CHAPTER II THREE CURRENT POLICY ISSUES IN DEVELOPING COUNTRIES

This chapter consists of essays on growth in the Middle East and North Africa, reserve accumulation in Asia, and the impact of industrial country exchange rate volatility on developing countries. The first essay examines the causes of the low economic growth in the countries in the Middle East and North Africa (MENA) region over the past two decades. The essay shows that the region's poor growth reflects mainly declining or low growth rates in oil-exporting countries. By contrast, growth in non-oil-exporting countries generally matched that of other developing countries (excluding east Asia), although it was not high enough to create enough new jobs to absorb the rapid expansion of the labor force, resulting in increased unemployment. Using an empirical model, the essay finds that the factors behind the region's weak performance differ across subgroups of countries. Key findings are that, for the members of the Cooperation Council of the Arab States of the Gulf (GCC),[1] high oil revenues that financed excessive government expenditures lowered growth, and that improvements in institutional quality would provide substantial gains for other countries in the MENA region.

The second essay investigates the rapid accumulation of foreign reserves over the past decade in emerging market countries, especially emerging economies in Asia, where the bulk of the increase has occurred. The essay finds that reserves—scaled by imports, short-term external debt, or broad money—in emerging markets have generally risen, quite sharply in many cases. The essay shows that reserves in many emerging market economies have increased more rapidly since 2001 than supported by economic fundamentals, using an empirical model to assess the relative importance of five key factors behind the reserve buildup—economic size, current account vulnerability, capital account vulnerability, exchange rate flexibility, and opportunity cost. After reviewing the main costs and benefits of holding a high level of reserves, the essay concludes that reserves in emerging economies in Asia are now at the point where some slowdown in the rate of accumulation is desirable from both domestic and multilateral perspectives.

The last essay examines the impact of industrial country exchange rate volatility on trade, capital inflows, and the likelihood of exchange rate crises in developing countries. The essay finds that these adverse effects are small for the average country: even the complete elimination of all G-3 (Group of Three industrial countries) exchange rate volatility would boost developing country trade by a modest 1 percent and reduce the probability of exchange rate crises by only 2½ percentage points. Also, these effects arise mainly indirectly, through the impact of G-3 exchange rate volatility on developing country exchange rates, which are more heavily influenced by developing countries' own exchange rate regimes. Simulations indicate that these adverse effects are greatest in those countries that peg to a specific industrial country currency, where external debt is high, and where there is a substantial mismatch between the currency composition of debt and of trade. This suggests that, in many cases, more flexible exchange rate regimes and better hedging may help reduce vulnerabilities. The simulations also find that the beneficial impact on developing countries of any attempt to stabilize G-3 exchange rates could easily be offset by the resulting fluctuations in G-3 interest rates and output.

[1]The members of the GCC are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates.

How Can Economic Growth in the Middle East and North Africa Region Be Accelerated?

The main author of this essay is Dalia Hakura. Ben Sutton provided research assistance.

Over the past two decades, economic growth in the MENA region has been weaker than in other developing country regions. Indeed, between 1980 and 2001, real per capita GDP in the MENA region did not increase at all, compared with average annual growth of 6.3 percent in east Asia and 1.3 percent in all other developing countries over the same period.[2] The MENA region's poor growth performance during the 1980s and 1990s also contrasts sharply with the 1970s, when annual per capita GDP growth averaged 3 percent, exceeding that of other developing countries (excluding east Asia) by three-fourths of a percentage point.

As discussed below, a closer look at the region's growth performance during 1980–2001 reveals that MENA's poor performance owed much to the dominant share of oil-exporting countries. These—in common with oil exporters in the rest of the world—experienced a significant decline in real per capita GDP in the 1980s and very low growth in the 1990s. In contrast, GDP growth in non-oil-exporting countries was relatively similar to that of other developing countries (excluding those in east Asia). Nonetheless, in the specific circumstances of the MENA countries, such a performance was not good enough; given their relatively high labor force growth, their economies needed to grow considerably faster just to create the necessary job growth. Because this did not happen, unemployment is now high throughout the region[3] and, looking forward, GDP growth will need to be significantly faster to absorb the continuing strong increase in the labor force and bring unemployment down.

Consequently, regional policymakers have for many years focused on how best to improve the region's growth performance (e.g., IMF, 1996; Page, 1998; and Makdisi, Fattah, and Limam, 2000). Unfortunately, while significant progress has been made in eliminating macroeconomic imbalances, reducing inflation, and advancing structural reforms in some MENA countries, the trend has not been encouraging—GDP growth in the 1990s remained relatively weak. The persistence of these growth problems suggests that they should be analyzed from a more long-run, structural perspective. Indeed, a number of recent studies, including Abed (2003) and the *Arab Human Development Report* (UNDP, 2002), have pointed to a diverse set of structural causes behind the poor growth performance in the MENA region, including dependence on oil, restrictive trade regimes, weak institutions, political instability, and large public sectors.[4] Extending this literature, this essay uses an empirical model of long-run growth—for the first time including a large number of MENA countries—to analyze MENA's growth performance during the past two decades, focusing on the following questions.

- How different was the MENA region's growth performance during 1980–2001? Have some MENA countries performed better than others?
- Where are the differences between MENA countries and other developing countries when it comes to the main determinants of growth? Are there important differences among MENA countries?
- How much of the growth differential between MENA countries and east Asian countries (the fastest growing group of developing countries) do these differences in growth factors explain? Is the dependence on oil important?
- What policies are needed to strengthen growth in the years ahead?

[2]GDP weights in purchasing-power-parity terms are used to construct the regional averages.

[3]Data for seven MENA countries indicates an increase in the unemployment rate from an average of 12.5 percent in 1990 to 15 percent in 2000 (Gardner, 2003).

[4]See also Dasgupta, Keller, and Srinivasan (2002), Keller and Nabli (2002), Sala-i-Martin and Artadi (2002), Makdisi, Fattah, and Limam (2000), Davoodi and Erickson von Allmen (2001), and Alonso-Gamo, Fedelino, and Paris Horvitz (1997).

MENA's Growth Performance in Perspective

The MENA region comprises a group of countries bound together by their geographical location, close historical and cultural ties, and common economic challenges.[5] To account for fundamental differences in economic structure, countries within the region are divided into oil-exporting countries and other MENA countries, which the essay will refer to as non-oil MENA countries (see Appendix 2.1 for country groups and data definitions). The oil-exporting MENA countries are further divided into the members of the GCC—because of their large oil sectors—and other MENA oil exporters.

An initial comparison of the evolution of real GDP per capita over the past two decades suggests that MENA's growth performance has been considerably weaker than that in other developing countries (Figure 2.1). However, this reflects the large share of oil exporters in the MENA region, which—especially the GCC oil exporters—experienced particularly low growth rates. While this performance was broadly similar to that in major oil exporters outside the MENA region—suggesting that common factors, notably related to the oil market, played a key role—the magnitudes of the changes were even larger for MENA, perhaps reflecting sharper changes in oil production in the region.[6] In contrast, non-oil MENA

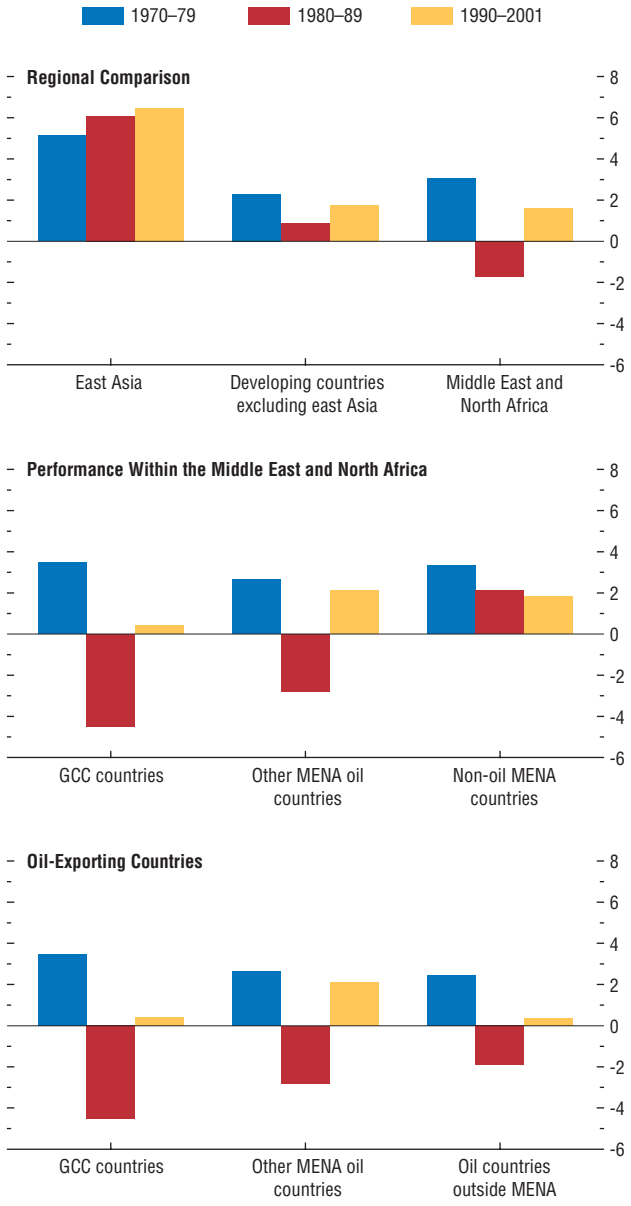
[5]Specifically, for the purpose of this essay, the region includes Algeria, Bahrain, Egypt, the Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, the United Arab Emirates, and Yemen.

[6]Since growth in the oil exporters is correlated with crude oil production, the decline in Organization of Petroleum Exporting Countries (OPEC) quotas in the 1980s explains part of the lower growth during that decade, and the recovery of OPEC crude oil production during the 1990s underlies the improved performance of oil exporters during this period. As the oil sector accounts for a larger share of GDP among MENA oil-exporting countries (particularly the GCC countries) than for those outside the region, they are more susceptible to changes in quotas. On the other hand, it should be noted that the relationship between OPEC production quotas and real per capita GDP growth is not necessarily proportional given the considerable scope for output and consumption smoothing in oil-producing countries (through government expenditures).

Figure 2.1. MENA Growth Performance in Comparison[1]

(Average real GDP per capita growth rate; percent)

The MENA region's poor growth performance in the 1980s and 1990s reflects in large part the poor growth in the oil-exporting countries and in part the decelerating growth in the non-oil countries.

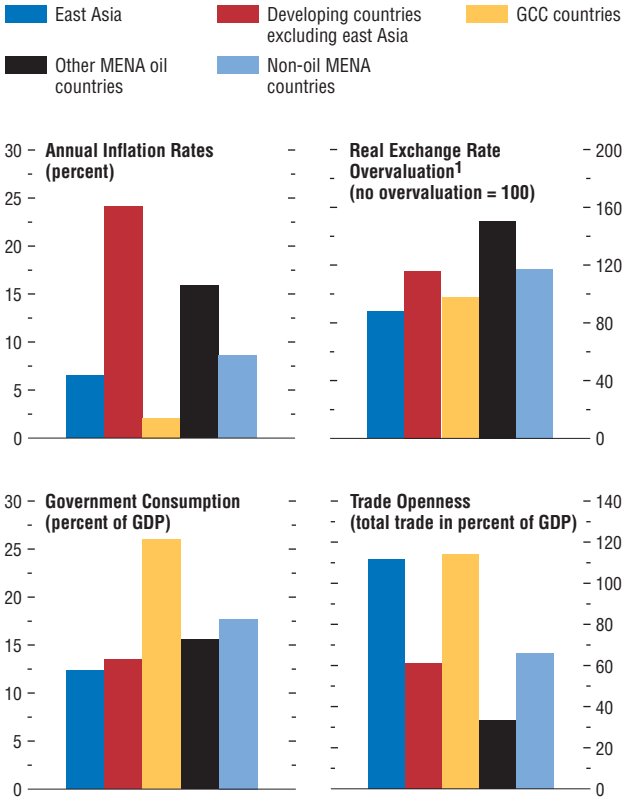


[1]Groups are weighted by GDP at purchasing-power-parity exchange rates.

Figure 2.2. Regional Comparison of Growth Determinants: Macroeconomic and Trade Policy Indicators, 1980–2000

(Simple average)

All MENA subgroups had relatively large governments. In addition, other MENA oil and non-oil MENA countries had relatively overvalued real effective exchange rates and low trade openness.



Sources: World Bank, *World Development Indicators;* Dollar (1992); and IMF staff calculations.

[1]Real exchange rate overvaluation shows the average exchange rate misalignment over 1980–2000. It is based on purchasing power parity comparisons, using the Summers-Heston measure, where 100 signifies parity and higher (lower) numbers indicate over-(under-) valuation, following Dollar (1992).

countries, on average, achieved positive rates of growth during all three decades since 1970, which—while well below those achieved in the fast growing countries of east Asia—were comparable to those of other developing countries (excluding east Asia). However, as noted above, this growth performance fell far short of that needed to avoid a sustained rise in unemployment, and the trend was disappointing, as growth rates in the non-oil MENA countries declined from one decade to the next.

What are the causes of MENA's disappointing growth performance? The empirically oriented growth literature has identified a number of fundamental determinants of long-run economic growth that, broadly speaking, fall into six categories. For each of these growth determinants, this section will briefly outline how they are generally thought to affect economic growth and how MENA compares with other developing country regions over 1980–2000.

- *Macroeconomic instability* is often cited as a fundamental reason for poor growth, as (1) high inflation creates uncertainty, which adversely affects productivity and investment, and, as a consequence, economic growth (Fischer, 1993); and (2) overvalued exchange rates reduce the competitiveness of dynamic, outward-oriented sectors. The MENA region's performance with regard to each of these determinants of growth relative to other developing countries varies considerably (see Figure 2.2). The MENA countries generally had average inflation rates of less than 10 percent over the 1980–2000 period, which are below levels typically considered detrimental to growth in developing countries (e.g., Khan and Senhadji, 2000). However, an index of exchange rate misalignment developed by Dollar (1992) suggests that exchange rate overvaluation was particularly relevant in other MENA oil-exporting countries, which score highest in this category. This finding is consistent with the notion that having oil makes countries vulnerable to exchange rate overvaluation (the so-called Dutch disease phenomenon).

In non-oil MENA countries, exchange rate overvaluation was comparable to that of other developing countries.

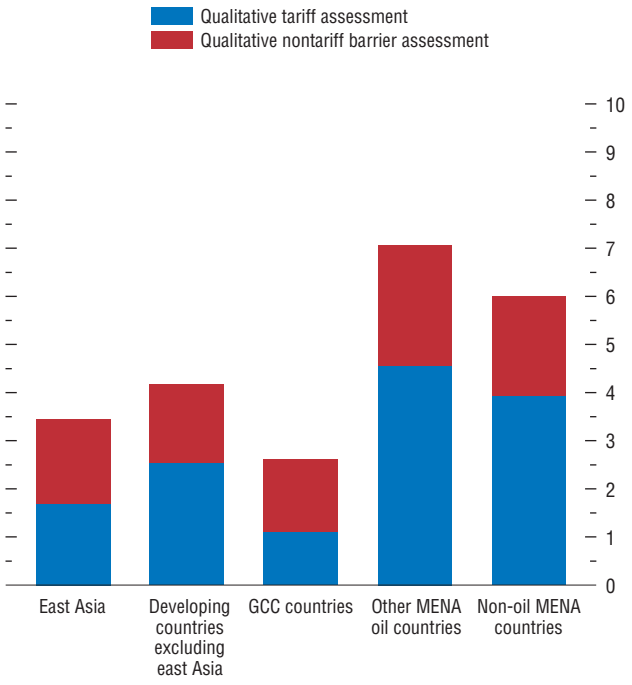
- *Role of government.* High levels of government consumption can—beyond some threshold—have negative effects on productivity, owing to the adverse effects on savings and the distortions resulting from high levels of taxation (Barro, 1991). The size of government is large in all MENA countries, including in oil-exporting countries, in which oil revenues traditionally financed large government sectors.
- *Trade openness and terms of trade volatility.* Restrictive trade regimes reduce productivity-enhancing effects from competition and international technology transfers (e.g., Coe, Helpman, and Hoffmaister, 1997). In addition, terms of trade volatility creates uncertainty, which is expected to act as a deterrent to growth.[7] The GCC oil exporters stand out as being very open, in terms of both trade openness—an outcome-based measure—and the IMF's trade restrictiveness indicator (Figure 2.3).[8] In contrast, other MENA oil exporters had the most restrictive regime within the region and compared with other developing countries according to both indicators. Non-oil MENA countries were, on average, as restrictive as other developing countries in their trade regime according to the trade openness measure but were more restrictive according to the trade restrictiveness indicator. With regard to terms of trade volatility, the MENA oil exporters experienced larger terms of trade volatility than any other region in the past two decades, reflecting the large fluctuations in oil prices.
- *Quality of institutions.* Recent research has emphasized the strong influence of institutions

[7]Some growth studies have also examined the effect of changes in the terms of trade on growth. An improvement in a country's terms of trade is expected to positively affect real per capita GDP growth if it stimulates an increase in production.

[8]Berg and Krueger (2003) emphasize that outcome-based measures of trade openness can be misleading.

Figure 2.3. Trade Restrictiveness Measure, 1997–2002[1]
(Qualitative scale: 1 to 5, simple average)

Other MENA oil countries and non-oil MENA countries had more restrictive trade regimes than all other regions.

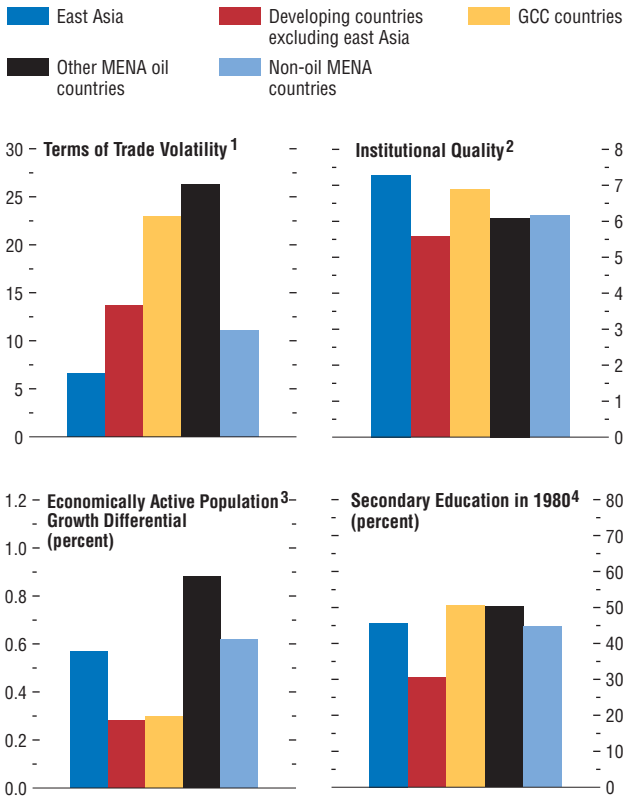


Source: IMF staff calculations.
[1]Each component is scaled 0 to 5, where 5 represents high trade restrictions.

Figure 2.4. Regional Comparison of Growth Determinants: Terms of Trade Volatility, Institutional Quality, Demographics, and Secondary Education, 1980–2000

(Simple average across years and countries unless otherwise noted)

Other MENA oil countries and non-oil MENA countries had relatively low institutional quality while GCC and other MENA oil countries had relatively high terms of trade volatility.



Sources: PRS Group, *International Country Risk Guide;* World Bank, *World Development Indicators;* and IMF staff calculations.

[1]Terms of trade volatility is the standard deviation of the annual percent change in total terms of trade.

[2]Institutional quality is an average of bureaucratic quality, control of corruption, government stability, and rule of law indicators reported in the International Country Risk Guide. Each component is scaled 0 to 12, where 12 represents highest institutional quality.

[3]Economically active population annual growth rate minus total population annual growth rate.

[4]Secondary education is the number of residents enrolled in secondary education programs in percent of the secondary school age population at the beginning of the sample period (1980).

on economic growth, as good institutions encourage productive activities rather than rent seeking, corruption, and other unproductive activities (see Chapter 3 of the April 2003 *World Economic Outlook* and the references therein). In this regard, it has been argued that an abundance of oil wealth negatively affects institutional quality because it encourages rent seeking and corruption (e.g., Sachs and Warner, 1995). Based on a composite index of institutional quality that encompasses the effects of corruption, quality of the bureaucracy, rule of law, and government stability,[9] where higher values indicate better institutions, the GCC countries score higher than the rest of the region and nearly match east Asia's scores (Figure 2.4),[10] while the other MENA oil and non-oil countries score only marginally higher than developing countries excluding east Asia. When it comes to dimensions of institutional quality, the region scores high for stability of government, but in other dimensions, the scores are mixed and vary within MENA country groups (Figure 2.5).

- *Demographics.* The so-called demographic burden—the differential between population and labor force growth—is inversely related to growth (Bloom and Williamson, 1998). The demographic burden was relevant for GCC countries, which, like developing countries excluding east Asia, faced relatively rapid total population growth relative to labor force growth whereas other oil and non-oil MENA countries, like east Asia, experienced relatively rapid growth of the working population relative to the population as a whole (see Figure 2.4).

[9]The data to construct the institutional quality index comes from the *International Country Risk Guide* (see Appendix 2.1 for more details). This is along the lines of research by Knack and Keefer (1995), Barro (1996), Sachs and Warner (1997), and Hall and Jones (1999).

[10]The relative standing of the MENA subgroups vis-à-vis other regions with regard to institutional quality is virtually identical if an alternative indicator of institutional quality developed by Kaufmann, Kraay, and Zoido-Lobatón (1999) is used.

- *Initial conditions.* Growth theory suggests that a country's growth rate is negatively related to its relative initial level of income, as the latter varies inversely with the scope for catching up with the richest countries. In contrast, a larger initial stock of human capital is expected to have a positive influence on growth because it allows a country to engage in research and to adopt new products and ideas developed in advanced economies (Barro, 1991). Per capita income levels vary widely across the MENA region, ranging from one low-income country to three high-income countries, implying that the initial level of income will have a significantly different effect across the countries in the region. The MENA region fares relatively well in terms of the initial stock of human capital measured using the secondary school enrollment ratio when compared with developing countries excluding east Asia, suggesting that it would be difficult to relate the region's poor performance to this factor.[11]

Empirical Analysis of MENA's Growth Performance

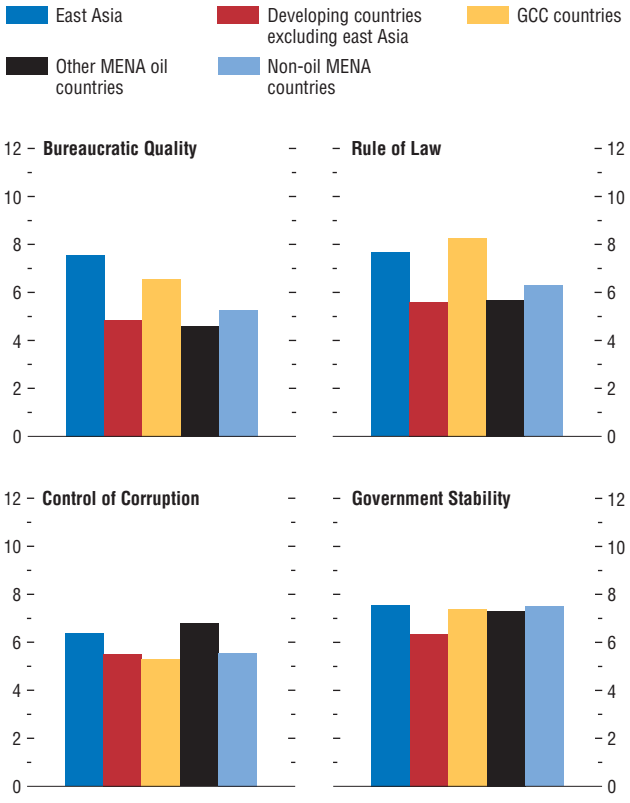
After the informal diagnosis of the causes of the MENA region's growth problem, the essay now turns to a formal econometric analysis to identify the relative contribution of each of these factors in explaining the region's poor growth performance. For this purpose, a standard growth model explaining variations in long-

[11]It should be noted, however, that this measure may not adequately capture differences across regions in the quality of education, which affects the productivity of human capital. For instance, Sala-i-Martin and Artadi (2002) argue that the education system in the Arab world does not prepare its citizens for a world of technical change. In addition, the discrepancy between female and male secondary enrollment ratios is relatively high in the MENA region except for the GCC countries, although it should be noted that female secondary enrollment ratios are high in the MENA region compared with other developing country regions. Moreover, UNDP (2002) emphasizes that the MENA region lags substantially behind other regions in female tertiary enrollments.

Figure 2.5. Institutional Quality, 1984–2000

(Scale 1 to 12 with 12 representing highest quality; simple average)

Most subgroups of MENA scored less than other regions for quality of the bureaucracy, rule of law, and control of corruption.



Sources: PRS Group, *International Country Risk Guide;* and IMF staff calculations.

Table 2.1. Growth Regression Results[1]

Explanatory Variables	Including GCC Oil Exporters	Excluding GCC Oil Exporters
Initial income[2]	**–1.21**	**–1.26**
Institutional quality[3]	**0.87**	**0.85**
Trade to GDP	0.003	0.003
Terms of trade volatility (weighted)[4]	–0.0004	***–0.002***
Growth of economically active population minus total population growth	**1.95**	**2.09**
Secondary education, 1980[5]	**0.02**	**0.02**
Government consumption to GDP[6]	***–0.09***	**–0.11**
Inflation rate[7]	–0.001	–0.002
Real exchange rate overvaluation[8]	**–0.01**	–0.01
R^2	0.62	0.61
Number of observations	74	71
Number of MENA countries	10	7

Source: IMF staff estimates.

[1]The dependent variable is real per capita GDP growth over 1980–2000. The regressions are estimated using an instrumental variables estimation technique in which the endogenous variables in the regression are the institutional quality and the trade openness variables. Following research by Hall and Jones (1999) and the April 2003 *World Economic Outlook*, the fraction of the population that is English speaking, the fraction of the population speaking one of the major languages of western Europe, and a set of dummy variables that capture a country's legal origin (British, French, or German) are used to instrument for the institutional quality variable. The predicted trade shares computed as for Frankel and Romer (1999) are used to instrument for trade openness. Bold values signify statistical significance at the 5 percent level and bold italics signify significance at the 10 percent level.

[2]Log of initial per capita purchasing-power-parity GDP as reported in the *World Economic Outlook*.

[3]The institutional quality variable is measured as the average of four indices reported in the *International Country Risk Guide*.

[4]Terms of trade volatility is weighted by the share of natural resource exports in GDP in 1980.

[5]Secondary education represents the initial level of secondary education.

[6]This is the ratio of nominal government final consumption to GDP.

[7]Inflation is the average annual inflation rate over 1980–2000.

[8]Real exchange rate overvaluation shows the average exchange rate misalignment over 1980–2000. It is based on purchasing-power-parity comparisons, using the Summers-Heston measure, where 100 signifies parity and higher (lower) numbers indicate over- (under-) valuation, following Dollar (1992).

run growth was estimated for a cross section of 74 countries, including 21 advanced economies (Table 2.1). A key consideration was to include as many MENA countries in the sample as possible, which, given data availability, allowed the model to be estimated for 1980–2000.

The results, which are broadly in line with those in the literature (e.g., Barro, 1991), confirm that higher real per capita growth rates are associated with low initial levels of income, stronger institutions, more open trade regimes, smaller governments, lower terms of trade volatility, higher growth of working-age population relative to total population growth, lower inflation, lower exchange rate overvaluation, and a higher initial level of secondary school enrollment.[12] Perhaps surprisingly, variables capturing a country's abundance of oil were not found to be significant, a point further elaborated on below. All of the explanatory variables are statistically significant except the inflation and trade policy variables;[13] the model, as typically found in growth regression models, explains 62 percent of the cross-country variation in growth rates.

While the model, inevitably, does not provide a full explanation of MENA's growth in the past two decades, it does allow us to identify a number of key factors affecting MENA's growth performance. To illustrate this, following Easterly and Levine (1997), we use the growth model to analyze the causes of the growth differential between the MENA region and the fast-growing developing countries in east Asia. As can be seen in Figure 2.6, the causes of

[12]An instrumental variables estimation technique was used to account for possible endogeneity of some of the explanatory variables. Interactions of the macroeconomic policy variables and the institutions variable (see, for example, Edison and others, 2002) were also included in the regressions to investigate whether there is a nonmonotonic relationship between institutions and growth. However, the interaction terms were not significant and are therefore not reported here. Also, the ratio of private sector credit to GDP, which proxies for the depth of the financial market, was included as an explanatory variable in the regression but was not found to be significant (as in the April 2003 *World Economic Outlook*) and so was not reported.

[13]When the IMF's trade restrictiveness indicator for 1997 is substituted for the trade to GDP ratio, the estimated coefficient is of the correct sign but is also insignificant. The insignificance of the trade and inflation variables is consistent with other recent studies that included a variable of institutional quality. Some have interpreted this as suggesting that institutional quality matters more for growth (e.g., Rodrik, Subramanian, and Trebbi, 2002, and Acemoglu and others, 2002) while others have argued that the significance of the macroeconomic variables depends on the specification of the regression (Sachs, 2003, and Bosworth and Collins, 2003).

weaker growth vary considerably across the MENA subgroups.

- For the GCC countries, the key factors are the relatively high initial income and the relatively large size of the public sector, accounting together for nearly 70 percent of the differential with east Asian countries. The terms of trade volatility, the population growth, and the quality of institutions variables also contribute to explaining the growth differential, albeit to a lesser extent.
- In other MENA oil-exporting countries, higher initial income also plays a key role but after that, lower scores in institutional quality explain the largest fraction of the growth differential. This is followed by exchange rate overvaluation, terms of trade volatility, government consumption, and trade openness variables, respectively.
- For the non-oil MENA countries, consistent with the findings in the April 2003 *World Economic Outlook*, the main variable explaining the growth differential is the institutional quality variable. The government consumption, exchange rate overvaluation, and trade openness variables also matter but to a lesser extent.

Given that a large number of the MENA countries are among the world's main oil exporters, it is important to understand to what extent their dependence on oil has mattered for their long-run growth performance.[14] The main variable that distinguishes the performance of the MENA oil exporters, especially the GCC countries, from east Asian countries as well as oil exporters outside the region is their high initial levels of per capita income. This finding should not be surprising because soaring oil revenues in the 1970s raised not only income and consumption but also led to a surge in investment spending and rapid capital stock growth, which could be interpreted as reflecting an accelerated catching up (especially in the GCC countries). However, with much of this spending undertaken by governments, it proved relatively inefficient and simply perpetuated the countries' dependence on oil.[15] Therefore, the negative effect on growth of high initial levels of per capita income to some extent also reflects the adverse effects of high oil income on the incentives for economic diversification.[16] Indeed, a growth accounting exercise suggests that capital per worker and total factor productivity declined in the GCC countries during 1980–2000, reflecting the low productivity of initial capital stocks (Box 2.1).

Oil is also likely to have affected growth performance through a number of other channels. In particular, in the GCC countries, high oil revenues have been used to finance very high levels of public employment and wage-related benefits (reflected in the high level of government consumption noted above), hampering labor market flexibility and the development of the non-oil private sector. While other distortions, such as those arising from trade restrictions, are less severe in the GCC, the large size of the government has, in fact, been a veil for other distortions that have impeded diversification of the economies away from oil. Finally, as captured by the terms of trade volatility variable, the fluctuations in the oil prices exposed the private sector

[14]In this context, it should be noted that our framework captures the effects of persistent country characteristics related to oil but not the effects of oil-related country-specific shocks with long-lasting but nevertheless temporary effects on growth (Easterly and others, 1993). Also, as noted above, a variable that measures a country's abundance of oil (the share of fuel exports in total exports) was not found to be significant and was dropped from the final regression. In part, this may be because it is highly correlated with terms of trade volatility, which makes it difficult to isolate its partial effect. Similarly, the effects of changes in the terms of trade were not found to be significant, which may reflect the fact that most of the oil exporters in the sample (for whom movements in the terms of trade would mainly capture movements in the relative price of oil) have oil production quotas in the context of their membership in the OPEC.

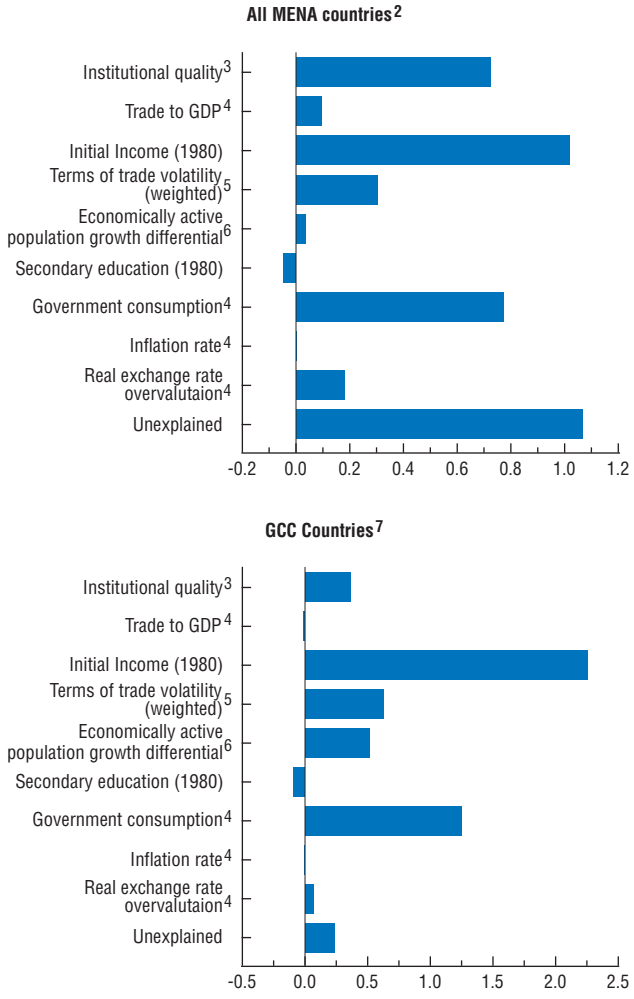
[15]See Hausmann and Rigobon (2002) for a complementary discussion.

[16]The coefficient on initial income could also be biased because the GCC countries' initial income was likely to have been negatively correlated with shocks to oil prices and production over the sample period (see Barro and Sala-i-Martin, 1995). However, comparing the coefficients obtained from regressions including and excluding GCC countries from the sample suggests that this bias is at best small and without material implications for the analysis.

Figure 2.6. Decomposition of Growth Differentials Among Subgroups of MENA and East Asian Countries[1]

(Percentage points)

After initial income, government consumption explains the largest fraction of the GCC countries' growth differential, and institutional quality explains the largest fraction of the other MENA oil countries' growth differential. Institutional quality explains the largest fraction of the non-oil MENA countries' growth differential.



to boom and bust cycles that are likely to have adversely affected the growth of the non-oil sector. In the other MENA oil exporters, it is also possible that oil revenues may have contributed to weaker institutional quality, for the reasons already noted.

A second factor that has clearly been important for some countries, and is also difficult to capture in formal regressions, is internal and external conflict. Even though countries that were particularly affected by conflicts were excluded from the sample, MENA countries had a higher incidence of conflicts than all other regions (Figure 2.7).[17] To assess the potential impact, the model was reestimated using an institutional quality variable that encompasses the effects of indicators of internal and external conflicts collected by the *International Country Risk Guide*. This increased the explanatory power of the model for some regions,[18] especially for other MENA oil exporters (10 percentage points) and for non-oil MENA countries (4 percentage points),[19] suggesting these factors may indeed be important.

A third characteristic of MENA countries that is clearly different from other regions is the low participation ratios of women in the labor force. Given that female secondary school enrollment ratios are generally high in MENA countries relative to other developing country regions, this prevents a substantial stock of human capital from having a positive impact on the economy (see footnote 11 on the education of women).

[17]Lebanon and the Republic of Yemen were excluded from the analysis as they suffered from extended internal conflicts during the period under consideration.

[18]However, there is a high correlation between institutional quality variables (such as those defined in the previous section) and the conflict variables, reflecting the difficulties of running high-quality government operations with conflict. Similarly, weak governance and corruption can even be the instigators of political tensions. This makes it difficult to precisely estimate the effects of the latter from regressions that include the conflict variables as additional explanatory variables.

[19]The results are broadly consistent with the earlier results in the sense that the ranking of the explanatory variables for explaining the growth performance of each MENA subgroup remains unchanged.

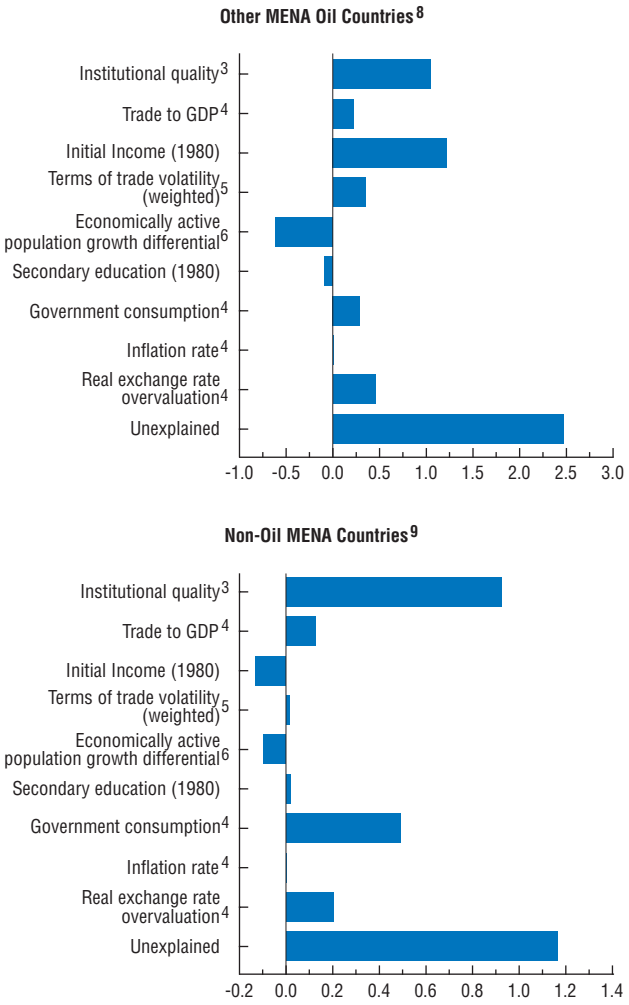
Another drawback of low female participation ratios is that they can reduce competition in the labor market. However, female participation ratios rose faster in MENA countries than elsewhere from 1980 to 2000, and in 2000 the gap with other developing countries was generally reduced compared with 1980. While the growth impact is difficult to quantify, this should have boosted growth in MENA countries compared with other regions, everything else being equal. Looking forward, structural reforms aimed at enhancing labor market flexibility that at the same time would facilitate female labor force participation—thereby narrowing the gap with other countries further—could enhance their positive impact on productivity and growth in the MENA region (see also UNDP, 2002, and Klasen, 1999).

Conclusions and Policy Implications

While the MENA region's disappointing growth performance has many causes, the analysis above has identified a number of common factors—the large size of government, the poor quality of institutions (including political instability), misalignment of the real exchange rate, terms of trade volatility, and barriers to trade. The relative importance of the factors varies significantly across the subgroups of MENA countries, however, with the policy implications correspondingly rather different for each MENA subgroup.

- A key source of low growth for the GCC countries appears to have been the large size of public sector consumption, which has been spurred in part by the growth of economic rents in the region. This growth is linked, as described above, to the use of oil revenues to finance subsidies and transfers and high public employment. According to the empirical analysis, the high public sector consumption has accounted for nearly 1¼ percentage points of the growth differential with east Asian countries. This finding underscores the need to reduce the size of government over time, accompanied by structural reforms

Figure 2.6. ***(concluded)***



Sources: Dollar (1992); PRS Group, *International Country Risk Guide;* World Bank, *World Development Indicators*; and IMF staff estimates.

[1]The regression coefficients are applied to the difference between the average values for the explanatory variables for MENA (and its subgroups) and east Asian countries. The calculations use averages for each variable and for all countries in the relevant group for which the data is available and not only the countries included in the regression estimations. The main findings are broadly similar when the calculations are based on average values for the countries included in the regression only.

[2]The growth differential between all MENA countries and the east Asian countries is 4.2 percent.

[3]Simple average 1984–2000.

[4]Simple average 1980–2000.

[5]Standard deviation of the annual percent change in total terms of trade multiplied by the share of natural resource exports in GDP in 1980. This weighting captures the effect of volatility in income flows that is associated with trade in natural resources.

[6]Growth rate of economically active population minus growth rate of total population.

[7]The growth differential between the GCC countries and the east Asian countries is 5.2 percent.

[8]The growth differential between other MENA oil countries and the east Asian countries is 5.4 percent.

[9]The growth differential between non-oil MENA countries and the east Asian countries is 2.7 percent.

to increase labor flexibility and strengthen the legal and institutional framework for private sector–led growth. Economic diversification and medium-term fiscal rules delinking government spending from oil prices are also important to reduce vulnerability to oil price fluctuations, which—as captured by the terms of trade volatility variable—accounted for more than ½ percentage point of the growth differential with east Asian countries.

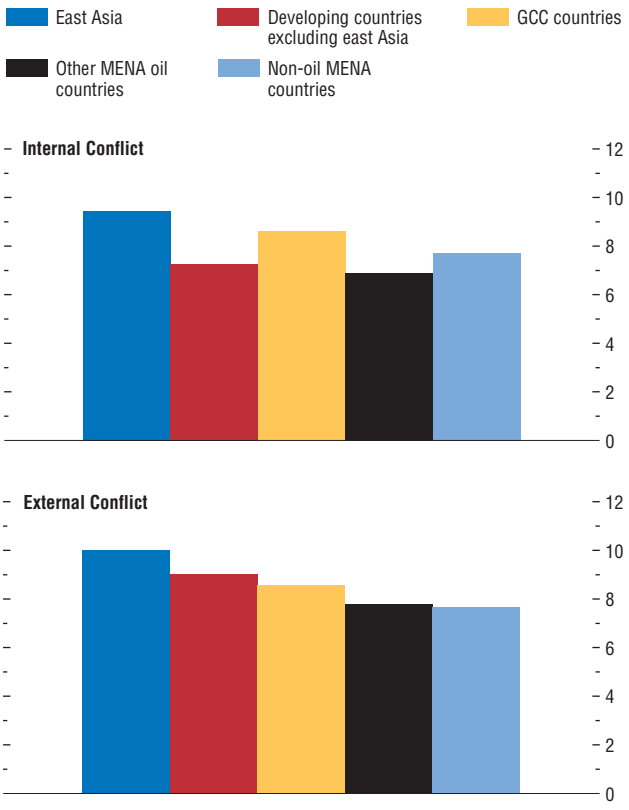
- Other MENA oil-exporting countries would gain significantly from improving institutional quality, especially with regard to transparency in government operations, the quality of the bureaucracy, and the strength of the rule of law; indeed, the model suggests that if these could be brought to the level in east Asian countries, annual per capita GDP growth could be increased by 1 percentage point. There would also be a substantial payoff to trade and exchange rate liberalization, which together account for close to 0.7 percentage point of the growth differential with east Asia.
- In the non-oil MENA countries, improving institutional quality is again critical, accounting for 0.9 percentage point of the growth differential with east Asian countries. In addition, despite some progress during the past decade, the size of the public sector remains a drag on growth—if it were reduced to east Asian levels, per capita GDP growth could be boosted by ½ percentage point. More flexible exchange rates and trade liberalization are also priorities (Jbili and Kramarenko, 2003).

In addition to the policy implications outlined above, the evidence in the essay suggests, albeit indirectly, that political tensions and conflicts in the region contributed to the slowdown of growth of other oil exporters and non-oil exporters. Consequently, an improvement in the actual and perceived security situation would be conducive to reviving growth in the MENA region. Moreover, the analysis suggests that further increases in female labor force participation ratios would also support the region's growth prospects.

Figure 2.7. Indicators of Internal and External Conflict, 1984–2000

(Scale 1 to 12 with 12 representing least conflict; simple average)

Nearly all subgroups of MENA had more internal and external conflicts than other regions.



Sources: PRS Group, *International Country Risk Guide;* and IMF staff calculations.

Box 2.1. Accounting for Growth in the Middle East and North Africa

Over the past two decades, as discussed in the main text, GDP growth in the Middle East and North Africa (MENA) has fallen short of the level required to absorb the rapidly growing labor force. This box looks at the MENA region's growth performance using growth accounting, a methodology that is complementary to the one applied in the main text (e.g., Bosworth and Collins, 2003). This approach breaks down the growth in output per worker into the separate contributions of increases in (physical and human) capital per worker and the residual, typically labeled total factor productivity (TFP), which captures changes in the efficiency with which the factor inputs are used. It is important to note that this residual can also reflect the effects on output of various factors that are not (fully) accounted for by their effects on measured increases in factor inputs, including the effects of war, political turmoil, external shocks, and policy changes.

Using this methodology for the MENA region as a whole, average annual output per worker declined by 0.2 percent annually during the period 1980–2000 (see the table). Within this, physical capital per worker remained almost constant, while the beneficial effects of higher educational attainment (human capital) were offset by a steady and substantial *decline* in TFP. However, there are significant differences between oil-exporting and non-oil MENA countries. For the oil exporters, output per worker fell, on average, by about 1 percent a year during 1980–2000.[1] While human capital improved steadily, this was more than offset by sharp declines in physical capital per worker and TFP. The one exception was Iran, where TFP slightly increased during this period.[2] In contrast, output per worker in the non-oil countries rose by 1.4 percent a year during 1980–2000, which was above the average rate for 45 developing countries outside east Asia (albeit substantially below the rate for east Asian developing countries). Unlike in the oil exporters, over half of this growth was accounted for by increases in physical capital per worker, accompanied again by solid improvements in human capital. Reflecting a pattern common to other developing countries outside east Asia, TFP stagnated (and in a number of countries, including Morocco, Syria, and Jordan, declined).

Three striking aspects of these findings are worth noting.

- First, the contribution to growth from increases in human capital in MENA countries was generally greater than in other developing country regions, including east Asia. In addition, the growth contribution of human capital often exceeds, proportionally, the contributions coming from increases in physical capital and TFP, a pattern not found elsewhere. This finding reflects the sharp rise in the average years of schooling for the population aged 15 and older (the proxy measure for human capital) from just 3.3 years in 1980 to 5.8 years by 2000, which, in turn, reflected the substantial efforts at improving education in the region.[3]
- Second, and less favorably, the growth contribution of physical capital per worker has been small, especially given the relatively high levels of investment. In part, this has reflected the strong growth in the labor force, which, everything else being equal, required more investment (as a percent of GDP) for the capital stock per worker to increase at the same rate as elsewhere. In addition, while the high

Note: The main authors of this box are Barry Bosworth and Susan Collins.

[1]The country coverage differs from that in the main text.

[2]Given the difficulties in measuring the implications of the 1990 invasion on Kuwait's capital stock, the average rate of decline in TFP may be overstated. However, substantial TFP declines are also obtained if the years 1990–91 are omitted from the calculations.

[3]As noted in the table, the contribution from increases in human capital is included in the TFP residual for Saudi Arabia and United Arab Emirates due to data limitations, implying that the "true" TFP declines would be even larger if increases in human capital similar to those in other oil-exporting countries were assumed.

Box 2.1 *(concluded)*

Growth Accounts, 1980–2000[1]

Countries and Regions (number of countries)	Average Annual Rates of Change					Capital/Output		Investment/ Output
			Contribution of					
			Capital/worker					
	Output	Output/ worker	Physical	Human	TFP	1980	2000	
Middle East and North Africa (10)	3.1	–0.2	–0.1	0.6[2]	–0.7	2.1	2.1	22.5
Non-oil countries (5)	4.3	1.4	0.8	0.6	—	2.3	2.5	23.7
Egypt	4.9	2.2	0.9	0.8	0.5	2.3	2.5	27.0
Jordan	3.5	–1.7	0.2	0.6	–2.5	1.9	2.9	27.6
Morocco	3.0	0.5	0.3	0.4	–0.2	2.2	2.4	19.1
Syria	3.8	—	0.5	0.5	–0.9	1.7	2.2	20.3
Tunisia	4.1	1.3	0.5	0.4	0.4	2.8	2.8	26.2
Oil-exporting countries (5)	2.4	–1.1	–0.6	0.6[2]	–1.1	2.0	1.9	19.6
Algeria	2.2	–1.5	–0.3	0.6	–1.8	2.9	3.1	24.7
Iran	3.4	0.7	—	0.6	0.2	2.2	1.9	15.1
Kuwait	0.3	–2.1	0.8	0.6	–3.5	0.9	2.1	18.6
Saudi Arabia	1.4	–3.1	–1.5	. . .	–1.6	1.6	1.1	26.7
United Arab Emirates	2.8	–1.9	–1.4	. . .	–0.5	1.7	1.3	19.7
Other developing countries (45)	3.4	1.0	0.5	0.4	0.1	2.2	2.4	18.0
East Asia (7)[3]	6.4	3.9	2.4	0.5	0.9	1.7	2.8	29.2

Sources: Bosworth and Collins (2003); and World Economic Outlook database.
[1]All regional averages are weighted by GDP at purchasing-power-parity exchange rates.
[2]Excludes Saudi Arabia and United Arab Emirates.
[3]Excludes China.

investment of the 1970s resulted in relatively high ratios of the capital stock to GDP in the early 1980s (see the table), this investment was not always productive, as evidenced by the low growth that ensued. Accordingly, average capital productivity was relatively low during the latter period, diminishing the beneficial effect of high investment ratios on capital stock.

- Third, TFP growth in many countries in the region has been disappointing. While—as noted above—this may partly reflect the variety of shocks that the region has experienced, it also suggests that there is significant scope to improve the efficiency with which resources are used.

As already noted, the central challenge facing many MENA countries is the relatively high level of unemployment; in contrast, investment and capital-output ratios are now often average to high by developing country standards—particularly in the non-oil-exporting countries. This suggests that, in the past, economic policies and incentives have been focused relatively too much on encouraging investment—not least through the public sector—at the expense of policies that would promote efficiency and create employment.

Are Foreign Exchange Reserves in Asia Too High?

The main author of this essay is Hali Edison. Emily Conover and Yutong Li provided research assistance.

Global foreign exchange reserves have risen sharply over the past decade, with the buildup accelerating over time and the bulk of the increase occurring in emerging market countries (Figure 2.8). Reserves almost doubled from 4.1 percent of world GDP in 1990 to 7.8 percent of world GDP in 2002, and rapid reserve accumulation has continued in the first half of 2003. The share of global reserves held by emerging market countries rose from 37 percent in 1990 to 61 percent in 2002, with emerging economies in Asia accounting for much of the increase (Figure 2.9). During the recent period of U.S.

dollar weakness, real effective exchange rates in most emerging market economies have depreciated and reserves in emerging economies in Asia have increased at a record pace (see Chapter I).

The rapid accumulation of foreign exchange reserves over the past decade, especially in emerging Asia, raises important questions.

- Why do countries hold reserves? How do economic size, external vulnerability, and exchange rate flexibility affect reserve holdings?
- What are the recent trends in reserves, once they are appropriately scaled?
- What explains a country's reserve holdings in a richer empirical framework? Are reserves in some emerging economies now greater than warranted by fundamentals?
- What are the policy implications? Is it time for emerging economies in Asia to consider slowing the pace of reserve accumulation?

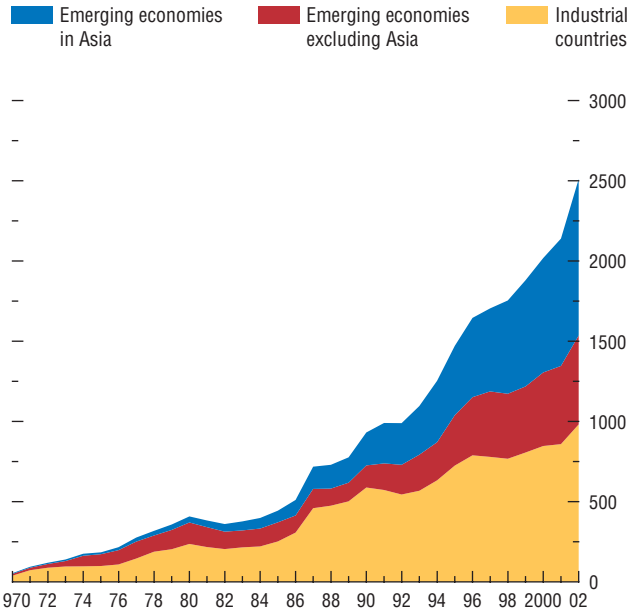
The essay is organized as follows. The first section discusses why countries hold reserves, suggesting that the demand for reserves depends positively on economic size, current account vulnerability, and capital account vulnerability, and negatively on exchange rate flexibility and opportunity cost. Recent trends in reserves scaled by imports, short-term external debt, and broad money are presented next, showing that reserve ratios in emerging market countries have generally increased over the past decade—in some cases quite sharply. The discussion then turns to an empirical model that simultaneously incorporates the various determinants of reserve holdings. The main finding is that reserves in many emerging market economies have increased more quickly since 2001 than warranted by fundamentals. The final section concludes that reserves in emerging economies in Asia are now at the point where some slowdown in the rate of accumulation is desirable from both domestic and multilateral perspectives.

Why Do Countries Hold Reserves?

A country's foreign exchange reserves consist of the financial assets under the control of the

Figure 2.8. Foreign Exchange Reserves
(Billions of U.S. dollars)

The stock of global reserves increased rapidly in the 1990s.



Source: IMF, *International Financial Statistics.*

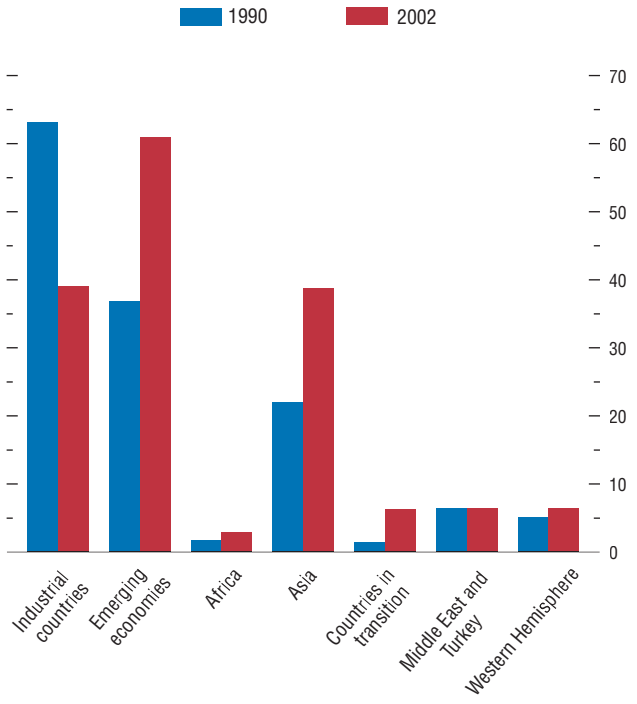
monetary authority that are readily available for balance of payments financing. While the definition of reserves is straightforward, measuring them is more complicated because of the need to account for future claims on reserves, for example, from derivative contracts (Box 2.2). The ideal solution would be to net out those claims on reserves that might result in immediate drains on reserves and other elements that might overstate gross reserves, yielding a concept of "usable reserves." To help implement this concept, the IMF developed in 1999 a template for reporting reserves, which is now being used by about 50 countries, including 30 emerging market countries. However, data on usable reserves are only available for a very limited period, so this essay focuses on gross foreign reserve assets net of gold.[20]

The main reason why countries hold foreign exchange reserves is to smooth unpredictable and temporary imbalances in international payments. Thus, the basic idea in the theory of the demand for reserves is that a country chooses a level of reserves to balance the macroeconomic adjustment costs incurred if reserves are exhausted (the precautionary motive) with the opportunity cost of holding reserves.[21] Building on this theory, empirical work has identified a relatively stable long-run demand for reserves that is based on a limited set of explanatory variables.[22] There are five key factors that explain reserve holdings.

- *Economic size.* To the extent that international transactions increase with economic size, reserves are expected to rise with population and real GDP per capita.
- *Current account vulnerability.* A more open economy is more vulnerable to external shocks, so greater trade openness would be

Figure 2.9. Share of Global Reserves
(Percent of global reserves)

Reserve holding patterns have changed over time, reflecting the surge in reserve accumulation in emerging economies in Asia.



Source: IMF, *International Financial Statistics.*

[20]Most emerging market countries hold very little gold. Including gold valued at market prices does not affect the conclusions of this essay.

[21]See Heller (1966) and Frenkel and Jovanovic (1981).

[22]See Heller and Khan (1978), Edwards (1983, 1985), Lizondo and Mathieson (1987), Lane and Burke (2001), Flood and Marion (2002), and Aizenman and Marion (2002a, 2002b).

associated with higher reserve holdings. Also, the larger the external shocks (say, export volatility), the higher the level of reserves.

- *Capital account vulnerability.* As with the current account, greater financial openness could be associated with higher crisis vulnerability and thus influence the demand for reserves. In addition, the greater the potential for resident-based capital flight from the domestic currency, the higher the level of reserves.
- *Exchange rate flexibility.* Greater flexibility reduces the demand for reserves, because central banks no longer need a large stockpile of reserves to manage a pegged exchange rate. However, many countries that have adopted more flexible exchange rate regimes (including managed floats) appear reluctant to allow much actual variability.[23] Consequently, it is important to focus on the actual behavior of exchange rates, which suggests that there has in fact been some increase in exchange rate flexibility in recent years, especially in several emerging Asian economies (Figure 2.10).[24]
- *Opportunity cost.* The opportunity cost of holding reserves is the difference between the yield on reserves and the marginal productivity of an alternative investment. The greater the opportunity cost, the lower the level of reserves. With industrial country interest rates hitting 40–50 year lows in many countries (see Chapter I), the cost of holding foreign exchange reserves has likely increased for many emerging economies over the past three years.

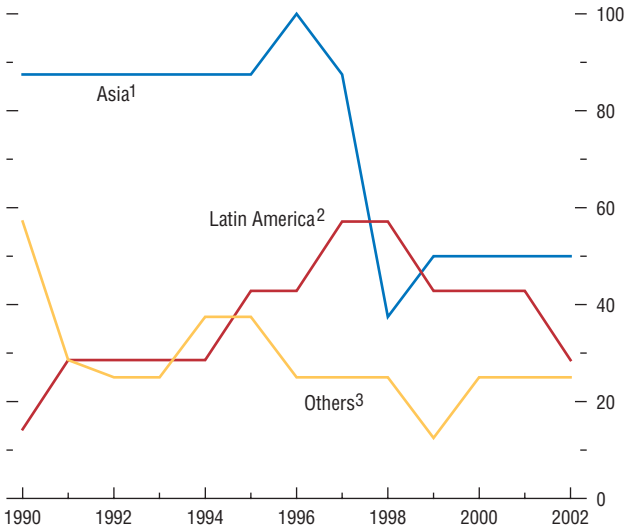
[23]See Calvo and Reinhart (2002), who argue that there seems to be a "fear of floating"; see also Reinhart and Rogoff (forthcoming).

[24]The classification of exchange rate regimes is based on Reinhart and Rogoff (2002), which is generally consistent with Baig (2001), Calvo and Reinhart (2002), Hernández and Montiel (2001), and Levy-Yeyati and Sturzenegger (2002). Note that (1) in Asian emerging economies, exchange rate volatility actually declined a little between 1997 and 2002, but not by enough to warrant a reversal of the change in exchange rate classification; (2) all the results in this paper also hold if the official exchange rate classification is used; and (3) in India, exchange rate flexibility has increased somewhat in recent months.

Figure 2.10. Selected Emerging Economies: Exchange Rate Regimes

(Percent of exchange rate regime with limited flexibility within each group)

Several emerging markets have moved toward more flexible exchange rate arrangements.



Source: IMF staff estimates based on Reinhart and Rogoff (2004).
[1]China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, and Thailand.
[2]Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. Argentina was reclassified in 2002 as a managed floater.
[3]Czech Republic, Hungary, Israel, Pakistan, Poland, Russia, South Africa, and Turkey.

Box 2.2. Measuring Foreign Reserves

The definition of foreign reserves is straightforward, but their measurement is more complicated. Reserves are defined as foreign financial assets controlled by the monetary authorities that are readily available for balance of payments financing.[1] This means that reserves need to be liquid claims in foreign currency on nonresidents under control of the central bank, so that they can be used for operations in the foreign exchange market or repayment of external debt. In practice, there are often claims on reserves that can restrict their availability or result in drains, including derivative positions, the use of reserves as collateral for loans, and the investment of reserves with the government or domestic banks. If such claims need to be met immediately, then some reserve assets cannot be used for balance of payments financing and should not be counted as reserves (see IMF, 2000).

In practice, a useful concept is usable reserves, which nets out any questionable item from reserves. In deriving usable reserves, a primary consideration is the net short position in foreign currency derivatives, which in past crises has severely hindered the availability of reserves. Such positions can quickly become large when the authorities try to defend unsustainable exchange rates through forward sales of foreign currency. For example, in Thailand, forward liabilities contracted by the central bank in support of the domestic currency in 1997 were in excess of $25 billion, a level comparable to gross reserves. Derivatives can impose immediate drains on reserves for two reasons. First, foreign currency derivatives can be subject to margin calls so a movement in the exchange rate can result in an immediate claim on reserves. Second, while few central banks in practice need explicit pledges to take derivative positions, such pledges may be forced upon them in a crisis.

Another important issue in measuring reserves is the valuation of gold. While gold remains an important reserve asset, especially for larger industrial countries, it is no longer the core asset of reserve holdings. For emerging market economies, gold now constitutes only about 3 percent of total reserve holdings, compared with an average of 25 percent in the period 1950–70. If the *level* of reserves is being assessed, then gold should be valued at market prices, to reflect the value it would provide if sold.[2] Even for those emerging market countries with large holdings, gold is likely to be sufficiently liquid at times when the central bank would really need it (for example, during a crisis in the international financial system).[3] If the focus is on the *accumulation* of reserves, then gold could be valued at constant prices, to filter out valuation adjustments.

To help ensure that all the relevant information on the availability of reserves is available in the public domain, the IMF with the support of the G-10 developed in 1999 a template for reporting reserves, which is now being used by over 50 countries.[4] In addition to the gross amount of reserves, the template reports a breakdown of reserves and other foreign currency assets, as well as many potential drains on reserves, such as repayment obligations of the central bank and government. The information on drains is provided to help determine whether such drains pose any limitations on the availability of the reserves, and what claims might reduce reserves in the foreseeable future.[5]

With the introduction of the template, data reporting on reserves has significantly improved.[6] Nevertheless, for statistical analysis, time series on usable reserves are not yet sufficiently long. Thus, for the time being, cross-country empirical studies need to continue to use gross reserves, as is the case for this essay.

Note: The main author of this box is Christian Mulder.

[1]See IMF (1993), paragraph 424.

[2]See IMF (2001), paragraph 135.

[3]Many countries assign a fixed price to gold, which helps to insulate the central bank's accounting profits from fluctuations in the price of gold. It would be undesirable for the central bank's profit remittances to increase just because, say, widespread inflation concerns cause gold to become more valuable.

[4]Countries that subscribe to the IMF's Special Data Dissemination Standards are required to use the template. Other countries are encouraged to do so.

[5]The reserve template allows, in line with standard practice, for several ways of booking certain assets, some of which may lead to an overstatement of reserves. For example, banks may lend securities but keep both the securities and the cash received for the lent securities on their books. This is not a preferred method, but if done the template provides information on the drain to allow for netting (IMF, 2001, paragraph 85).

[6]These data can be accessed via the IMF website at http://www.imf.org/external/np/sta/ir/topic.htm.

What Are the Recent Trends in Reserves?

Comparisons of reserve holdings across countries and over time need to be scaled to reflect country characteristics and changes therein over time. Based on the foregoing discussion of the main factors that influence a country's level of reserve holdings, three scaling methods are considered.

- *Months of imports.* This ratio represents the number of months for which a country can support its current level of imports if all other inflows and outflows stop.
- *Short-term external debt based on remaining maturity.* This ratio is an indicator of the likelihood and depth of a financial crisis, as it reflects the country's ability to service external debt falling due in the coming year if external financing conditions deteriorated sharply.
- *Broad money.* Like the ratio to short-term external debt, this ratio is an indicator of reserve adequacy in the event of a financial crisis, as it reflects the potential for resident-based capital flight from the domestic currency.[25]

These three reserve ratios are calculated for the standard set of selected emerging market economies (data limitations preclude calculations for all emerging market countries).[26]

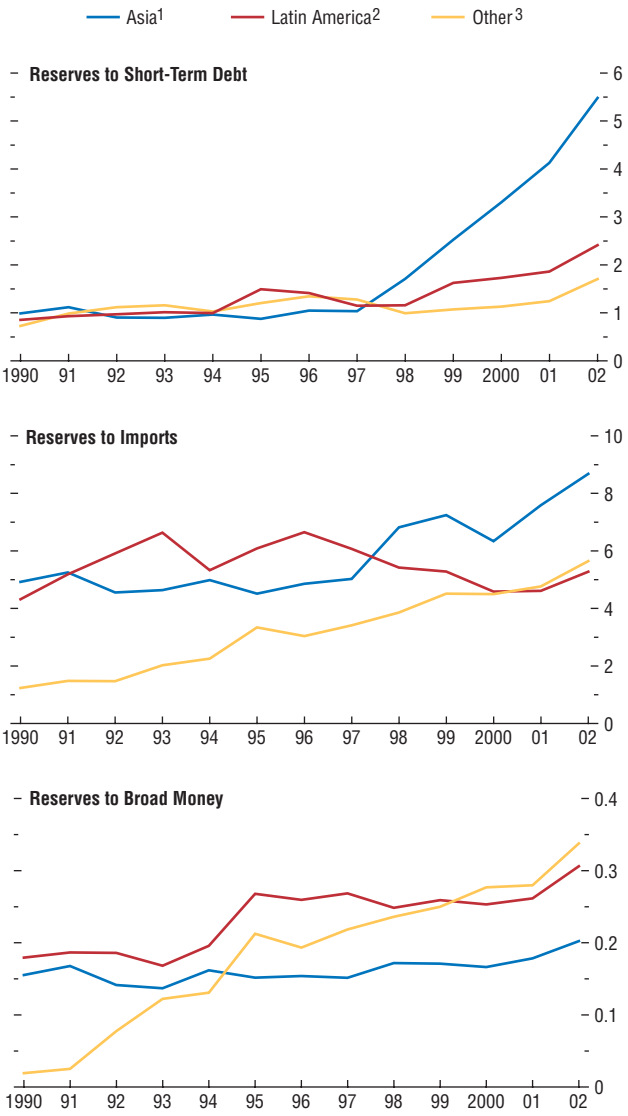
Reserve ratios in emerging market countries have generally increased over the past decade (Figure 2.11). Since the mid-1990s, the ratios of reserves to short-term debt and reserves to imports increased most sharply for emerging economies in Asia, while the ratio of reserves to broad money rose quickly for emerging market countries outside Asia and Latin America. This divergence is not surprising, given that the data for Asia are dominated by China, which is less financially developed and therefore a country in

[25]This ratio was used extensively during the gold standard and again by Calvo (1996).

[26]The economies are divided into three regional groups: Asia (China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Taiwan Province of China, and Thailand), Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela), and others (Czech Republic, Hungary, Israel, Pakistan, Poland, Russia, South Africa, and Turkey).

Figure 2.11. Selected Emerging Economies: Reserve Accumulation

Increases in reserves are apparent for most emerging markets when reserves are scaled by standard ratios.



Sources: CEIC Data Company Limited; IMF, *International Financial Statistics;* and IMF staff calculations.

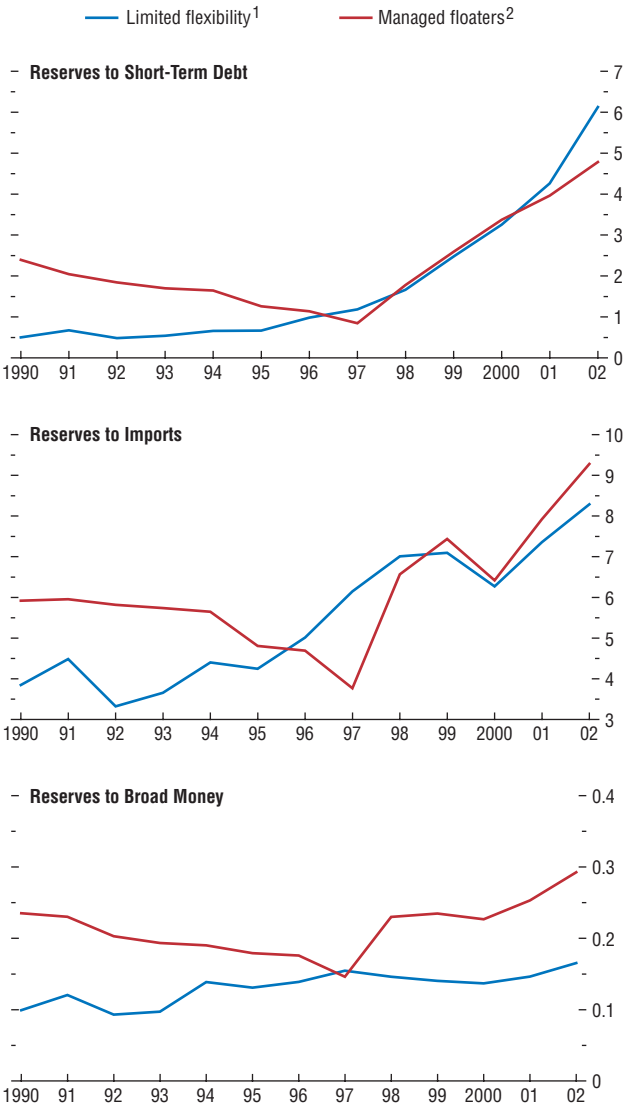
[1]China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Taiwan Province of China, and Thailand.

[2]Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.

[3]Czech Republic, Hungary, Israel, Pakistan, Poland, Russia, South Africa, and Turkey.

Figure 2.12. Selected Emerging Economies in Asia: Reserve Accumulation

In emerging economies in Asia, reserve buildup has been similar across exchange rate regimes.



Sources: CEIC Data Company Limited; IMF, *International Financial Statistics;* Reinhart and Rogoff (2004); and IMF staff calculations.
[1]China, Hong Kong SAR, India, and Malaysia.
[2]Indonesia, Korea, the Philippines, Taiwan Province of China, and Thailand.

which high savings are typically channeled into bank deposits. The main exception to the general increase in reserves is Latin America, where the ratio of reserves to imports declined during the second half of the 1990s but that decline has partly reversed in 2002. Within emerging economies in Asia, both economies with limited exchange rate flexibility and those with managed floating exchange rates experienced large increases in reserves (Figure 2.12).

What Explains a Country's Reserve Holdings?

This section develops a richer framework to examine the recent increase in the level of reserves in emerging market economies, moving beyond simple ratios to an empirical model that simultaneously incorporates the various determinants of reserve holdings. Specifically, a multivariate regression model is used to explore the factors discussed above, using data from 1980 through 2002 to capture the most recent surge in reserves.[27] The explanatory variables used in the analysis are the empirical counterparts of the factors discussed above for which data are available (unfortunately, too few historical data on short-term debt are available). The model is estimated using panel data for 122 emerging market countries from 1980 to 1996 and the remaining years are used to compare out-of-sample forecasts with actual reserve buildups.[28]

The simple correlations between reserves and each of the explanatory variables are consistent with the theoretical predictions (Table 2.2). As expected, real reserves are positively and significantly correlated with indicators of economic size (real GDP per capita and population) and

[27]Detailed data on the currency composition of reserves necessary to calculate the impact of valuation changes are not available. However, valuation changes are not believed to have a large input, because most reserves are held in U.S. dollar–denominated assets, and the period under investigation includes times of both U.S. dollar strength and weakness.

[28]This work builds on Aizenman and Marion (2002a, 2002b) by expanding the set of explanatory variables to include measures of financial openness, potential for capital flight, and opportunity cost, and extending the data set through 2002.

Table 2.2. Simple Regressions of Reserves on Explanatory Variables

(Sample: emerging economies, 1980–96)

	Dependent Variable: Real Reserves
Economic size	
Real GDP per capita	1.63**
Population	2.37**
Current account vulnerability	
Ratio of imports to GDP	0.57**
Trade openness	0.16
Export volatility	0.11+
Capital account vulnerability	
Financial openness	0.18
Ratio of broad money to GDP	0.15
Exchange rate flexibility	
Exchange rate volatility	−0.01**
Opportunity cost	
Nominal interest rate differential	−0.01**
Real interest differential	−0.01**

Source: IMF staff estimates.
Notes: All regressions include fixed effects; + denotes significance at 10 percent; * significance at 5 percent; and ** significance at 1 percent.

Table 2.3. Multiple-Variable Regression Results for Reserves

(Sample: emerging economies, 1980–96)

	Dependent Variable: Real Reserves
Real GDP per capita	1.44
	(6.23)**
Population	1.98
	(4.85)**
Imports to GDP	0.44
	(3.58)**
Export volatility	0.09
	(0.92)
Exchange rate volatility	−0.01
	(2.02)*
Number of observations	1,692
R^2	0.91

Source: Estimates based on country fixed effects and a constant.
Notes: Robust *t* statistics in parentheses; * denotes significance at 5 percent; ** denotes significance at 1 percent.

current account vulnerability (the ratio of imports to GDP and export volatility).[29] The correlations between real reserves and indicators of capital account vulnerability (financial openness and the ratio of broad money to GDP, which reflects the potential for capital flight) are correctly signed, but are not significant.[30] Consistent with theory, indicators of both exchange rate flexibility and the opportunity cost of holding reserves are negatively and significantly correlated with real reserves.[31]

The results of the multiple-variable analysis of the demand for reserves are largely in line with those of the simple correlations and with those in the existing literature (Table 2.3).[32] Explanatory variables with insignificant estimated coefficients have been dropped from the regression, with the exception of export volatility, which has the expected sign and has been found by several other studies to be significant. The empirical model, which includes country fixed effects, accounts for over 90 percent of the variation in reserves and the results are robust.[33] As foreshadowed by the simple correlations, real reserves are positively and significantly related to economic size (both real GDP per capita and population) and current account vulnerability (the ratio of imports to GDP), and negatively and significantly related to exchange rate volatility.[34] Indicators of capital account vulnerability (financial openness

[29]Real reserves are defined as nominal reserves in U.S. dollars deflated by the U.S. consumer price index. Real GDP per capita and population are measured in logs. Export volatility is defined as the standard deviation of real export receipts.

[30]Financial openness is defined as the ratio of capital flows to GDP, which is highly correlated with the stock measure.

[31]Exchange rate volatility is defined as the standard deviation of monthly changes in the exchange rate against the U.S. dollar. The nominal interest differential is the domestic deposit rate minus the interest rate on U.S. treasury bills. The real interest differential deflates nominal interest rates by the respective consumer price inflation rates.

[32]See Flood and Marion (2002) and Aizenman and Marion (2002b).

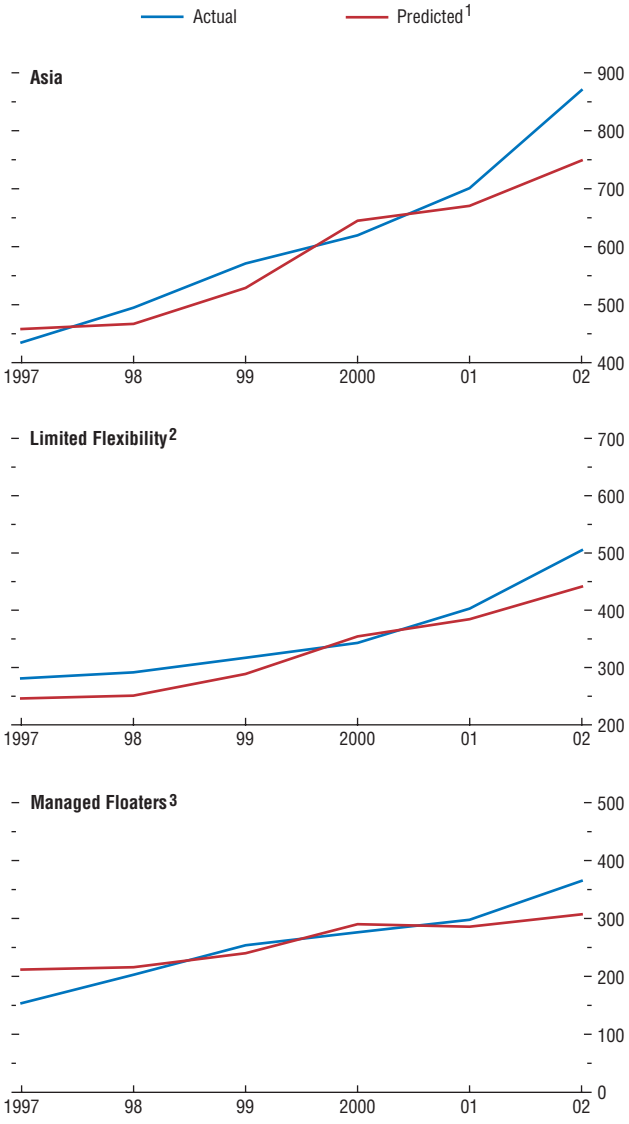
[33]Four robustness tests were conducted. First, when reserves were redefined to include gold valued at market prices, the coefficient estimates and significance levels were essentially unchanged. Second, when a time trend was added (to take account of the fact that several explanatory variables may be trending and thus lead to spurious results), the main results were unchanged, but as expected the estimates of the coefficients on the trending real GDP per capita and population variables fell. Third, when the model was estimated through 2000, the results—coefficient estimates and forecasts—were consistent with the reported results, suggesting that there is no structural break in the late 1990s as a result of the financial crisis. Fourth, when the model was estimated over different country samples the results were similar.

[34]This analysis implicitly treats exchange rate volatility as an exogenous policy choice.

Figure 2.13. Selected Emerging Economies in Asia: Actual and Predicted Reserves

(Billions of U.S. dollars)

The rapid reserve accumulation in emerging economies in Asia between 1997 and 2001 is consistent with the evolution of fundamentals, but the acceleration in 2002 is not well explained. Reserves are now greater than predicted both in economies with limited exchange rate flexibility and in those with managed floating exchange rates.



Sources: IMF, *International Financial Statistics;* and IMF staff estimates.
[1]Based on the empirical model described in the main text.
[2]China, Hong Kong SAR, India, and Malaysia.
[3]Indonesia, Korea, the Philippines,Taiwan Province of China, and Thailand.

and the ratio of broad money to GDP) are not significantly correlated with reserves. As in previous empirical studies, the opportunity cost of holding reserves is also not a significant determinant of reserves, reflecting measurement problems and the impact of the correlation between explanatory variables on the precision of the coefficient estimates.

How does the reserve buildup in emerging market economies between 1997 and 2002 compare with the model's forecasts based on evolving fundamentals? For emerging economies in Asia as a whole, reserve accumulation between 1997 and 2001 is broadly in line with the forecast, but the acceleration in 2002 is well in excess of what one would expect based on fundamentals (Figure 2.13).[35] The main drivers of the increase in predicted reserves are rising real GDP per capita and rising population, with the rising propensity to import also making a positive contribution, while falling export volatility subtracted from the predicted buildup. The lower panels of the figure show that, when emerging economies in Asia are divided into economies with limited exchange rate flexibility and those with managed floating exchange rates, most countries in both groups have experienced reserve buildups that exceed the model's forecasts.

By contrast, reserve accumulation in Latin America has been basically flat (Figure 2.14). Actual reserves have fallen slightly, while predicted reserves have risen gently, reflecting the positive impact of population growth that more than offsets negative contributions from falling real GDP per capita and declining import shares (especially in Argentina and Venezuela) as well as from rising exchange rate volatility. The lower panels of the figure show that Mexico is primarily responsible for the excess of actual reserves over predicted reserves in recent years. Also, actual reserves in Mexico have risen considerably over the past five years, while actual reserves in other emerging markets countries in Latin America have trended down.

[35]In some individual countries, excess reserves became apparent somewhat earlier.

Reserves in other emerging market countries have also increased, though significantly less sharply than in emerging economies in Asia (Figure 2.15). Until 2001, this increase was in line with that predicted by fundamentals, reflecting improving living standards, growing populations, and greater import penetration. The lower panels of the figure show that Russia is largely responsible for the excess of actual reserves over predicted reserves in recent years, reflecting mainly the large increase in the value of oil exports. Actual reserves in other emerging market countries in 2002 were broadly in line with predicted reserves.

What Are the Policy Implications?

The previous analysis suggests that foreign exchange reserves in some emerging market economies have recently increased more quickly than warranted by traditional considerations. The rapid accumulation of reserves between 1997 and 2001 was broadly in line with fundamentals, but the surge in reserves in 2002—which has continued into 2003—was above the level predicted by the model. This surge in reserves has been largely driven by increases in the current account and to a lesser extent by capital flows. Emerging market economies in Asia, as well as some others like Russia and Mexico, account for much of the excess of actual reserves over predicted reserves.

Holding excess reserves entails costs and benefits, which can be divided into three main categories: crisis prevention, domestic issues, and multilateral concerns.

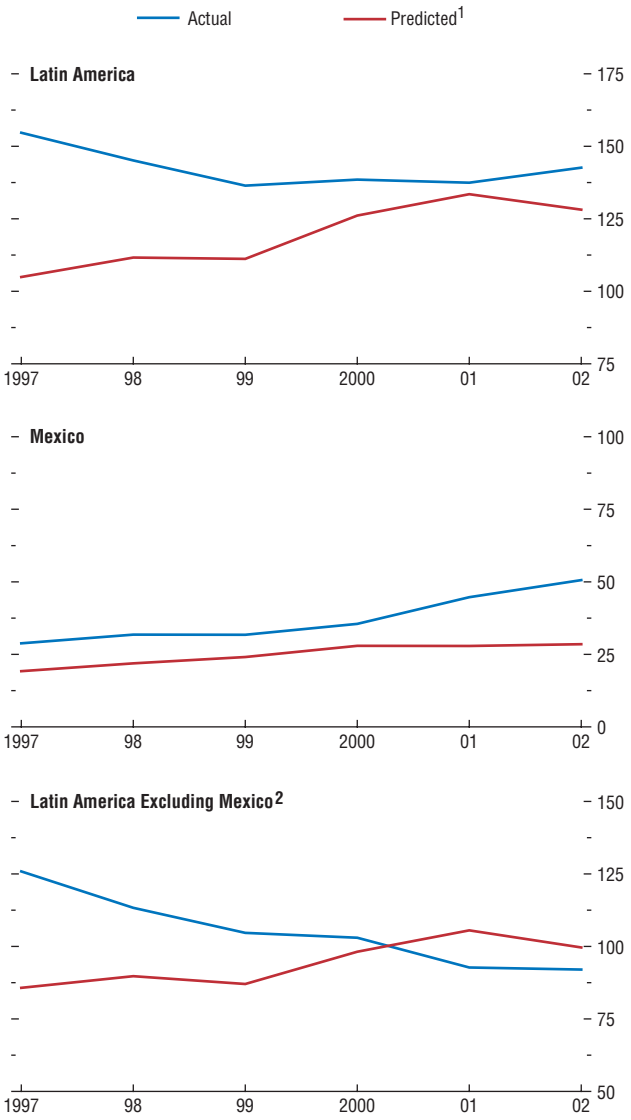
Crisis Prevention

First, there is considerable evidence that higher reserves reduce both the likelihood of a crisis and the depth of a crisis, should one occur.[36] Thus, reserves serve as a cushion against

[36]There is by now a large empirical literature on Early Warning Systems (EWS), including Berg and Pattillo (1999a), Berg and others (1999), Edison (2000), and Goldstein, Kaminsky, and Reinhart (2000).

Figure 2.14. Selected Emerging Economies in Latin America: Actual and Predicted Reserves
(Billions of U.S. dollars)

Reserve holdings in Latin America have been relatively flat. Mexico's reserves have risen more quickly than predicted by fundamentals.

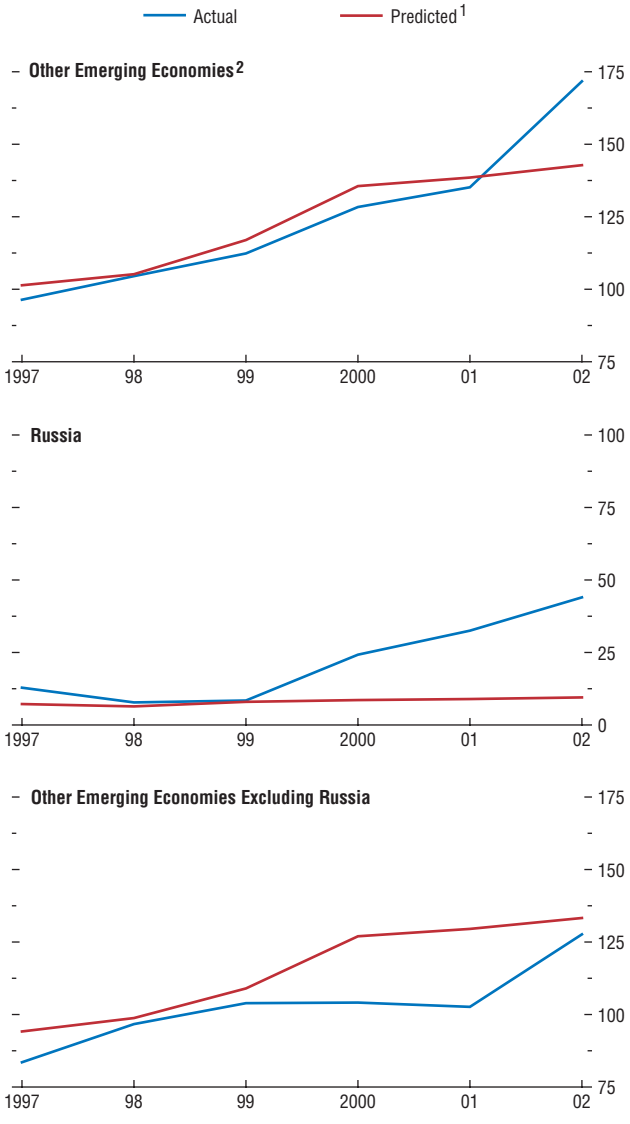


Sources: IMF, *International Financial Statistics;* and IMF staff estimates.
[1]Based on the empirical model described in the main text.
[2]Argentina, Brazil, Chile, Colombia, Peru, and Venezuela.

Figure 2.15. Selected Other Emerging Economies: Actual and Predicted Reserves

(Billions of U.S. dollars)

The reserve buildup over the past five years is broadly in line with fundamentals, except for the surge in 2002. Actual reserves in Russia are now well above their predicted levels.



Sources: IMF, *International Financial Statistics;* and IMF staff estimates.
[1]Based on empirical model described in the main text.
[2]Czech Republic, Hungary, Israel, Pakistan, Poland, Russia, South Africa, and Turkey.

Table 2.4. Benefits of Eliminating Consumption Volatility (Upper Bounds)

(Percent of GDP)

	Risk Aversion	
	Low	High
Output volatility		
Low	0.11	0.21
High	0.22	0.45

Note: Calculations based on Obstfeld and Rogoff (1999), p. 330, equation 75. Ljungqvist and Sargent (2000) suggest that values of relative risk aversion between 2 (low) and 4 (high) are reasonable.

an undesired shortage of international currency that would damage the economy. One way of thinking about the value of this cushion is in terms of smoothing consumption. An upper bound on the value of holding reserves is a country's willingness to pay for the elimination of all consumption volatility. Clearly, this willingness to pay increases with risk aversion and output volatility. As shown in Table 2.4, this willingness to pay could range from zero to about ½ percent of GDP, given sensible values of risk aversion and output volatility.[37] Given the experience in emerging market countries over the past decade, it would certainly be understandable if this motive were a factor behind the reserve buildup.[38] To the extent that higher reserves lower crisis vulnerability, they can also help to lower borrowing costs and limit exposure to changing market sentiment.

However, there are limits to the level of reserves needed to prevent financial crises. The empirical literature on the emerging market crises of the 1990s, including work done at the IMF, suggests that a ratio of reserves to short-term debt above 1 marks an important reduction in crisis vulnerability, as long as the current account balance is not out of line and the exchange rate is not misaligned (Box 2.3). The rationale is that, if reserves exceed short-term debt, then a country

[37]This calculation is based on Obstfeld and Rogoff (1999), who show that the cost of exclusion from global capital markets is a function of how much volatility a country faces.

[38]Lee (2003) suggests that the insurance motive helps to explain the high level of reserves held by many Asian economies.

Table 2.5. Illustrative Sterilization Costs
(Percent of GDP)

	Expected Depreciation	
	0 Percent	5 Percent
Interest spread		
5 percent	0.5	0.0
10 percent	1.0	0.5

Note: Table is based on the assumption that reserve accumulation is 10 percent of GDP.

Table 2.6. Selected Emerging Market Countries: Sources of Reserve Accumulation,[1] 2001–02
(Billions of U.S. dollars)

	Increase in Reserves	Current Account	Capital and Financial Account[2]	Errors and Omissions
Asia[3]	252.5	194.0	50.3	8.2
Latin America[4]	1.7	−53.3	63.1	−8.0
Other[5]	39.7	38.9	9.4	−8.6

Source: World Economic Outlook database.
[1]In balance of payments terms.
[2]Excluding change in reserves.
[3]China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Taiwan Province of China, and Thailand.
[4]Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.
[5]Czech Republic, Hungary, Israel, Pakistan, Poland, Russia, South Africa, and Turkey.

can be expected to meet its obligations over the forthcoming year and thus avoid rollover problems that stem from concerns about liquidity. While the ratio of reserves to short-term debt is now between 1 and 2 in Mexico, it is much higher in emerging economies in Asia, so there is a real question about whether a further buildup in reserves in these latter economies would do much to reduce crisis vulnerability.[39]

In addition, to the extent that rapid reserve accumulation reflects exchange rate rigidity, it might actually *increase* vulnerability to a crisis. Exchange rate rigidity can boost capital inflows by reinforcing the perception of a one-way bet, given a positive interest differential. The prolonged buildup in interest-sensitive capital inflows, and associated increase in unhedged foreign currency exposure in the corporate sector, can increase the economy's vulnerability, and possibly even increase the risk of a crisis. In conjunction with exchange rate rigidity, a high level of reserves can create moral hazard in the private sector by discouraging companies and households from taking out adequate insurance against the risk of exchange rate variability.

Domestic Costs

Second, there are important costs to holding and accumulating foreign exchange reserves. The cost of holding reserves is the difference between the interest paid on the country's public debt and the interest earned on reserves, typically the interest rate on U.S. treasury or similar debt.[40] In most emerging market countries, domestic assets earn a higher return than foreign assets. In addition, the reserve buildup is typically sterilized—that is, the central bank reduces net domestic assets to offset the increase in net foreign assets.[41] The cost of sterilization depends positively on the amount of reserve accumulation and the interest spread (net of the risk premium), and negatively on the expected depreciation of the domestic currency. The cost of sterilizing a reserve accumulation of 10 percent of GDP (which has been fairly typical recently in emerging economies in Asia) can range from zero to 1 percent of GDP, depending on the interest spread and the expected exchange rate depreciation (Table 2.5).[42]

Rapid reserve accumulation may also reflect an undervalued exchange rate. Table 2.6 shows that while Latin America (including Mexico) ran a current account deficit over the past two years,

[39]Also, reserves help to prevent crises only if the crises are of the speculative attack variety; if the fundamentals are out of line, then additional reserves do not help and actually may make things worse, because of the associated fiscal costs (Kletzer and Mody, 2000).

[40]An increase in reserves implies an equal increase in public debt; equivalently, if the additional reserves were not added to the central bank's assets, then the same amount of public debt could have been purchased by the central bank.

[41]If the reserve buildup is not sterilized, then it boosts base money growth, fueling inflationary pressures, as in China and Russia.

[42]This range is somewhat higher than the estimates in the literature—¼ to ½ percent of GDP (see Khan and Reinhart, 1995)—because of the large assumed reserve accumulation.

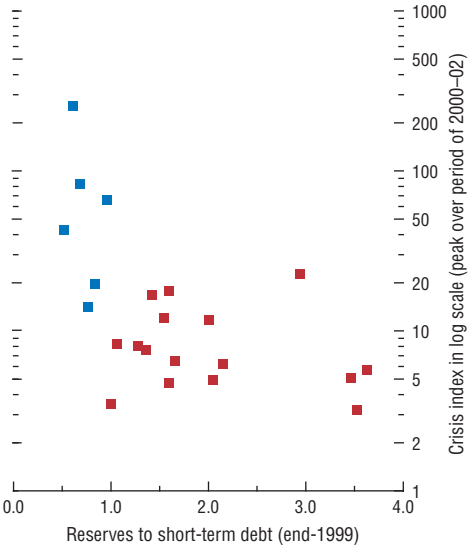
Box 2.3. Reserves and Short-Term Debt

Following the crises in several emerging market countries in the late 1990s, the assessment of reserve adequacy for crisis prevention has increasingly focused on the ratio of reserves to short-term external debt by remaining maturity (see IMF, 2000; and Wijnholds and Kapteyn, 2001). While other factors such as the scope for capital flight by residents and the quality of private debt management also need to be taken into account, short-term debt is the main source of capital outflow and the capital (and not the current) account is a key source of external risk.[1] A large empirical literature has found the ratio of reserves to short-term debt to be closely related to the likelihood and depth of crises.[2]

A benchmark value of 1 for the ratio of reserves to short-term debt is important for crisis prevention. If reserves exceed short-term debt, then—in the absence of a current account deficit and capital flight by nonresidents—a country can be expected to meet its external cash flow needs at least for the forthcoming year, which can help prevent rollover problems that stem from concerns about liquidity. Indeed, capital market access for emerging economies that are fundamentally solvent does not usually dry up for more than three to six months. Thus, a ratio of reserves to short-term debt of 1 provides a cushion to weather interruptions in capital market access and reestablish market confidence.

The practical relevance of the benchmark of 1 for the ratio of reserves to short-term debt is supported by formal empirical work. Bussière and Mulder (1999) estimate the level of reserves that corresponds to averting a crisis during three periods of external financing pressures for emerging market countries. They find that the necessary level broadly corresponds to a ratio of reserves to short-term debt of 1, though an external current account deficit or a significantly overvalued exchange rate imply significantly higher required reserves.[3] This is illustrated in the figure, which shows for selected emerging market countries a scatter plot of the ratio at the end of 1999 and crisis pressures over 2000–02. Crisis pressures are measured as a weighted average of the loss in reserves and the change in the exchange rate, with the weight varying inversely with the variance. Countries with a ratio of reserves to short-term debt less than 1—that is, short-term debt

Selected Emerging Markets: Ratio of Reserves to Short-Term Debt and Crisis Indicator



Sources: BIS *Consolidated International Banking Statistics;* IMF *International Financial Statistics;* and IMF staff estimates.

Note: The main authors of this box are Christian Mulder and Nicolas Blancher.

[1]For developing countries with little or no access to private capital markets, the focus remains on current account–related measures of reserve adequacy, including the level of imports.

[2]See Berg and Pattillo (1999a), Berg and others (1999), Edison (2000), and Goldstein, Kaminsky, and Reinhart (2000).

[3]Note that additional reserves may be second-best to policies such as improved private sector debt risk management, which reduce the need for reserves, and may in fact worsen risk management if reserve buildup is associated with excessive nominal exchange rate stability.

that exceeded reserves—tended to suffer greater crisis pressures during 2000–02.[4]

[4]For reasons of data availability and uniformity, short-term external debt is based on the Joint BIS-IMF-OECD–World Bank Statistics on External Debt (http://www1.oecd.org/dac/debt/). Specifically, it sums lines G (Liabilities to banks from the consolidated BIS statistics), H (debt securities issued abroad), and I (nonbank trade credits, official and officially guaranteed by 25 OECD countries).

In sum, the ratio of reserves to short-term debt is an important indicator of reserve adequacy for crisis prevention for countries with sizable but uncertain private capital market access. While the threshold level of reserves needed to avoid a crisis is difficult to determine precisely, a ratio of reserves to short-term debt of 1 serves as a useful benchmark, absent an external current account deficit or a significantly overvalued exchange rate.

emerging economies in Asia and other emerging market countries ran large current account surpluses. While exchange rate depreciation can help to boost external demand in the aftermath of a crisis, it eventually becomes important to shift to domestic sources of growth. An undervalued exchange rate can have potentially harmful effects on growth and welfare by reducing consumption, lowering domestic investment, and excessively increasing exposure to external shocks. In general, an appropriately valued exchange rate enhances the economy's ability to adjust to rapid productivity growth and greater trade and financial integration with the global economy.

Multilateral Concerns

Finally, from a multilateral perspective, the current account surpluses in many emerging market countries are the largest counterpart to the U.S. current account deficit. In 2002, the current account surplus for emerging economies in Asia was $133 billion, larger than that of Japan ($113 billion) or the euro area ($72 billion). And while faster growth of domestic demand in the euro area and Japan would clearly be welcome, neither area appears particularly well placed to generate this in the short run. Thus, an eventual narrowing of the U.S. current account deficit from its present unsustainable level will likely require emerging economies in Asia to share in the adjustment, to prevent an undue burden of adjustment on other countries.

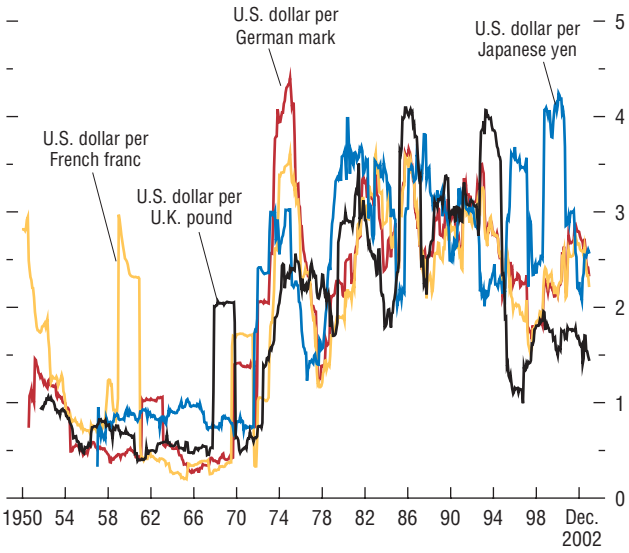
However, during the recent period of U.S. dollar weakness, the relative price adjustment has in fact fallen on the euro area, along with some small industrial countries. In emerging economies in Asia, the rapid reserve buildup and stability of exchange rates against the U.S. dollar have meant that real effective exchange rates have actually depreciated. As a region with highly open economies, emerging economies in Asia have a strong interest in the smooth rotation of demand from the United States to other parts of the world, to ensure that global growth does not slow unnecessarily and to maintain the orderly adjustment of exchange rates, not least to keep protectionist pressures at bay. This region is clearly an important part of the global economy, accounting for about 20 percent of world trade.

In conclusion, the rapid buildup of foreign exchange reserves in some emerging economies is understandable from a number of perspectives, but may now be approaching the point where some slowdown in the rate of accumulation is desirable. From both the domestic and the multilateral perspective, there would be advantages for growth in emerging economies in Asia to become more reliant on domestic demand, accompanied by a steady reduction in current account surpluses over the medium term. While such a strategy involves many elements, including further progress in structural reforms, one key aspect will be to allow greater exchange rate flexibility. It would be helpful for countries with managed floats to intervene less

Figure 2.16. Industrial Country Real Exchange Rate (RER) Volatility

(Standard deviation of monthly percentage growth rate of the RER over the preceding two years)

The volatility of industrial country RERs increased substantially after the collapse of the Bretton Woods system.



Sources: Global Financial Data; IMF, *International Financial Statistics;* U.S. Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics;* and IMF staff estimates.

in the foreign exchange market and for some countries where exchange rate flexibility has been limited—notably China—to gradually move to greater flexibility, as has long been advocated by the IMF.

How Concerned Should Developing Countries Be About G-3 Exchange Rate Volatility?

The main author of this essay is Nikola Spatafora. Bennett Sutton provided research assistance; Alessandro Rebucci and Susanna Mursula implemented the Global Economy Model simulations.

The post–Bretton Woods floating exchange rate period has been characterized by volatile, unpredictable exchange rate movements. Such unpredictability can be costly, both directly and through the potential for associated exchange rate misalignments. Indeed, these issues have come to the fore over recent years as the dollar appreciated rapidly against other major currencies, resulting in widening international imbalances that are an increasing source of policy concern (see, for instance, Chapter II of the September 2002 *World Economic Outlook*). Even after the recent depreciation of the dollar, in particular against the euro, the possibility of a rapid realignment of the major currencies remains a significant risk for the global economy.

This essay examines the potential spillover effects on developing countries of volatility across the three major currency areas, the United States, Japan, and the euro area—a topic that has received limited attention in the existing literature. The impact of such exchange rate movements on advanced economies has already been extensively analyzed and generally found to be small (see, for instance, Appendix 1.2 of the April 2002 *World Economic Outlook*, and Appendix II of the May 2001 *World Economic Outlook*). Linked to this, the potential effects of coordinating industrial country policies to lower their exchange rate volatility are generally believed to be limited

and ambiguous.[43] However, developing countries could be particularly vulnerable to exchange rate spillovers because the less developed nature of their financial markets and their limited ability to borrow in their own currencies could hamper adjustment to external disturbances. For instance, it has been argued that the Asian and Argentine crises partly reflected inflexibilities, including formal or informal dollar pegs, which made it difficult to adjust to G-3 exchange rate shocks, and in particular to the misalignments associated with an appreciation of the dollar.

Why Might G-3 Exchange Rate Volatility Be a Concern?

The analysis starts from some broad observations.

- *Industrial country real exchange rate (RER) volatility increased substantially after the breakdown of the Bretton Woods system* (Figure 2.16). In particular, there were significant spikes in volatility after the oil price shocks, around the periods of rapid dollar realignment starting in 1985 and in 1995, and again in the late 1990s. This short-run volatility has been accompanied by significant long-run G-3 exchange rate misalignments, as typified by the sharp dollar overvaluation of the mid-1980s.
- *Even after Bretton Woods, between one-half and two-thirds of all developing countries de facto continued pegging their exchange rate to industrial country currencies* (Figure 2.17). The exchange rate inflexibility induced by such pegs may increase their potential vulnerability to G-3 exchange rate instability.[44]

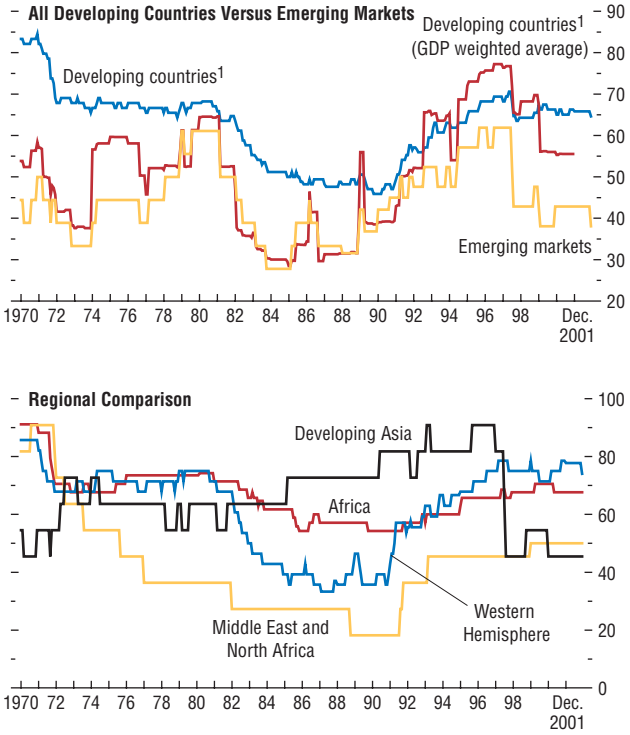
[43]Most studies find that international monetary policy coordination is likely to yield few benefits, relative to having the G-3 central banks follow good domestic monetary policies; in addition, effective international coordination could actually require greater exchange rate volatility. See Rogoff (2003) and Obstfeld and Rogoff (2002).

[44]Pegs remained popular among both large and small countries and across all major regions, including the Western Hemisphere, Africa, and developing Asia (the last less so after the crises of the late 1990s). Most pegs were to the dollar, but African countries often pegged to the French franc.

Figure 2.17. Share of Countries on a Hard or Crawling Peg

(Percent of countries within group with de facto pegged exchange rate regime, simple average unless otherwise noted)

Even after the breakdown of the Bretton Woods system, many developing countries de facto continued pegging their exchange rate to industrial country currencies.

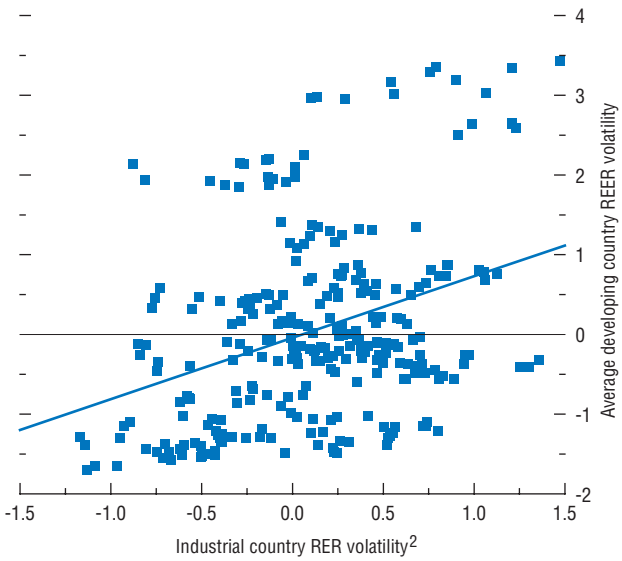


Sources: Reinhart and Rogoff (2002); and IMF staff calculations.
[1]Excludes transition economies.

Figure 2.18. Volatility in Industrial Countries' Real Exchange Rates (RERs) and Developing Countries' Real Effective Exchange Rates (REERs)[1]

(Standard deviation of monthly percentage growth rate of the exchange rate over the preceding year)

There is a significant correlation between volatility in industrial countries' RERs, and in developing countries' REERs.



Sources: IMF, *International Financial Statistics;* and IMF staff estimates.

[1]The volatility of an exchange rate is defined as the standard deviation of its monthly percentage growth rate over the preceding year. Here, all volatilities are plotted as deviations from their country-specific means, to control for fixed country-level characteristics. Further, the volatilities at any given point in time are averaged across all developing countries, to abstract from the significant cross-sectional heterogeneity discussed in the text.

[2]Defined as a weighted average of the volatilities of the real U.S. dollar / yen and U.S. dollar / deutsche mark exchange rates (see Appendix 2.2 for details).

- *Partly as a result, the volatilities of major industrial countries' real exchange rates and of developing countries' real effective exchange rates (REER) are correlated.* Increases in G-3 RER volatility are on average associated with an increase of over one-half the size in the volatility of developing countries' own REER (Figure 2.18).[45]
- *Greater volatility in developing countries' REER has been associated with greater exchange rate misalignments.* Shocks to real exchange rates are sufficiently persistent for volatility to translate into longer-lived fluctuations. Overall, if REER volatility increases by one standard deviation, then the average misalignment (defined as the average deviation of the exchange rate from trend) increases by about 5 percentage points (Figure 2.19).[46]

The thrust of the limited existing literature is that G-3 exchange rate instability can indeed disrupt developing countries through both trade and finance channels. On the trade side, depending on a developing country's exchange rate regime and on its trade partners, G-3 exchange rate volatility may lead to volatility and uncertainty in the developing country's REER, and/or may require a costly geographical reorientation of trade as relative competitiveness changes vis-à-vis different partners. Both effects increase the riskiness and reduce the attractiveness of trade and investment. This is particularly true in developing economies, which are characterized by a faster pass-through of exchange rates into prices and limited access of firms to financing.[47]

Building on these financial issues, developing countries' financial markets are also less sophisticated. In many cases, the absence of (liquid) futures markets precludes all but costly hedging (say, through the building up of reserves, as discussed in the second essay in this chapter).

[45]G-3 RER volatility is defined as a weighted average of the volatilities of the real dollar/yen and dollar/deutsche mark exchange rates (see Appendix 2.2 for details).

[46]These estimates assume the underlying equilibrium path of the exchange rate is relatively stable over time (see Appendix 2.2 for details).

[47]In addition, the floating rate period was associated with greater volatility in many commodity prices (Cashin and McDermott, 2002, and Cuddington and Liang, 1999).

Further, the fact that developing countries can generally only borrow in foreign currency, and their limited diversification with respect to the currency composition of external debt, suggest that exchange rate swings may have important effects on wealth and debt sustainability (see Chapter III). This limited ability to borrow and lend implies that exchange rate volatility may have larger welfare effects than in advanced economies (Bergin and Tchakarov, 2002).

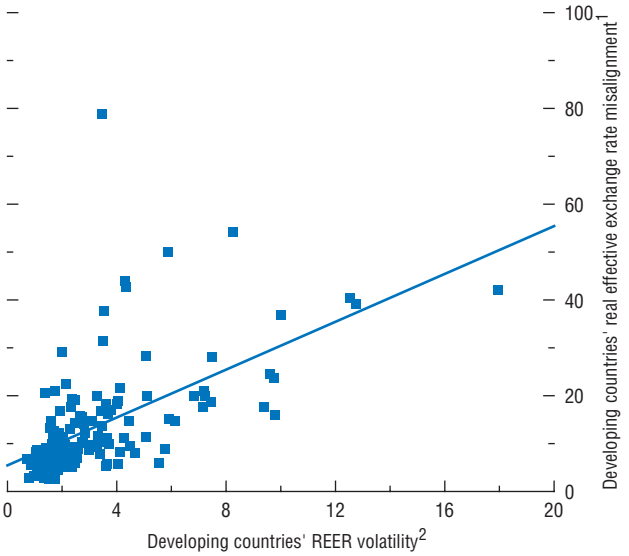
Indeed, if trade and debt are denominated in different currencies, this may cause tensions for policymakers. In particular, it may be difficult to stabilize both competitiveness and debt service in the face of volatility in G-3 exchange rates (Slavov, 2002). This mismatch between trade and financial links, which has not been analyzed empirically before, is measured here in terms of the correlation between the geographical structure of trade links and the currency composition of external debt (see Appendix 2.2 for details). This correlation is in general far from perfect, and varies widely across countries (Figure 2.20). Clearly, these issues are most important for emerging markets that enjoy significant access to private capital flows, rather than poorer countries whose debt service is mainly on concessional, less volatile terms.

The Argentine crisis provides an illustration of how these effects can help contribute to a costly crisis. During the 1990s, Argentina was pegged to the dollar and borrowed in this currency. Its largest trading partners, however, were Brazil (reflecting the impact of Mercosur) and the European Union. Over much of this period, Brazil's currency was pegged to the dollar, so that a large share of Argentina's trade was tied to the U.S. currency. However, after Brazil's exchange rate crisis in 1999, the Brazilian *real* depreciated sharply and started floating. Argentina then faced both a sharp loss in competitiveness and an increased mismatch between its trade and debt. Given the latter, the former could not be remedied without undermining the sustainability of Argentina's (dollar-denominated) debt burden.

Any assessment of the costs of industrial country exchange rate volatility, however, must also

Figure 2.19. Volatility and Misalignment of Developing Countries' Real Effective Exchange Rates (REERs)

Volatility in developing countries' REERs is also associated with REER misalignments.



Sources: IMF, *International Financial Statistics;* and IMF staff calculations.
[1]Misalignment is defined as the absolute value of the 12-month moving average of the detrended real effective exchange rate. In this figure, the misalignment for any given country is averaged over all observations.
[2]Standard deviation of monthly percentage growth rate of the REER over the preceding year. In this figure the volatility for any given country is averaged over all periods.

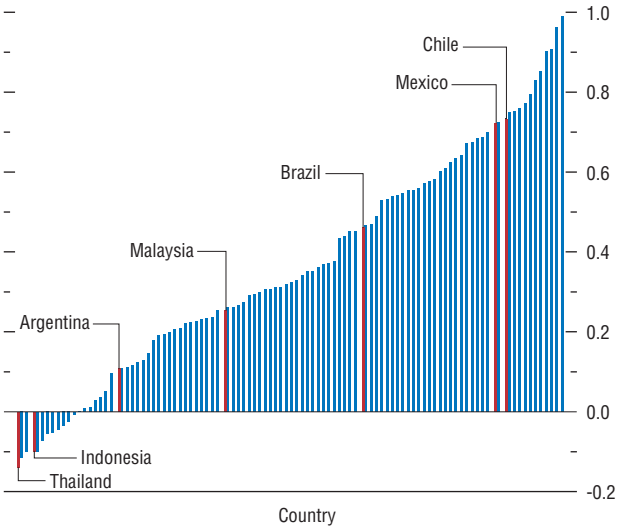
take into account two countervailing considerations. First, G-3 exchange rate volatility is only one among several sources of uncertainty, both domestic and external, affecting developing countries. Even confining ourselves to exchange rate instability, it should be noted that this varies widely among developing countries. Further, the "average" exchange rate volatility in developing countries is larger, and fluctuates more over time, than is true for industrial countries, even though many developing countries peg their exchange rates (Figure 2.21).[48] Second, reducing exchange rate uncertainty across the G-3 could result in more volatility in other variables. In particular, and even though it is difficult to assess the precise tradeoff, it could lead to higher volatility in G-3 interest rates and output (Reinhart and Reinhart, 2001, 2002), which would impose its own costs (see Chapter II of the October 2001 *World Economic Outlook*). Hence, it is even possible that acting to reduce industrial country exchange rate volatility could increase overall developing country instability.[49]

What Do the Data Tell Us?

Quantitatively, how important are all these arguments? The large literature analyzing the effect of volatility in an industrial country's own exchange rate on its trade generally points to small effects (MacDonald, 2000; McKenzie, 1999; Côté, 1994). The impact, however, appears to be larger in developing countries, consistent with their less sophisticated financial structure (Calvo and Reinhart, 2000, summarize the literature).[50]

Figure 2.20. Correlation Between the Structure of Trade Links and of Financial Links[1]

The correlation between the geographical structure of trade and the currency composition of external debt varies widely, and is generally lower in crisis countries.



Sources: IMF, *International Financial Statistics;* World Bank, *World Development indicators;* and IMF staff estimates.

[1]Defined as follows: two sets of weights are constructed for each country, at each date. The first is based on the currency composition of debt, using the major currencies: U.S. dollar, Japanese yen, German deutsche mark, British pound, French franc, Swiss franc, and others. The second set of weights gives the geographical composition of trade, broken down in an analogous way, with the exception that all trade with any country that is pegged to, say, the U.S. dollar is for these purposes counted as part of the trade with the United States. Finally, we compute the correlation between these two sets of weights. For this chart, we also take averages for each country over all available observations.

[48]For instance, in our sample, the mean level of exchange rate volatility across developing countries, its standard deviation across countries, and its standard deviation over time are all much larger than average G-3 exchange rate volatility.

[49]That said, to the extent that G-3 exchange rate volatility reflects the presence of bubbles, sterilized intervention might be used to deflate such bubbles, reducing instability in both exchange rates *and* interest rates. See, for instance, Bergsten (2003).

[50]The evidence also suggests that currency unions stimulate trade significantly (Rose, 2000, 2001, 2002; Parsley and Wei, 2001).

Turning to the specific issue of the effect of G-3 exchange rate instability on developing countries, the limited number of existing studies provide mixed evidence. Esquivel and Larraín (2002) find relatively large effects: a 1 percentage point increase in G-3 exchange rate volatility reduces real exports of developing countries by about 2 percent, and increases the probability of exchange rate crises by 2½ percentage points. Likewise, dollar-euro volatility has been found to negatively affect domestic employment and domestic investment in Argentina and Brazil (Belke and Gros, 2002).

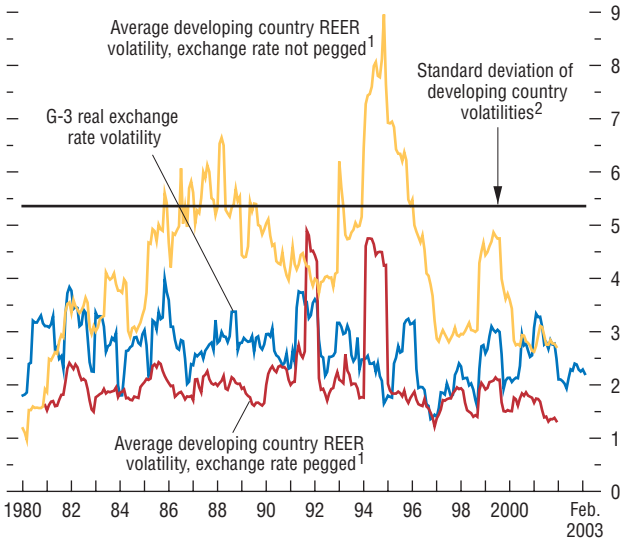
On the other hand, Reinhart and Reinhart (2001, 2002) find that periods of relatively high volatility in G-3 real exchange rates are not associated with significantly diminished capital flows to developing countries, with lower portfolio investment being offset by higher foreign direct investment. In contrast, they find that periods of relatively high volatility in U.S. short-term interest rates do appear associated with sharp changes in capital flows. Also, most studies of the factors that predict exchange rate or debt crises emphasize the role of exchange rate misalignment, rather than volatility (see, for instance, Kaminsky, Lizondo, and Reinhart, 1998).

To illustrate and refine these findings, a broad sample of over 120 developing countries over the period 1980–2001 is now examined. Briefly, cross-country panel regressions are used to analyze whether G-3 exchange rate volatility affects trade, capital flows, and/or the probability of an exchange rate crisis in developing countries (Appendix 2.2 provides more details about the data and methodology). Throughout, standard specifications are adopted, augmented by measures of G-3 RER volatility, as well as measures of a country's own REER volatility, misalignment, and/or trade-finance mismatch (depending on the specific regression). The latter variables also help capture the potential indirect effects of industrial country volatility. Results are reported for the full sample, for countries on an exchange rate peg (to help examine the impact of a country's exchange rate regime), and for a narrow sample of 21 emerging markets that

Figure 2.21. Developing Country Real Effective Exchange Rate (REER) Volatility

(Standard deviation of monthly percentage growth rate of the REER over the preceding year)

There are huge differences across developing countries in REER volatility, reflecting the impact of many factors other than G-3 real exchange rate volatility (RER).



Sources: IMF, *Direction of Trade Statistics;* and World Bank, *Global Development Finance.*

[1] Simple average of volatility measure across all countries in group for each month.

[2] Standard deviation of volatility measure for all developing countries over all periods.

Table 2.7. Impact of Exchange Rate Volatility on Trade and on Emerging Market Capital Inflows[1]
(Percent change)

Impact on	Of	Full Sample	Exchange Rate Pegs	Emerging Markets
Exports	Increase in G-3 RER volatility[2]	–0.28	–0.70	0.79
	Increase in REER volatility[3]	**–3.01*** **	**–1.65*** **	5.59
	Memorandum: indirect impact of eliminating all G-3 RER volatility, through lower REER volatility[4]	**0.95****	**1.48****	–2.90
Imports	Increase in G-3 RER volatility[2]	0.21	0.50	**0.77***
	Increase in REER volatility[3]	**–3.75*** **	0.38	**–1.69*** **
	Memorandum: indirect impact of eliminating all G-3 RER volatility, through lower REER volatility[4]	**1.18****	–0.34	**0.88***
Total capital inflows	Increase in G-3 RER volatility[2]	. . .	. . .	**–4.27***
	Increase in REER volatility[3]	. . .	. . .	**–6.52****
	Memorandum: indirect impact of eliminating all G-3 RER volatility, through lower REER volatility[4]	. . .	. . .	**3.44****
Foreign direct investment	Increase in G-3 RER volatility[2]	. . .	. . .	2.56
	Increase in REER volatility[3]	. . .	. . .	**–5.48*** **
	Memorandum: indirect impact of eliminating all G-3 RER volatility, through lower REER volatility[4]	. . .	. . .	**2.93****

Source: IMF staff calculations.

[1]The results for exports, imports, total capital flows, and foreign direct investment (FDI) are based on panel regressions for, respectively, 133, 131, 132, and 124 developing countries, over 1980–2001, using monthly data. All coefficients are computed using procedures that allow for nonstationarity. Standard errors are corrected for autocorrelation and groupwise-heteroscedasticity. Statistically significant results are reported in bold type. The symbols *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. In the export regression, the dependent variable is exports/GDP. Controls include the REER, a trade-share-weighted index of trade partners' real GDP, and a time trend. In the import regression, the dependent variable is imports/GDP. Controls include the REER, real GDP, and a time trend. In the total capital flow regression, the dependent variable is total capital flows/GDP. In the FDI regression, the dependent variable is FDI/GDP. In both of these last regressions, controls include world real GDP, the LIBOR, capital account openness, and a time trend.

[2]Given by a one-standard-deviation increase in our measure of G-3 RER volatility. The latter is defined as the standard deviation of the monthly percentage growth rate of a weighted average of the U.S. dollar/deutsche mark and U.S. dollar/yen RER (with weights as described in Appendix 2.2) over the preceding 12 months.

[3]Given by a one-standard-deviation increase in our measure of REER volatility. The latter is defined as the standard deviation of the monthly percentage REER growth rate over the preceding year.

[4]This calculation uses the results of the above regressions, but focuses on the indirect impact of G-3 RER volatility on trade and capital inflows through REER volatility. Specifically, we estimate separately the correlation between REER volatility and G-3 RER volatility, multiply this correlation coefficient by the mean G-3 RER volatility in the sample, and then multiply by the impact of a one-unit-increase in REER volatility.

enjoy greater access to international financial markets.[51]

Our analysis suggests that the direct impact of G-3 exchange rate volatility on trade is probably small but that indirect effects through a country's own REER volatility are significant (Table 2.7). The direct link between G-3 RER volatility and trade is statistically weak, occasionally incorrectly signed, and minor in magnitude, even in countries on an exchange rate peg. For instance, a one standard deviation increase in G-3 RER volatility is associated with at most a 0.7 percent reduction in exports.[52] In contrast, a one standard deviation increase in REER volatility is associated with reductions in exports and imports of 3 percent and 4 percent, respectively. The impact on exports remains significant when one focuses on those countries with exchange rate pegs, although its magnitude falls by about half, as the REER is less volatile under such regimes. The effects are harder to detect when examining only emerging markets, possibly because of the small sample. Overall, these results suggest that increased G-3 RER volatility reduces developing

[51]Results for the sample of developing countries excluding these 21 emerging markets are very similar to the results for the full sample. Differences between the full sample and the countries on an exchange rate peg roughly mirror, although with the opposite sign, those between the full sample and the countries not on a peg.

[52]The estimated impact is weaker than found by Esquivel and Larraín (2002), largely because we control for own-currency REER volatility.

Table 2.8. Determinants of Exchange Rate Crises[1]
(Change in percentage points)

	Probability of Exchange Rate Crises		
	Full Sample	Exchange Rate Pegs	Emerging Markets
Increase in G-3 RER volatility[2]	1.41	1.14	–0.42
Increase in real effective exchange rate (REER) overvaluation[3]	**8.58*** **	**7.28*** **	**6.42*** **
Increased correlation between geographical structure of trade and currency composition of debt[3]	**–1.28*** **	**–1.22*** **	**–4.73*** **
Increase in external debt/GDP[3]	**3.75*** **	**3.75*** **	**6.80*** **
Increase in exports/GDP[3]	**–3.97*** **	**–3.17*** **	**–6.70*** **
Regional contagion[4]	**2.94*** **	**0.36***	**2.45*** **
Memorandum			
Indirect impact of eliminating all G-3 RER volatility, through lower likelihood of REER overvaluation[5]	**–1.12****	**–2.38*** **	**–1.13****

Source: IMF staff calculations.

[1]The results are based on a panel probit regression for 88 developing countries, over 1980–2001, using monthly data. The dependent variable is whether an exchange rate crisis occurred in the subsequent 24 months. Standard errors are corrected for autocorrelation and groupwise-heteroscedasticity. Statistically significant results are reported in bold type. The symbols *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively.

[2]Given by a one-standard-deviation increase in our measure of G-3 RER volatility. The latter is defined as the standard deviation of the monthly percentage growth rate of a weighted average of the U.S. dollar/deutsche mark and U.S. dollar/yen RER (with weights as described in Appendix 2.2) over the preceding year.

[3]Given by a one-standard-deviation increase in the relevant variable.

[4]Defined as a crisis occurring in at least one other country in the region.

[5]This calculation uses the results of the panel regression above, but focuses on the indirect impact of G-3 RER volatility on the probability of a crisis through the likelihood of REER overvaluation. Specifically, we estimate separately the correlation between REER overvaluation and G-3 volatility, multiply this correlation coefficient by the mean G-3 RER volatility in the sample, and then multiply by the impact of a one unit increase in REER overvaluation.

countries' trade levels principally through its impact on their own REER volatility.

Own REER volatility also matters for capital flows to emerging markets. In our broad sample, total capital inflows display no clear link with volatility, whether in a country's REER or in G-3 real exchange rates. However, it may be more relevant to focus on the emerging markets, which account for the bulk of private sector capital inflows. In these countries, the direct impact of G-3 RER volatility remains statistically weak but own REER volatility is associated with significantly lower capital inflows (see Table 2.7). Among the various components of the financial account, foreign direct investment (FDI) is most clearly affected by REER volatility, perhaps because returns on FDI projects often require a long time horizon, with correspondingly limited hedging opportunities.

The connection between G-3 exchange rate volatility and exchange rate crises in developing countries is also indirect, this time coming through misalignments and trade/finance mismatches. We analyzed whether G-3 RER volatility increases the likelihood of exchange rate crises in developing countries, using a probit regression of a type familiar from the literature on Early Warning Systems (reviewed in Berg, Borensztein, and Pattillo, 2003; see also Berg and Pattillo, 1999a, 1999b; and Kaminsky, Lizondo, and Reinhart, 1998). Again, the results indicate no robust direct link between G-3 RER volatility and the probability of a crisis (Table 2.8). However, if the degree of REER overvaluation increases by one standard deviation, then the probability that an exchange rate crisis will occur over the subsequent two years rises by almost 9 percentage points. As increases in the volatility of developing countries' REER are associated with larger misalignments, this provides an indirect link to G-3 volatility. Simply put, these results indicate that pegging becomes more difficult and less meaningful when G-3 exchange rate volatility is high. Greater trade-finance mismatches also significantly increase the probability of an exchange rate crisis. At the extreme, going from no mismatch to a complete mismatch would increase average crisis probabil-

ities by 8 percentage points. Of course, the decision on where to finance also depends on other factors, such as the depth and efficiency of alternative markets.

Overall, our results then suggest that G-3 RER volatility mainly affects developing countries indirectly, by increasing the variability of their own REER or the chance of misalignment. These indirect effects through own REER volatility or misalignment depend on countries' exchange rate regimes so that the impact of G-3 exchange rate volatility is partly reflected through the prism of their own policy choices. To quantify the indirect effects of G-3 RER volatility, one possible thought experiment is to assume that all volatility in G-3 real exchange rates could be costlessly eliminated. Then, given the estimated correlation between volatility in G-3 real exchange rates and both volatility in developing countries' REER and our measure of developing countries' overvaluation:

- exports and imports would increase on average by about 1 percent, and perhaps slightly more in countries on an exchange rate peg;
- capital flows to emerging markets would increase by 3½ percent; and
- the average probability of crises would decrease, but by less than 2½ percentage points.

These numbers clearly represent an upper limit, given that industrial countries' exchange rates did in fact display some volatility also under the Bretton Woods system and that any reduction in such volatility might be associated with greater G-3 interest rate instability. Even so, the effects are small, compared with other feasible policy changes. To put matters into perspective, it has been estimated that limited increases in trade barriers, as measured by a one unit increase in the IMF's 1–10 index of the restrictiveness of trade policy, reduce trade levels by 5 percent (Chapter III of the September 2002 *World Economic Outlook*). Conversely, full trade liberalization in developing countries would increase North-South trade by over 20 percent, and South-South trade by about 50 percent. Similarly, as regards crisis probabilities, the impact of eliminating all G-3 RER volatility is roughly equivalent to that of reducing the average degree of overvaluation by 2 percent. The relatively weak effects of G-3 RER volatility may not be surprising, given that it is only one of many factors behind volatility and misalignment in developing countries' REER.

Which Vulnerabilities Matter Most?

While for the "average" developing country the estimated spillovers from G-3 exchange rate volatility may be limited, such exchange rate fluctuations may be a much more serious concern for some specific countries. The Asian crises, for instance, represent a situation where G-3 exchange rate volatility, together with inflexible domestic exchange rate regimes, contributed to extremely costly crises. Most emerging markets in east Asia de facto pegged to the U.S. dollar until 1997 (possibly out of concern that their liabilities had become increasingly dollarized), even while trading significantly with Japan. Given these pegs, the dollar's sharp real appreciation against the yen from 1995 onward led directly to significant REER appreciations in Korea, Thailand, Indonesia, and Malaysia, among others (Figure 2.22). As discussed earlier, such appreciations increased the likelihood of a crisis. In addition, given the importance of intraregional trade, the end of the (often informal) dollar pegs after 1997 lowered the share of trade linked to the dollar, increased trade-finance mismatches, and hence further raised the likelihood of crises in the region.

Macroeconomic model simulations can help analyze what structural characteristics or policy actions would exacerbate or reduce vulnerabilities. Simulations can also provide some insight into whether industrial country policy cooperation, aimed at reducing exchange rate volatility across the major economies, would create more or less instability in real activity. Accordingly, this section reports simulations using the IMF's Global Economy Model (GEM) to examine the impact of industrial-country

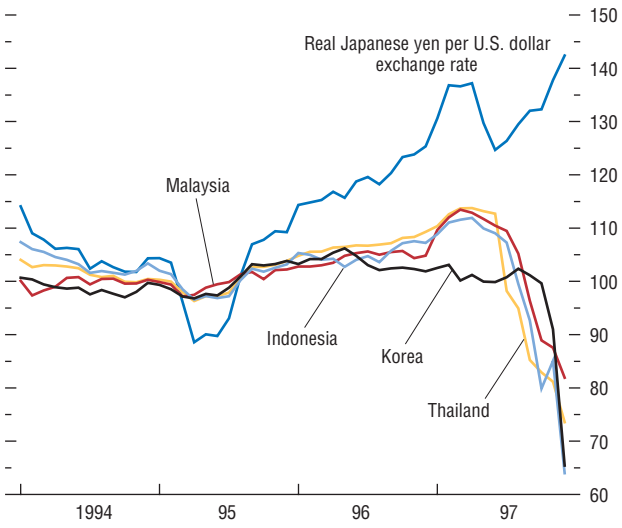
exchange rate volatility.[53] GEM is the IMF's new macroeconomic model, explicitly based on rigorous microeconomic foundations and on the "new open-economy macroeconomics" literature (see Chapter IV, Box 4.3, of the April 2003 *World Economic Outlook*, and Pesenti, forthcoming, for an overview of GEM). For the purposes of this essay, a three-country version of GEM was constructed, comprising two large industrial countries (which will be called the euro area and the United States) and a smaller, relatively open emerging market. In the baseline, the developing country trades equally with the euro area and the United States, has a steady-state debt to GDP ratio of 40 percent, borrows exclusively from the United States, and pursues an inflation target. The rest of the model is calibrated based on earlier work by Hunt and Rebucci (2003) and Laxton and Pesenti (2003).

In the baseline, the spillover effects of industrial country exchange rate volatility generate a volatility of emerging market GDP of slightly over 0.1 percent (Table 2.9). This cost varies depending on the structure of the developing country. An increase in its external debt renders it more vulnerable to exchange rate or interest rate shocks, increasing its output volatility. Analogously, if the economy were less open to trade, it would be less vulnerable to external shocks, and its output less volatile—although underlying growth might of course be lower.[54] For a given trade ratio, if the emerging market were to trade mainly with the United States, and given that its debt is dollar denominated, the greater match between the currency composi-

Figure 2.22. Yen/Dollar Real Exchange Rate, and Real Effective Exchange Rates (REERs) in East Asia

(REER unless otherwise noted; 1995 = 100)

East Asian emerging markets de facto pegged to the U.S. dollar until 1997, even while trading significantly with Japan. As a result, the dollar's sharp real appreciation against the yen from 1995 through 1997 led directly to a significant REER appreciation in Korea, Thailand, Indonesia, and Malaysia.



Source: IMF staff calculations.

[53]This volatility is modeled as shocks to the risk premium between euro- and dollar-denominated assets. The shocks were parameterized to produce realistic levels of exchange rate instability between the two industrial countries.

[54]Our results only hold for small disturbances around a stable equilibrium, and are therefore not applicable to large shocks, such as would arise in a crisis-type situation. In particular, the above result might not hold in crises, when lack of openness to trade can limit a country's ability to adjust (Chapter III of the September 2002 *World Economic Outlook*).

Table 2.9. Global Economy Model Simulations: How Various Emerging Market Characteristics Increase or Reduce the Impact of G-3 Real Exchange Rate (RER) Volatility[1]
(Standard deviation, percent, on an annual basis)

	Volatility of Developing Country Real GDP
Baseline[2]	0.14
Changes in structure:	
Emerging market debt doubles to 80 percent of GDP	0.22
Emerging market trades less	0.08
Emerging market trades mostly with United States	0.09
Emerging market trades mostly with euro area	0.22
Emerging market faces lower exchange rate pass-through into domestic prices	0.05
Changes in monetary regime:	
Emerging market pegs to U.S. dollar . . .	0.38
. . . and trades mostly with United States	0.26
Industrial countries conduct monetary policy to stabilize their exchange rate	0.14

Source: IMF staff calculations.
[1]Volatility in G-3 RER is modeled as shocks to the risk premium in the Uncovered Interest Parity condition between euro-denominated and U.S. dollar-denominated assets.
[2]The developing country is modeled as smaller and more open than the two large countries (euro area and United States), trades equally with the euro area and United States, has debt equal to 40 percent of GDP in the stochastic steady state, faces higher transaction costs in international borrowing, and faces higher exchange rate pass-through into domestic prices. The euro area and United States are modeled as identical, except that all internationally traded financial assets are denominated in U.S. dollars.

tion of its trade and of its debt would lower the induced macroeconomic instability. The converse holds if the emerging market trades mainly with the euro area. Finally, if the degree of exchange rate pass-through into domestic prices in the developing country were reduced to industrial country levels, its producers would be better insulated from exchange rate shocks and its output volatility would be correspondingly lower.

The impact of changes in developing countries' exchange rate regimes is generally larger. Pegging the exchange rate to one of the industrial country currencies increases interest rate volatility significantly. For our parameterization, emerging market output volatility also increases. The effect is smallest when the emerging market trades and borrows largely with the country to which it pegs, but even in this case output volatility would be almost three times as large as under inflation targeting (although clearly the results depend on the structure of the country and parameterization of the model).

Finally, we analyze what would happen if the euro area and the United States changed their monetary policy objectives and acted to stabilize their bilateral exchange rate. In the simulations, this reduces exchange rate volatility, but only at the cost of a significant increase in interest rate volatility in the industrial countries. For our parameterization, this has little net effect on the emerging market, while the volatility of industrial country output increases significantly. That said, it should be noted that those who advocate reducing G-3 exchange rate volatility generally believe such a policy shift would reduce the magnitude of the underlying shocks to exchange rates, for instance by preventing the buildup of speculative bubbles, and hence help stabilize all countries (Bergsten, 2003).

Overall, and consistent with the earlier empirical work, the simulations suggest that the impact of industrial country exchange rate volatility on emerging markets is likely small relative to other disturbances. For instance, the results in Table 2.9 are small compared with actual developing-country output volatility of about 5 percent (see, for instance, Chapter III, Table 3.4 of the April 2003 *World Economic Outlook*). In addition, the estimated changes to developing country macroeconomic stability coming from G-3 exchange rate volatility are of a similar magnitude to those found in GEM for minor adjustments to inflation targeting rules in developing countries (Laxton and Pesenti, 2003).

Conclusions

This essay examined the potential spillover effects of industrial country exchange rate volatility on developing countries' trade, capital inflows, and the likelihood of exchange rate crises. Such volatility was found to have negative effects on developing country economic per-

formance. These effects come mainly through indirect channels, as G-3 volatility increases the instability of developing countries' own real effective exchange rate and the chance of developing country exchange rate misalignments and overvaluations. The degree of mismatch between trade and financial links was also found to influence the likelihood of crises. In addition, simulations were used to explore which factors might amplify or dampen the effects and whether acting to reduce G-3 exchange rate volatility would benefit emerging markets.

That said, the magnitude of the estimated effects appears to be quite limited. On average, the estimates presented here suggest that even a complete elimination of all volatility in G-3 real exchange rates would boost developing country trade by a modest 1 percent, increase capital flows to emerging markets by 3 percent, and reduce the probability of exchange rate crises by up to 2½ percentage points. These indirect effects partly depend on the exchange rate policy being followed by the developing country, suggesting that more flexible exchange rate regimes and the use of various hedging instruments may help lower existing costs. Still, overall, the significant variation across developing countries in the extent of REER volatility and misalignment suggests that these can only be explained to a limited degree by factors that are more or less common to all developing countries, such as the extent of industrial country real exchange rate volatility. In addition, the reported policy simulations found that the beneficial impact on developing countries of any attempt to stabilize G-3 exchange rates could easily be offset by the induced fluctuations in G-3 interest rates and output.

Finding limited costs of industrial country exchange rate volatility is in a sense quite comforting, given recent moves in G-3 exchange rates and given that the size of current international imbalances raises the possibility of further significant exchange rate swings. Nevertheless, the analysis does not provide grounds for complacency. While G-3 exchange rate volatility might have small effects *on average*, it raises more significant issues for certain types of developing countries. For instance, while the decision on what exchange rate regime to adopt depends on many factors not discussed in this essay, policymakers should be particularly concerned about such volatility when their country is pegged to a specific industrial country currency. In addition, countries may become especially vulnerable to G-3 exchange rate volatility when their debt ratios are relatively high and when external trade and external debt are mismatched, so that a peg that stabilizes competitiveness may be associated with a volatile debt service. Indeed, G-3 volatility and misalignments, combined with inflexible exchange rate regimes, appear to have played a role in the buildup to the Argentine and Asia crises and the associated large losses in output.

Appendix 2.1. Economic Growth in the Middle East and North Africa Region: Definitions, Data Sources, and Country Coverage

The main author of this appendix is Dalia Hakura.

This appendix defines variables, provides data sources, and specifies country coverage for the essay on economic growth in the MENA region.

Data Definitions and Sources

Economic growth is measured as the average growth rate of real per capita GDP over 1980–2000 (reflecting the availability of reliable data). The source of the data is the WEO database.

Inflation is the average of the logarithm of annual inflation rates in the Consumer Price Index over 1980–2000 (reflecting the availability of reliable data). The source of the data is the World Bank's *World Development Indicators* (WDI).

Initial level of income is measured as the natural logarithm of per capita GDP in purchasing power parity terms in 1980. The source of the data is the WEO database.

Government consumption is the average of the ratio of government "consumption" expenditure to GDP from 1980 to 2000 (reflecting the availability of reliable data). The source of the data is the WDI.

Trade openness is defined as the sum of imports and exports of goods and services (from balance of payments statistics), divided by GDP. The source of the data is the WDI.

Exchange rate overvaluation is based on purchasing-power-parity comparisons, using the Summers-Heston measure, where 100 signifies parity and higher (lower) values indicate over- (under-) valuation, following the methodology of Dollar (1992). The average degree of overvaluation over 1980–2000 is used. Since this index is not available for the GCC countries (except for Bahrain), exchange rate misalignment for these countries is calculated using the percentage difference between the actual real effective exchange rate (REER, reported in the IMF's Information Notice System) and a Hodrik-Prescott filter of the REER.

Institutional quality is constructed as the average of four indices reported by the International Country Risk Guide (ICRG) over 1984–2000. The indices are (1) corruption—the degree of all forms of corruption such as patronage, nepotism, and suspiciously close ties between politics and business; (2) rule of law—the strength and impartiality of the legal system and the extent of popular observance of the law; (3) bureaucracy quality—the strength and expertise of the bureaucracy to govern without drastic changes in policy or interruptions in government services; and (4) government stability—the ability of the government to carry out its declared program and to stay in office. The indices are re-scaled from 1 to 12, where high values indicate good institutions. For an alternative regression specification, the institutional quality index is constructed as the average of the four indices above as well as two indicators of internal and external conflict reported by the ICRG. The internal conflict indicator refers to the extent of political violence in the country, and the external conflict indicator refers to the risk to the government arising from foreign action ranging from nonviolent external pressure (e.g., trade restrictions, territorial disputes, and diplomatic pressures) to cross-border conflicts and war.

Terms of trade volatility is measured as the standard deviation of the annual change in the terms of trade over 1980–2000 weighted by the share of natural resource exports in total exports in 1980 to capture the volatility of income flows that is associated with exports of natural resources. Natural resource exports are defined as the sum of exports of fuel, ores and metals, agricultural and raw materials, and food products. The data to measure the share of natural resources in total exports come from the WDI, while the terms of trade data are from the WEO database.

Secondary education is measured as the number enrolled in secondary school as a percent of the secondary-school-age population. The source of these data is the WDI.

The demographic burden is defined as the difference between the growth rate of the economically active population and the total population growth rate. The economically active population is defined as the population aged 15–64. The data to calculate the growth rates of the economically active population and total population are obtained from the WDI.

Female labor force participation is calculated as the ratio of females in the labor force to female working-age population (defined as the female economically active population aged 15–64). The data to calculate female participation ratios are obtained from the WDI.

Country Coverage

This section specifies all the countries used in the essay. Owing to data constraints, the regression analysis in the essay is limited to a sample of 74 countries, including 21 advanced economies and 53 developing countries, of which 10 were MENA countries—5 non-oil MENA countries, 3 GCC countries, and 2 other oil-exporting MENA countries.

Advanced Economies

Australia, Austria, Canada, Cyprus, Finland, France, Greece, Iceland, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

East Asia

China, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand, Taiwan Province of China, and Papua New Guinea.

Other Developing Countries

Argentina, Bangladesh, Barbados, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Chile, Colombia, Congo, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guyana, Haiti, Honduras, India, Jamaica, Kenya, Madagascar, Malawi, Mauritania, Mexico, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Rwanda, Senegal, Sierra Leone, South Africa, Sri Lanka, Tanzania, Togo, Trinidad and Tobago, Turkey, Uganda, Uruguay, Venezuela, Zambia, and Zimbabwe.

Middle East and North Africa

This group is divided into non-oil MENA countries and oil-exporting MENA countries—GCC oil-exporting countries and other oil-exporting MENA countries. Following WEO convention, a country is classified as an oil exporter if its oil export earnings over 1994–98 constituted more than 50 percent of total export earnings.

Non-oil MENA countries. Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia, and Yemen.

GCC countries. Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates.

Other oil-exporting MENA countries. Algeria, Iran, and Libya.

Appendix 2.2. How Concerned Should Developing Countries Be About G-3 Exchange Rate Volatility? Data and Modeling Strategy

The main author of this appendix is Nikola Spatafora.

This appendix provides further details on the data and the modeling strategy regarding the impact of G-3 exchange rate volatility on developing countries.

Data

The empirical work analyzes a broad panel of up to 133 developing countries,[55] representing all major geographic regions, over 1980–2001. Monthly data were used for exchange rates, and quarterly or annual data for other variables. Two subsamples were also analyzed. The first covers 21 large emerging markets.[56] The second covers all observations when countries are on an exchange rate peg, according to the Reinhart and Rogoff (2002) classification. This classification is based on de facto exchange rate performance, including in parallel markets, rather than on the de jure exchange rate regimes officially reported by countries. The Reinhart and Rogoff measure is available for three-fourths of the full sample. Exchange rate pegs account for 58 percent of these observations; 88 countries are reported as having been on a peg for some fraction (on average, over one-half) of the sample period.

The analysis focuses on the impact of G-3 real exchange rate (RER) volatility on the following measures of macroeconomic performance:

- *Exports; imports; net total capital inflows; and net FDI inflows.* These are all measured as the loga-

[55]The regressions for exports, imports, capital inflows, FDI, and exchange rate crises use, respectively, 133, 131, 132, 124, and 88 countries.

[56]Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, the Philippines, Poland, Russia, South Africa, Thailand, Turkey, and Venezuela.

rithm of the ratio of the relevant variable to GDP (all variables being measured in dollar terms).

- *Exchange rate crisis.* This is an indicator variable, equal to unity if (1) the country's nominal exchange rate against the U.S. dollar depreciated by at least 12.5 percent in that month; and (2) the depreciation rate exceeded its value in the previous month by at least 10 percentage points; and (3) the country had not experienced any crisis in the previous six months. It is equal to zero in all other cases.

A key issue is measuring G-3 RER volatility. Here it is defined as a weighted average of the volatilities of the real U.S. dollar/yen and U.S. dollar/deutsche mark exchange rates, where

- the volatility of any individual exchange rate is defined as the standard deviation of its monthly percentage growth rate over the previous year;[57] and
- the above weights are region-specific, and are based on a panel regression for each region of real effective exchange rate (REER) volatility on the volatilities of the real U.S. dollar/yen and U.S. dollar/deutsche mark exchange rates. The resulting coefficients are then scaled to add up to unity.

The analysis also measures the indirect impact of G-3 RER volatility on economic performance through its impact on REER volatility, misalignment, and overvaluation. REER volatility has been defined. REER misalignment is defined as the absolute percentage deviation of the 12-month moving average of the REER from its equilibrium level, as proxied by a country-specific exponential time trend. Similarly, REER overvaluation is defined as the percentage deviation of the REER from its equilibrium level, as proxied by a country-specific exponential time trend. Throughout, we use relative-CPI-based measures of real exchange rates.

The analysis also makes use of a novel variable: the correlation between the geographical structure of trade and the currency composition of debt, or "trade-finance mismatch." This is measured as follows. For each country, at each date, two sets of weights are constructed. The first is based on the currency composition of debt, using the major currencies: U.S. dollar, yen, deutsche mark, British pound, French franc, Swiss franc, and others. The second set of weights gives the geographical composition of total trade, broken down in an analogous way, with the exception that all trade with any trade partner that is pegged to, say, the U.S. dollar is for these purposes counted as part of the trade with the United States. The trade-finance mismatch is then computed as unity minus the correlation between these two sets of weights.

Summary statistics for the key variables used in the analysis are shown in Table 2.10.

Modeling Strategy

To examine the importance of G-3 RER volatility as a determinant of developing country trade or capital inflows, the following equations were estimated:

$$Y_{it} = \alpha_i + \beta \cdot Vol_t(REER_i) + \gamma \cdot Vol_t(G\text{-}3\_RER_i) + \delta \cdot Z_{it} + \varepsilon_{it}; \quad (1)$$

$$Vol_t(REER_i) = a_i + b \cdot Vol_t(G\text{-}3\_RER_i) + e_{it}, \quad (2)$$

where Y is the specific macroeconomic outcome of interest; $Vol(REER)$ is the measure of REER volatility; $Vol(G\text{-}3\_RER)$ is the measure of G-3 real exchange rate volatility; Z is a set of control variables; and the subscripts i and t denote, respectively, the country and the time period. Equation (1) captures the direct impact of G-3 real exchange rate volatility on the country's macroeconomic outcomes, while equation (2) allows us to estimate the indirect impact through

[57]Various alternative measures of perceived volatility are possible, including some based on high-frequency data. For instance, daily observations on exchange rates could be used to estimate perceived monthly exchange rate volatilities (see Andersen and others, 2001, for technical details; Baum, Caglayan, and Ozkan, 2003, or Klaassen, 1999, for applications). Such data, however, are difficult to obtain for such a wide range of countries.

Table 2.10. Selected Summary Statistics[1]
(Percent)

Variable	All Sample Countries	Exchange Rate Pegs	Emerging Markets
Economic outcomes			
Exports/GDP	25.8 (29.8)	22.8 (18.2)	22.1 (18.0)
Imports/GDP	35.9 (30.8)	34.0 (24.8)	23.4 (16.8)
Net capital inflows/GDP	5.9 (12.2)	7.1 (16.9)	4.4 (3.7)
Net FDI/GDP	2.5 (4.1)	3.2 (5.3)	1.4 (1.6)
Volatility measures[2]			
Volatility (REER)	3.3 (5.4)	2.1 (2.9)	2.8 (3.4)
Volatility (G-3 RER)	2.5 (0.6)	2.4 (0.6)	2.6 (0.6)
REER overvaluation[3]	5.7 (11.8)	6.0 (9.6)	5.4 (9.5)

Sources: IMF, *International Financial Statistics;* World Bank, *Global Development Finance;* and IMF staff estimates.
[1]Values are means, with panel standard deviations provided in parentheses next to each value.
[2]Volatility of an exchange rate is defined as the standard deviation of its monthly percentage growth rate over the previous year.
[3]Defined as the percentage deviation of the REER from a country-specific exponential time trend, subject to a minimum value of zero.

its effect on the country's REER volatility. In principle, a correlation between G-3 and developing country RER volatility need not imply causality from the former to the latter. For instance, it might instead reflect the presence of common RER shocks. Such arguments would strengthen our finding that reductions in G-3 RER volatility would only have a limited impact on developing countries. Equations (1) and (2) are estimated using the panel fixed-effects estimator.

When analyzing the impact of G-3 RER volatility on the probability of exchange rate crises, a slightly different model was adopted:

$$Y_{it} = \alpha + \beta \cdot Overvaluation_{it} + \gamma \cdot Vol_t(G\text{-}3\_RER_i) + \delta \cdot Z_{it} + \varepsilon_{it}; \quad (3)$$

$$Overvaluation_{it} = a_i + b \cdot Vol_t(G\text{-}3\_RER_i) + e_{it}, \quad (4)$$

where Y indicates whether an exchange rate crisis occurred over the subsequent two years; and *Overvaluation* is the measure of overvaluation, with any negative values treated as being equal to zero, so as to capture the nonlinearity of its impact on crisis probabilities. Equation (3) is estimated using the panel probit estimator, while equation (4) is estimated using the panel fixed-effects estimator.

In each regression, we also allow for a standard set of additional explanatory variables.

- In the *exports* regression, the controls include the REER; a weighted average of the trading partners' real GDP indices, with the weights given by each trading partner's trade share; and a time trend, to capture the impact of reductions over time in trade barriers and transport costs.
- In the *imports* regression, the controls include the REER; real GDP; and a time trend.
- In the *total capital inflows* regression and in the *net FDI inflows* regression, the controls include an index of real GDP in industrial countries; the six-month LIBOR, as a proxy for industrial country interest rates; capital-account openness, as measured by the proportion of years in which a country did not have restrictions on its capital account; and a time trend.
- In the *exchange rate crisis* regression, the controls include the ratio of external debt to GDP; the ratio of exports to GDP; a contagion indicator, equal to unity if a crisis occurred in at least one other country in the region, and equal to zero in all other cases; and our measure of trade-finance mismatch.

All these controls broadly have the expected sign. In each regression, the volatility of industrial country interest rates, as proxied by the volatility of the six-month LIBOR, was initially also controlled for. However, when the results were significant, the sign was consistently the opposite of what was expected. This variable was therefore omitted.

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