeed, one repeated message of this paper is that emerging-market economies are different from their industrial brethren, having already surrendered a high degree of autonomy in their monetary policies, often pricing their goods in foreign—not local—currencies, and being vulnerable to sudden exclusion from world financial markets.

Table 3.14 Can "Excess" Real GDP Growth Be Explained by G3 Factors?

Type of Factor	Newly Industrialized Asia	Developing Countries	Africa	Asia	Middle East and Europe	Western Hemisphere
U.S. business cycle						
Expansion	8.24	6.07	2.42	–6.82	–0.23	0.69
	(3.02)	(2.26)	(1.53)	(1.97)	(0.68)	(0.69)
Recession	6.54	–0.17	–0.86	1.46	0.54	0.87
	(4.62)	(3.45)	(2.34)	(3.01)	(1.04)	(1.06)
U.S. monetary policy						
Tightening	4.12	4.37	0.29	–7.14	–1.23	–0.47
	(3.91)	(3.11)	(2.06)	(2.76)	(0.85)	(0.87)
Easing	10.14	4.08	2.20	–2.47	0.82	1.55
	(3.19)	(2.54)	(1.68)	(2.25)	(0.70)	(0.71)
Volatility of U.S. real short-term rates[a]						
High	9.74	0.66	2.36	–0.30	–0.85	–0.50
	(4.01)	(2.86)	(2.07)	(2.51)	(0.77)	(0.77)
Low	7.06	8.76	0.93	–9.37	–0.26	0.88
	(3.87)	(2.76)	(1.99)	(2.42)	(0.74)	(0.74)
Volatility of G3 exchange rates						
High	7.67	6.03	–0.40	–4.98	–0.34	0.46
	(3.47)	(2.64)	(1.73)	(2.46)	(0.78)	(0.79)
Low	7.80	2.10	3.54	–3.60	0.39	1.05
	(3.71)	(2.82)	(1.84)	(2.63)	(0.83)	(0.85)
Volatility of U.S. consumption						
High	2.12	1.31	–1.24	–3.83	0.19	0.98
	(3.10)	(2.57)	(1.64)	(2.46)	(0.78)	(0.79)
Low	14.15	7.50	4.50	–4.92	–0.22	0.46
	(3.32)	(2.75)	(1.75)	(2.63)	(0.84)	(0.85)
Currency crises[b]						
High	6.44	3.83	3.03	–7.35	–0.89	0.09
	(4.93)	(3.10)	(2.49)	(2.95)	(0.76)	(0.83)
Low	15.99	10.33	4.23	–5.47	–0.48	0.40
	(5.78)	(3.64)	(2.92)	(3.46)	(0.89)	(0.97)
Banking crises[c]						
High	9.30	4.70	4.24	–6.76	–0.71	0.12
	(5.39)	(3.36)	(2.61)	(3.11)	(0.80)	(0.87)
Low	11.75	8.64	2.76	–6.33	–0.73	0.34
	(5.68)	(3.55)	(2.75)	(3.28)	(0.84)	(0.92)

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

Notes: Relationship of the residual from the real GDP growth fundamentals equations to G3 dummy variables from 1970 to 1999. Standard errors are in parentheses.

[a]Estimated from 1973 to 1999.

[b]Estimated from 1980 to 1998.

[c]Estimated from 1980 to 1998.

Appendix

Determinants of Real Private Capital Flows to Emerging Market Economies

Region/Country	United States		R^2
	Nominal Interest Rate	Real GDP	
Africa			
Net private capital flows	0.21	0.04	0.06
	(0.17)	(0.19)	
Net private direct investment	–0.07	0.00	0.15
	(0.03)	(0.04)	
Net private portfolio investment	–0.09	0.04	0.21
	(0.04)	(0.05)	
Other net private capital flows	0.37	0.00	0.15
	(0.18)	(0.20)	
Asia and crisis countries			
Net private capital flows	0.05	–0.42	0.05
	(0.34)	(0.39)	
Net private direct investment	–0.12	–0.02	0.15
	(0.06)	(0.06)	
Net private portfolio investment	–0.25	–0.05	0.13
	(0.13)	(0.15)	
Other net private capital flows	0.43	–0.35	0.18
	(0.25)	(0.29)	
Other Asian emerging markets			
Net private capital flows	–0.26	–0.06	0.03
	(0.27)	(0.31)	
Net private direct investment	–0.64	0.07	0.19
	(0.27)	(0.31)	
Net private portfolio investment	–0.04	–0.04	0.03
	(0.05)	(0.06)	
Other net private capital flows	0.42	–0.09	0.11
	(0.25)	(0.28)	
Middle East and Europe			
Net private capital flows	–1.68	–0.25	0.33
	(0.46)	(0.54)	
Net private direct investment	–0.08	0.08	0.11
	(0.07)	(0.08)	
Net private portfolio investment	0.02	–0.06	0.01
	(0.12)	(0.14)	
Other net private capital flows	–1.63	–0.27	0.39
	(0.40)	(0.46)	
Western Hemisphere			
Net private capital flows	0.04	–0.29	0.01
	(0.47)	(0.54)	
Net private direct investment	–0.41	0.10	0.09
	(0.27)	(0.32)	
Net private portfolio investment	–0.73	–0.21	0.20
	(0.28)	(0.32)	
Other net private capital flows	1.18	–0.21	0.27
	(0.40)	(0.46)	

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

Note: Estimated using annual data from 1970 to 1999. Standard errors are in parentheses.

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Comment Joshua Aizenman

This interesting paper investigates an issue of great importance to emerging markets—the welfare effect of attempts to reduce the exchange rate volatility among the G3 currencies. My discussion will start with an overview of the main message of the paper and will conclude with several remarks regarding the robustness of the arguments advanced in it.

Overview

The Goal

The purpose of the paper is to examine the welfare effect, from an emerging-market perspective, of reducing the G3 currencies' variability. It explores the various channels of North-South transmission and analyzes the link between the G3 exchange rate and interest rate volatility, and economic growth in developing countries.

The Background

Using target zones as a mechanism for reducing the volatility of the G3 currencies has been advocated by various economists, including McKinnon, Williamson, Clarida, and others. These proposals focused mostly on the Organization for Economic Cooperation and Development (OECD). Little attention was given to the implications of adopting the target zone

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regime on the welfare of the emerging markets. This issue may be of special relevance as many developing countries tie their currency to that of one of the G3 countries, frequently to the U.S. dollar, as a manifestation of the "fear of floating" (see Calvo and Reinhart 2000).

The Main Argument

The authors are skeptical regarding the ultimate welfare gains from stabilizing the G3 currencies. They assert that lower volatility of the G3 currencies would ultimately lead to *higher* interest rate volatility. They observe that sterilized intervention does not work and that restricting capital mobility is against the consensus. Hence, the authors conclude that the interest rate adjustment will replace exchange rate adjustment. The welfare consequences of these changes are ambiguous—higher interest rate volatility would be costly to emerging markets (EMs), and these costs may exceed the benefits from more stable G3 currencies.

This argument is illustrated in figure 3C.1. The authors presume the presence of a concave association between the exchange rate and the emerging markets' output. Similarly, the association between the G3 interest rate and the emerging markets' output is concave. This in turn would imply that stabilizing the G3 currencies would increase the emerging markets' expected GDP and welfare, as is illustrated in panel A. However, the resultant greater volatility of the interest rate would reduce the emerging markets' expected GDP and welfare (see panel B). The net balance would be determined by the relative strength of these two conflicting effects.

In section 3.4 the authors review in detail the linkages between the G3 and EM. Among their interesting findings, they report that economic growth in developing countries tends to be faster against the backdrop of a more stable U.S. short-term interest rate. Specifically, EMGrowth (volatile G3 E. rates + stable $i_{U.S.}$) – EMGrowth (volatile $i_{U.S.}$ + stable G3 E. rates) = %1.25. This observation induces them to conclude that there is no natural presumption that the emerging markets would benefit from stabilizing the G3 currencies.

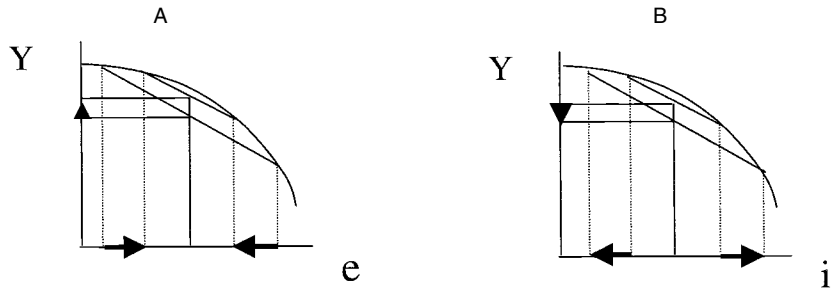

Fig. 3C.1 ***A,*** **Expected output and exchange rate volatility;** ***B,*** **Expected output and interest rate volatility**

Response

Is There a Trade-Off Between Interest Rate Volatility and Exchange Rate Volatility for the G3?

The logic of the paper presumes the existence of a trade-off between interest rate and exchange rate volatility for the G3. With such a trade-off, figure 3C.1 illustrates the ambiguity of the welfare effects attributed to greater exchange rate stability. However, no evidence is presented to support this presumption. The existing literature provides us with little guidance regarding this issue. In fact, several contributions are skeptical about this trade-off. For example, Flood and Rose (1995) failed to find such a trade-off, reporting, "The graphs indicate that there is no substantial tradeoff between exchange rate volatility and the volatility of (domestic) interest rate" (Flood and Rose 1995, 17). A recent update of this study is summarized by Jeanne and Rose (1999), who found that macroeconomic fundamentals do not exhibit regime-varying volatility. These authors advance a possible interpretation for these findings, focusing on the impact of the entry of noise traders to the market. Accordingly, a pure float with an endogenous number of noise traders may give rise to multiple equilibria. The same macrofundamentals are consistent with low exchange rate volatility and a low number of noise traders, or high exchange rate volatility and a high number of noise traders. The multiplicity follows from the observation that noise traders affect the allocation of risk in two ways—they create risk, and they allow for deeper risk sharing. The ultimate impact of the entry of noise traders on the risk premium is ambiguous. Jeanne and Rose illustrate that for certain configurations in which two equilibria exist, the inefficient one is associated with high exchange rate volatility. In that equilibrium, all noise traders are active. Their model provides a nice setup for the multiple equilibrium hypothesis (Eichengreen and Wyplosz 1993). In such an economy, a target zone may eliminate the inefficient equilibrium by restricting the feasible range of exchange rate volatility. In this case there is a "free lunch," in the sense that there is no trade-off between exchange rate volatility and interest rate volatility—the good equilibrium is associated with lower exchange rate volatility as well as with a lower risk premium and lower interest rate volatility.

This argument may be restated in terms of the earlier literature dealing with exchange rate regimes. If most of the shocks are nominal (as will be the case, for example, with an unstable demand for money), greater fixity of the exchange rate may be associated with lower interest rate volatility, if the supply of money was allowed to adjust to the shocks affecting the demand for money.

Interpreting the Empirical Facts

The empirical discussion dealing with the interest rate–monetary policy cycle is very interesting and illuminating. The results dealing with the as-

sociation between the North volatility and regional GDP and capital flows leave one in doubt. The methodology of comparing the flows of capital and the GDP between periods of relatively stable and unstable interest and exchange rates is useful in motivating the welfare questions, yet it does not allow one to fully assess the impact of policies. Specifically, there are no controls for "level" variables that may explain the capital flows and the GDP. Without controlling for all the level variables that may account for capital flows and the GDP, little can be inferred about the pure effect of volatility.

On the Association between Exchange Rate Volatility and the Gross Domestic Product

The presumption of the paper about the negative effect of exchange rate volatility on the gross domestic product (GDP) has been subject to recent debate. The earlier Flood and Rose (1995) contribution found a weak trade-off between exchange rate and output volatility. Recently, however, Levy-Yeyati and Sturzenegger (2001) report that for developing countries, less flexible exchange rate regimes are strongly associated with both slower growth and greater output volatility. For industrial countries, different exchange rate regimes do not appear to have any significant impact on growth.

To sum up, this paper is an interesting contribution. It raises several important questions, cautioning us that the welfare effects of attempts to stabilize the G3 on the emerging markets are ambiguous. Resolving these ambiguities requires further investigation.

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Discussion Summary

Michael P. Dooley remarked that there is no convincing empirical evidence for the existence of a trade-off between interest rate and exchange rate volatility and gave support to the authors' view that monetary policy would be the only tool for supporting a G3 target zone.

Richard Portes made reference to "the balloon analogy" for describing the volatility trade-off. He questioned the paper's dismissal of sterilized intervention as a way of enforcing a target zone and pointed to empirical evidence suggesting that foreign exchange intervention may be effective, at least over certain periods of time.

Robert Flood pointed to the asymmetries of crisis models data and emphasized the importance of unconstrained estimation in order to take account of skewness in the data.

Jeffrey Shafer made a reference to the European economies during the 1980s and argued that there is no observed trade-off between exchange rate and interest rate volatility. He questioned, however, whether soft target zones as opposed to fixed rates would be sufficient to meet the goals of a G3 target zone.

Morris Goldstein made a reference to earlier literature and noted that better bottom-line growth and inflation performance is not a likely outcome of target zones. Thus, the G3 countries would be unwilling to enter such an exchange rate arrangement, and even if they did, weaker G3 economic performance would not be of any help to emerging market economies.

Andrew Rose remarked that no exchange rate model seems to work well, at least not in the short run, and, therefore, even though a trade-off between exchange rates and interest rates seems to exist, this trade-off is hard to quantify. *Martin Eichenbaum* pointed out that as long as there is no clear understanding of what drives exchange rates, the idea of using monetary policy as a tool for steering exchange rates seems problematic. Dooley noted that doing nothing because of the lack of consensus regarding the "right" exchange rate model seems problematic as well.

Jeffrey A. Frankel noted that exchange rates are not always tightly linked to fundamentals and that sterilized intervention has been effective in the past. However, he added, it would be impossible to commit persistent intervention to maintain a target zone goal since a key element for effective sterilized intervention is sparing use of the intervention tool.

Vincent Raymond Reinhart remarked that he was sympathetic to the point made by Dooley regarding the lack of empirical evidence for a trade-off between exchange rates and interest rates and agreed that the assertion of such a trade-off is the weak part of the paper. He noted, in response to Goldstein, that the authors had avoided references to earlier literature, given that the focus of the paper is on emerging market economies. He remarked that even though it is indeed possible to achieve an anchoring of exchange rate expectations under various regimes, the necessary element is credibility; that is, the imposition of a target zone itself is not sufficient. With respect to the issue of the effectiveness of sterilized foreign exchange intervention, Reinhart noted that it is important to distinguish between effectiveness during regimes and effectiveness during episodes.