Capital Flows, Financial Integration, and International Reserve Holdings: The Recent Experience of Emerging Markets and Advanced Economies

Woon Gyu Choi, Sunil Sharma, and Maria Strömqvist [1]

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Abstract

This paper examines the interaction between capital flows and international reserve holdings in the context of increasing financial integration. The analysis suggests that for emerging market countries the sensitivity of reserves to net capital flows was negative in the 1980–90 period, but became positive after the Asian crisis when these countries used net capital flows to build up reserves. For advanced countries, the pattern, if any, has been the opposite. This suggests that even though funding opportunities for emerging markets have expanded with international financial integration, these countries have stockpiled reserves with heightened concern about the risk of sudden stops and loss of access to international capital markets.

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Authors' E-Mail Address: wchoi@imf.org; ssharma@imf.org; maria.stromqvist@hhs.se

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[1] Woon Gyu Choi is a Senior Economist at IMF Institute; Sunil Sharma is the Director of the IMF–Singapore Regional Training Institute; and Maria Strömqvist, a doctoral student at the Stockholm School of Economics, was a summer intern at the IMF Institute in 2005. We thank Si-Yeon Lee for valuable research assistance in an earlier stage of the project. The views expressed in this paper are those of the authors and should not be attributed to the International Monetary Fund, its Executive Board, or its management.

I. Introduction

Global holdings of international reserves have increased rapidly in recent years. This increase has been especially dramatic in emerging markets, both in absolute terms as well as in comparison to the reserves held by advanced countries. At the end of 2003, the average reserves-to-GDP ratio had climbed to 21 percent in emerging markets, compared to a ratio of 13 percent in the advanced countries. Emerging markets have accumulated reserves well above the levels suggested by the traditional rule of thumb based on current account transactions and short-term external liabilities.[2] Also, the recent record pace of reserve accumulation in emerging markets is at odds with the prediction of a standard reserve holding model (see, for example, IMF, 2003).

With increasing financial liberalization and openness to cross-border transactions, managing a country's liquid assets to facilitate current and future international transactions—what we call "sovereign liquidity"—has become a key element in macroeconomic management. Clearly, the desired level of reserves and the availability of liquidity depend on a sovereign's access to international capital markets. This paper uses panel data from 36 emerging markets and 24 advanced economies for the 1980–2003 period to examine the interaction between capital flows, financial integration, and reserve holdings.

In recent decades, currency and/or financial crises accompanied by reversals in capital flows have become more frequent and severe (see, for example, Eichengreen and Adalet, 2005). With increased financial integration, countries are more vulnerable to contagion from within and outside their regions.[3] In response, central banks in developing countries have accumulated reserves to cushion extreme events, the bunching of external debt maturities, or other shocks that could affect the foreign exchange market and the domestic economy.

Many of the currency and financial crises of the last ten years have been associated with the contractionary effects of currency depreciation, with substantial output losses, especially through balance sheet channels (see, for example, Choi and Cook, 2004, and Frankel, 2005). After the 1997–98 Asian financial crisis, emerging markets have reduced short-term external debt relative to reserves, and stockpiled reserves to reduce their vulnerability to a crisis (see, for example, Aizenman and Marion, 2004; McKinnon and Schnabl, 2004; Rodrik, 2006). Since a reserve holding country can always opt not to use its reserves for debt service, reserves have an

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[2] Prior to the 1990s, emerging market reserves fluctuated between three and four months of imports, in line with the traditional rule of thumb that reserves equivalent to three months of imports should be sufficient to accommodate current account transactions. At the end of 2004, emerging market reserves stood at a record average of 8 months of imports—Korea and China held more than 9 months and 14 months of imports, respectively. More recently, the Guidotti-Greenspan-IMF rule has been invoked: countries hold reserves to cover external liabilities maturing within a year or short-term debt (Rodrik, 2006). Even by this metric, emerging market reserve cover has been excessive: the ratio of reserves to short-term debt was greater than 3.5 for Korea and 4.0 for China in 2004. However, recent research suggests that a broader metric should be used for assessing reserve adequacy (see Lipschitz et al., 2006).

[3] See, Kaminsky and Reinhart (2000) for an examination of how trade and financial sector links influence the pattern of contagion. Forbes (2004), using cross-country firm-level data, shows that liquidity in global markets may have affected the stock returns on individual companies during the East Asian and Russian crises.

insurance value specific to the country (Van Wijnbergen, 1990). Holding large reserves is costly, but its perceived cost may be small relative to the economic and social cost of a crisis.

Central banks also hold reserves to back a pegged or managed exchange rate system. Since countries classified as having a free or a managed float often resemble pegs, a "fear of floating" appears to be pervasive (Calvo and Reinhart, 2002; Reinhart and Rogoff, 2004a). This is especially so for countries with dollarized liabilities (Choi and Cook, 2004). To soften local currency volatility, central banks use reserves to manage the currency even in the absence of severe shocks.

Reserve accumulation has also taken place as a by product of a strategy to protect external competitiveness in countries dependent on exports for output growth (Dooley, Folkerts-Landau, and Garber, 2004; Eichengreen, 2004). Furthermore, in principle, holding assets in foreign currencies, whether by the central bank or directly by individuals or firms, may constitute a reasonable investment strategy—the value of foreign currency assets may be negatively correlated with that of domestic investments, providing the benefits of risk diversification.

In the presence of financial frictions and information problems, international reserves are analogous to corporate liquidity holdings to cope with uncertain income streams and cash flows. In the face of external finance premia, the behavior of corporations suggests that the value of having liquid assets is disproportionately high for financially weak firms—a stockpiling motive (Kim et al., 1998; Choi and Kim, 2001; Almeida et al., 2004). Given frictions and information problems in international financial markets, countries facing uncertain growth prospects and volatile capital flows have a similar stockpiling motive in reserve management. Specifically, a country with volatile output and high sovereign risk will have an incentive to accumulate reserves, even at the cost of increased external debt. Reserves, if they are beyond the reach of creditors, allow a country to smooth consumption in the event of a default on external debt and loss of access to international financial markets.

The fact that more capital does not flow from rich to poor countries—the paradox of too little flow (Lucas, 1990)—might be substantially attributable to credit-market imperfections (Reinhart and Rogoff, 2004b).[4] For the high growth emerging markets, the paucity of capital flows has been ameliorated by financial globalization. Nevertheless, one would expect that emerging markets will take advantage of episodes of capital inflows to stockpile reserves, since in other times external financing may be expensive due to credit-market imperfections. With increasing financial integration, and greater exposure and dependence on international capital, sovereign liquidity management has become crucial for macroeconomic stability since capital flow reversals can result in huge output losses. This has increased the option value of holding reserves.

Given financial frictions and information problems, we examine the link between capital flows and a country's stockpiling of international reserves. Sovereign liquidity shortages may

[4] Reinhart and Rogoff (2004b) suggest that the true paradox may not be in uneven bouts of capital flows and volatile cycles, but that too much capital (specifically in the form of debt) is channeled to "debt-intolerant" serial defaulters.

lead to expensive borrowings, or a forced reduction in consumption and investment spending. Hence, countries perceiving a risk of binding liquidity constraints in the future have an incentive to fend off such potential financial strains by hoarding reserves today. Clearly, countries that can borrow at reasonable risk premia will need a smaller stock of reserves, and the reserve holding across countries should depend on the degree of access to international markets.

To examine the effect of net capital flows and financial integration on reserve holdings, we estimate panel data models and try to take account of the size of economies, openness, exchange rate volatility, exchange rate regimes, world interest rates, and fiscal conditions. Our analysis suggests that the sensitivity of the stock of reserves to (net) capital flows has changed dramatically over time for emerging markets, and their reserve holding pattern has been quite different from that of advanced countries. In the 1980s, emerging market reserve holdings decreased with net capital flows, whereas advanced countries' reserve holdings increased with capital flows. This suggests that for emerging markets capital flows were used to finance current account deficits. In the 1990s, the sensitivity of emerging market reserves to capital flows declined substantially, reflecting the use of capital flows to finance domestic expenditures. In recent years, net capital flows have had a strong positive effect on the stock of reserves held by emerging markets but not on the reserves held by advanced countries. This suggests that in recent years capital inflows have not just financed current account deficits in emerging markets but have also been used to build up reserve buffers. With increasing financial integration and the experience of recent capital account crises in the developing world, this buildup is attributable to heightened concerns about the risks of "sudden stops" and the loss of access to international capital markets.[5]

The rest of the paper is organized as follows. Section II presents the determinants of international reserves and empirical model specifications. Section III provides data descriptions and summary statistics of key variables. Section IV presents the results of panel regressions. Section V concludes the paper. The appendix contains a description of the data.

II. Determinants of International Reserves

Recent studies have used a number of factors to explain reserve holdings. This section reviews these factors and draws implications for sovereign liquidity management in the face of increased financial globalization and capital flows.

A. Buffer Stocks and the Precautionary Motive

Given informational problems and frictions in international financial markets, sovereign reserves can be viewed as analogous to corporate holdings of liquid assets. Liquid assets enable a firm to reduce the firm's dependence on costly external financing for funding future production activities—a precautionary or stockpiling motive. Choi and Kim (2001) suggest that firms increase liquid assets by drawing on lines of credit when external finance becomes costly due to

[5] Calvo (1998) views the financial crises in emerging markets as the result of ''sudden stops''—the sudden imposition of collateral constraints on international lending.

tighter monetary policies. Almeida et al. (2004) show that financially constrained firms have a propensity to use cash flows to build up cash or liquid assets, while financially unconstrained firms have no systematic tendency to do so. Both studies suggest that, under financial market frictions, the demand for liquidity depends on external finance premia and cash flows.

Van Wijnbergen (1990) suggests that the lack of terms-of-trade contingent instruments in international capital markets and differences in risk aversion between creditors and emerging market debtors explains why reserves have an option value. Aizenman and Marion (2003) show that an increase in loss aversion or an increase in volatility of shocks boosts precautionary reserves, and Aizenman and Lee (2005) emphasize that the precautionary holding of reserves can provide self-insurance against sudden stops and capital flight. Also, reserves may be used as macroeconomic stabilizers (Ben-Bassat and Gottlieb, 1992; Caballero and Panageas, 2004).

To explain international reserve holdings, the traditionally the buffer stock model has been used (see, for example, Frenkel and Jovanovic, 1981; Bahmani-Oskooee, 1985). This model says that central banks should choose a level of reserves to balance the opportunity cost of holding reserves with macroeconomic adjustment costs incurred in the absence of reserves or when they fall short. Flood and Marion (2002) find that buffer stock reserve models work about as well in the modern floating exchange rate period as they did during the Bretton Woods regime period. They observe that global reserve holdings were about 17 weeks of imports at the end of 1999, which is almost double what they were at the end of 1960, and 20 percent higher than they were at the start of the 1990s. The IMF (2003), using a standard buffer stock model based on Aizenman and Marion (2004), suggests that the rapid accumulation of reserves between 1997 and 2001 was broadly in line with fundamentals, but the surge in reserves in 2002 and 2003 was above the level predicted by the model.

Scaling factors

The scaling variable measures the size of international transactions and can be represented by GDP, GDP per capita, or population size. Aizenman and Marion (2004) suggest that reserve holdings should increase with the size of international transactions and thus be positively correlated with the country's population or standard of living. In emerging markets with large populations like China and India, population may overestimate the size of these countries since a large share of the population are not directly involved in international transactions. Hence, using the logarithm of population may be more appropriate.

Opportunity cost of holding reserves

The opportunity cost variable plays an important role in theoretical models. The standard measure of the opportunity cost in empirical studies is the differential between the country's own-interest rate and the interest rate on comparable US treasuries. Most empirical studies do not find a significant negative effect for the opportunity cost (Flood and Marion, 2002; IMF, 2003; Aizenman and Marion, 2004). As Aizenman and Marion (2004) point out, the opportunity cost variable may not be properly measured since the composition of reserves is not adequately reflected, and till the early 1990s, most emerging markets did not have market determined domestic interest rates. In addition, the standard measure does not take into account the cost of

acquiring international currencies for building up reserves, which importantly depends on the country-risk premium and access to international capital markets.

Adjustment cost and degree of openness

If an external deficit induced by a decline in exports is to be corrected by a decline in output, the required output adjustment increases with the marginal propensity to import. If countries finance their external deficit by using their international reserves to reduce such an adjustment cost, reserve holdings would be positively related to the marginal propensity to import. In most empirical studies, the average propensity to import has been used instead of the marginal propensity; it has also been interpreted to measure the economy's openness and vulnerability to external shocks (Edwards, 1984; Aizenman and Marion, 2004). The more open a country to external shocks, the greater the need for reserves.

Volatility of international transactions

The buffer stock approach suggests that reserve holdings increase with the volatility of international transactions (Frenkel and Jovanovic, 1981; Flood and Marion, 2002; Aizenman and Marion, 2004). The volatility of international transactions is usually measured by the standard deviation of the trend-adjusted changes in reserves over some period.[6] An alternative measure is the volatility of export receipts used by Edwards (1985) and Aizenman and Marion (2004).

B. Other Considerations

Exchange rate flexibility

Conventional wisdom holds that greater flexibility in the exchange rate should reduce the demand for reserves since central banks then do not need a large reserve stockpile to maintain a peg or to enhance the peg's credibility (Flood and Marion, 2002; Disyatat, 2001).[7] Also, more flexible exchange rate regimes are able to better accommodate shocks to the economy, compared to more rigid regimes, and hence need smaller liquidity buffers (see, for example, Heller and Mohsin, 1978).

However, central banks, in an attempt to dampen the appreciation of their currencies, may buy dollars, increasing international reserves (Frankel and Dornbusch, 1995; Dooley, Folkerts-Landau, and Garber, 2004). If the foreign exchange and capital markets are thin or imperfectly developed, volatile movements of capital can lead to substantial exchange rate and asset price

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[6] Such a reserve volatility measure, however, can be contaminated because it combines jumps in reserves owing to reserve restocking and sudden declines due to speculative attacks (Flood and Marion, 2002).

[7] Analyzing the effect of exchange rate regimes on reserve holdings relies on the assumption that the regimes are correctly classified. Recently, Reinhart and Rogoff (2004a) suggest a system of reclassifying historical exchange regimes based on *de facto* exchange rate practices, which may differ substantially from the conventional *de jour* regime classification.

volatility. Thus, to temper exchange rate and asset price volatility, the need for reserves may increase with greater exchange rate flexibility.

Sovereign ratings

Sovereign ratings summarize and supplement information about macroeconomic indicators and default history, as well as about social and political factors (Cantor and Packer, 1996). Since creditors in sovereign debt markets have limited enforcement rights (for example, few possibilities for seizing country assets), political and credit risk play an important role in the flow of capital from rich to poor countries (Reinhart and Rogoff, 2004b). Governments generally seek credit ratings to ease their access to international capital markets and broaden their investor base since many investors prefer rated securities over unrated securities with similar credit characteristics. For emerging economies, Kaminsky and Schmukler (2002) find that changes in sovereign ratings affect country risk premia and stock returns. Rating upgrades tend to lead to up turns in local markets. Since countries with low ratings have limited access to international capital markets, they have an incentive to hold more reserves to better withstand adverse external shocks.

Fiscal Conditions

Fiscal problems increase the risk of a currency or banking crisis. The weaker the fiscal stance, the higher the risk of sovereign default, and thus a higher external finance premium. Hence, countries in fiscally fragile situations are likely to hold larger reserve cushions, and this could lead to a negative link between reserves and fiscal surpluses (Reinhart and Rogoff, 2004b). On the other hand, Aizenman and Marion (2004) argue that political-economy considerations might change the optimal reserve levels. A greater chance of opportunistic behavior by future policymakers reduces the demand for international reserves, and may lead to higher external borrowing for increasing the current consumption of special interest groups.[8] In the same way, political corruption may also reduce optimal reserve holdings (Aizenman and Marion, 2003). Such political-economy considerations suggest a positive link between reserves and fiscal surpluses. Therefore, the net effect of the fiscal stance on reserve holdings will depend on a combination of political-economy factors and the risk of a crisis associated with fiscal vulnerability.

C. Capital Flows and Financial Integration

With increased financial integration and open capital accounts, the scope of international reserve management has expanded over time and includes not just moderating volatility in the exchange rate and facilitating the export and import of goods and services, but now also encompasses a wide variety of cross-border asset transactions. Due to this trend, sovereign liquidity management has gained in importance and is increasingly perceived as a key element in reducing the vulnerability to international financial shocks.

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[8] For a discussion on how differences in political institutions and political stability can contribute to explaining the variance in debt policies, see Alesina and Tabellini (1990).

How have countries reacted to changes in the global financial environment? The traditional buffer stock model of reserves assumes that the brokerage fee or the liquidation cost of assets for restocking reserves is known and fixed.[9] In reality, however, the cost of restocking reserves through selling assets or extending liabilities depends on the country's access to international capital markets. Since such adjustment costs depend on global financial conditions, they are state-dependent: in good times countries have low country-risk premia and may raise capital easily, but in bad times countries with low creditworthiness, facing restricted access to international capital markets, find it expensive to borrow. The precautionary view (Choi and Kim, 2001; Almeida et al., 2004) suggests that countries stockpile reserves for intertemporal liquidity management when liquidity is available at low financing costs.

Despite the development of financial markets and financial instruments, international markets are far from complete and subject to more than the usual frictions and information problems. And given the recent experience of developing countries, there is heightened concern about sudden reversals in capital flows and the risks of financial crises (see, for example, Calvo, 1998, 2002; Aizenman and Marion 2003; Caballero and Panageas, 2004; Edwards, 2004).

To capture changes in the financial environment faced by emerging markets, the empirical analysis uses a measure of the financial openness of an economy. This can be done in two ways: by *de jure* financial integration measures that are based on policies to promote capital account liberalizaton, or by *de facto* measures based on actual capital flows.[10] Prasad et al. (2003) and Lane and Milesi-Ferretti (2006) suggest a direct measure of financial openness based on the sum of foreign assets and liabilities as a share of GDP.

III. Data and Descriptive Statistics

The empirical analysis uses annual data for 36 emerging markets and 24 advanced countries for the 1980–2003 period (the list of countries is specified in Appendix). Most of the data have been collected from International Financial Statistics (IFS) and the World Economic Outlook (WEO). The data on sovereign ratings were provided by Standard and Poor's (S&P), and exchange rate regime classifications are based on Reinhart and Rogoff (2004a).

Table A1 in the appendix reports the descriptive statistics for two different groups: advanced countries and emerging markets. As in Aizenman and Marion (2004) and IMF (2003), international reserves are defined as gross reserves net of gold. Reserves relative to GDP over the entire period are about the same for emerging markets and advanced countries, about eleven

[9] Bar-Ilan, Marion, and Perry (2006) suggest that adjustment costs are important in explaining the time path of reserve accumulation. The cost of adjusting the stock of reserves indirectly reflects the costs of external finance.

[10] The indicators of the extent of government restrictions on capital flows across national borders may suggest that many countries in Latin America are closed to financial flows. However, the volume of capital actually crossing the borders of these countries has been relatively large compared to the average volume of such flows for all developing countries. Therefore, on a de facto basis, these Latin American countries are quite open to global financial flows. By contrast, some countries in Africa have few formal restrictions on capital account transactions but have not experienced significant capital flows.

percent. The population size is on average greater in emerging markets, in large part due to China and India. On average, the GDP per capita in advanced countries is five times that of emerging markets. However, GDP growth in dollar terms varies widely but on average is about six percent in both groups of countries. Exchange rate volatility is far higher in emerging markets. Reflecting better access to international financial markets, advanced countries have had larger net capital flows than emerging markets. The current account (*CA*) balance is on average more negative for advanced than emerging markets, mainly owing to the large negative balance for the U.S. The credit ratings are higher on average for advanced countries (22 compared to 14 for emerging markets). The range for credit ratings is much wider for emerging markets (from 2 to 23), while all the advanced countries are above investment grade (from 14 to 23). The M2-to-GDP ratio of advanced countries is on average twice as high as that of emerging markets, indicating the higher monetization of the former.

Table A2 in the appendix shows simple correlation coefficients between the key variables. It is worth noting that some correlations differ across the two groups of countries. For example, the correlation between the reserves-to-GDP and the import-to-GDP ratios for advanced countries is as high as 0.87, whereas its value for emerging markets is as low as 0.13. The reserves-to-GDP ratio is positively correlated with sovereign ratings for emerging markets (0.54), but is negatively correlated for advanced countries (–0.18), perhaps reflecting that reserve levels have a positive effect on the sovereign ratings for emerging markets but not for advanced countries.

Figure 1 (panel A) depicts the averages for the reserve level and reserves-to-GDP ratio by country group for the 1980–2003 period. In terms of the reserves-to-GDP ratio, the emerging markets as a group caught up with the advanced countries by the mid-1990s. Thereafter, for the advanced countries this ratio fluctuated around 12-13 percent, while for emerging markets it rose substantially after the Asian crisis and had reached 21 percent by 2003.

Figure 1 (panel B) shows the different patterns in the movement of net capital flows for the country groups. For emerging markets, as capital accounts were liberalized net capital flows increased steadily over the 1991–96 period, resulting in a sharp increase in the net capital flows-to-GDP ratio. The dramatic fall in net capital flows for 1998–2000 is associated with the Asian financial crisis (see Ghosh et al., 2002). For advanced countries, net capital flows showed a downward trend after 1992 and increased sharply after the Asian crisis. An upsurge in net capital flows in recent years for advanced countries reflects the funding of the large U.S. current account deficits.

Panel C plots the cross-section averages for the current account. For emerging markets, a downward swing in the current account for 1991–96 mirrors an upward swing in net capital flows. During recent years, emerging markets have exhibited a rising trend in current account. For advanced countries, the current account average fluctuates around a rising trend: it shows a downward swing during the late 1980s and early 1990s, reflecting the banking crises in the Nordic countries and the turmoil in the European Monetary System. The negative current account average for advanced countries for 1998–2003 is attributable to the U.S current account deficit: excluding the U.S. from the sample, the cross-section average has been positive.

Figure 2 shows over sub-periods the changes in the distribution of the reserves-to-GDP ratio. The figure complements the recent increasing divergence in reserve holding behavior between the two groups of countries. For emerging markets (column 1), the distribution has shifted to the right. In contrast, for the advanced countries (column 2) if the outliers (Singapore and Hong Kong SAR) are excluded, the distribution has become more concentrated around 5 percent.

The variability of net capital flows and current accounts over time is shown in Figure 3. For emerging markets, the variability of net capital flows increased during the second half of 1980s reaching a peak in 1992 before declining. It rose again in 1997, reflecting the reversal in capital flows during the Asian financial crisis, and showed a slight increase in 2002. For advanced countries, volatility of net capital flows was high in the 1980s, relatively low in the 1990s, and increased somewhat after 2001. Current account volatility for emerging markets on average was high till the early 1990s, before falling to relatively low levels. In contrast, the current account volatility for the advanced countries was low till the early 1990s, and since then has been on a rising trend. Hence, for emerging markets compared to advanced countries, lower volatility in net capital flows and current accounts is coupled with higher reserves relative to GDP.

IV. Empirical results

In this section, we first specify and estimate baseline regressions, and then extend the regressions to include other factors affecting reserve accumulation. Instrumental variables and dynamic panel methods are used to deal with the endogeneity of regressors. Statistical inferences about estimated coefficients are based on White's heteroscedasticity-consistent standard errors.

A. Baseline regressions

Our basic regression is similar to Aizenman and Marion (2004), except that we normalize reserves by GDP and include output growth, sovereign ratings, and net capital flows.[11] For country *i* at time *t*, the regression for the ratio of reserves to output is given by

$$\left(\frac{IR}{GDP}\right)_{i,t} = \alpha_i + \beta_S SIZE_{i,t} + \beta_\sigma \sigma_{i,t} + \beta_{IM}\left(\frac{IM}{GDP}\right)_{i,t} + \beta_G GROWTH_{i,t} + \beta_{SR} SR_{i,t} + \beta_{CF}\left(\frac{CF}{GDP}\right)_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where *IR/GDP* is the ratio of international reserves to GDP (gross domestic product in U.S. dollars); *SIZE* is the natural log of population, a supplementary scale factor in the model since we scale the dependent variable, reserves, by GDP; σ is the standard deviation of the nominal exchange rate divided by GDP—the standard deviation is assumed to be constant over the sample period for a country but differs across countries; and *IM/GDP*, the ratio of imports to

[11] Aizenman and Marion (2004) find the volatility of export receipts to be statistically insignificant. We exclude this variable from our regressions because the sign of its coefficient varies depending on which other variables are included in the model and is highly sensitive to normalizations.

GDP, is a measure of the degree of openness of an economy. The parameter α denotes fixed-county effects, and ε the error terms.

GROWTH is the GDP growth rate. Countries with robust growth are likely to attract capital and thus less likely to run into financial constraints. So countries with higher growth can hold lower reserves, and the expected sign of β_G is negative. *SR* is the sovereign rating assigned by Standard and Poor's. Since a higher rating implies a lower risk of default on external debt, it reduces the need for reserves, suggesting that β_{SR} is negative. *CF /GDP* is the ratio of net capital flows to GDP. If net capital flows are used mainly for financing current account deficits, β_{CF} will be negative. Conversely, if net capital flows are used mainly for stockpiling reserves, β_{CF} will be positive.

It is possible that the net capital flow variable is correlated with the error term due to reverse causality, which may arise, for example, when countries borrow from abroad to meet a reserves target. To deal with the endogeneity of a regressor, we use instrumental variables (IV), with lagged net capital flows as the instruments. A first-stage regression showed that the lagged net capital flow variables were highly correlated with the endogenous variable. In addition, we performed the Hansen test for overidentification to check if the regression model was correctly specified and that the instruments were valid.

Table 1 summarizes the estimated baseline regressions for the pooled sample as well as the two country groups: emerging markets and advanced countries. For the pooled sample, when country heterogeneity is taken into account by fixed country effects, the adjusted R-squares, $\overline{R}^2$, show that the model explains about 92 percent of the variation in reserves. However, if the fixed country effects are excluded, $\overline{R}^2$ drops sharply to 17 percent, suggesting that variations in reserves are largely picked by country-specific heterogeneity. For the group specific regressions, the explanatory power of the model is much higher for advanced countries than for emerging markets, as indicated by their $\overline{R}^2$ (0.95 vs. 0.81). Excluding the variation explained by the fixed country effects, $\overline{R}^2$ is 0.35 for emerging markets and about 0.76 for advanced countries, suggesting much larger heterogeneity in reserve holding behavior for the former group.

Reserves increase with the scale variable, decrease with exchange rate volatility, and increase with openness for both OLS and IV regressions, in accordance with the results in Aizenman and Marion (2004). More specifically, first, the population coefficient is positive and larger for emerging markets than for advanced countries. One could argue that the need for reserves relative to output initially increases as an economy grows to a certain threshold, and then flattens out or even declines. Second, the exchange rate variability coefficient is negative, consistent with Flood and Marion's (2002) finding that greater flexibility in the exchange rates is associated with lower reserve levels. The effect of exchange rate volatility is much stronger for the advanced countries than for emerging markets. Third, the coefficient of the import-to-GDP ratio (openness) is positive for all groups of countries and larger but less significant for advanced countries than emerging markets.

The sovereign rating has a negative effect on reserves, implying that the higher is a country's creditworthiness, the less is the need for reserve holdings since it can access international markets. The sovereign rating effect is stronger for the advanced countries than for emerging markets: it becomes insignificant in the IV regression for emerging markets. The GDP growth variable is statistically significant (with a negative sign) for the advanced economies, implying that they can economize on reserves during periods of relatively high growth. However, it is statistically insignificant for the emerging markets.

It is worth noting that the coefficient of the net capital flows to GDP ratio is statistically insignificant for both groups of countries, while it is marginally significant in the OLS pooled regression. Hence, on average over the whole sample period, there appears to be little or no evidence on the effect of net capital flows on the accumulation of international reserves.

Also, we do not report the regressions including the standard opportunity cost measure of reserves, because, as in previous studies, we did not find that it had any discernible effect on reserve accumulation. However, in section D below, we examine how world interest rates affect reserve holdings.

B. Estimating the Effects of Financial Integration

The level of global capital flows has increased substantially in the last decade. There has not only been an increase in flows among industrial countries but also a sharp rise in the flows from industrial to developing countries. The effects of financial integration in terms of increased capital flows, however, have been spread unevenly across developing countries (Reinhart and Rogoff, 2004b).[12]

Lane and Milesi-Ferretti (2006) define global financial integration in terms of the ratio of the sum of foreign assets and liabilities to GDP. This measure gradually increased during the 1970s and 1980s but accelerated, especially in advanced countries, in the mid-1990s, suggesting 1998 as the year when there was a change in the trend over 1970–2004 period. This is reinforced by the net capital flows plot in Figure 1 which also suggests that a change around 1998 for both emerging markets and advanced countries. Figure 4 depicts the Lane and Milesi-Ferretti measure for the country groups used in this paper. For advanced countries, it shows an upward trend with a sharp increase starting in 1999. For emerging markets, it shows a gradual increase over the 1980s, some fluctuations with no apparent trend over the 1990s, and then a modest rise in recent years. This suggests that in recent years international financial transactions, relative to output, have grown much more rapidly for advanced countries, compared to emerging markets.

[12] Prasad et al. (2003) divide developing countries into two groups, by ranking them according to their average financial openness, which is measured by the ratio of the gross stock of foreign assets and liabilities to GDP as in Lane and Milesi-Ferretti (2006). The more financially integrated group is included in the sample of emerging markets used in this paper, and it is these emerging markets that have received the vast majority of capital flows to the developing world.

The baseline regressions showed that over the sample period, the effect of net capital flows on international reserves has been weak. To investigate whether this effect of net capital flows has varied over subperiods, we estimated the following regression:[13]

$$\left(\frac{IR}{GDP}\right)_{i,t} = \alpha_i + \beta_S SIZE_{i,t} + \beta_\sigma \sigma_{i,t} + \beta_{IM}\left(\frac{IM}{GDP}\right)_{i,t} + \beta_G GROWTH_{i,t} + \beta_{SR} SR_{i,t} + \sum_{j=1}^{k} \beta_{CF,j} D_j \times \left(\frac{CF}{GDP}\right)_{i,t} + \varepsilon_{i,t}. \quad (2)$$

Table 2 shows the results of regression model 1 for the two country groups. Model 1 has three time dummies interacting with the capital flow variable: $D_{(80\text{-}90)}$, $D_{(91\text{-}97)}$, $D_{(98\text{-}03)}$ take on the value 1 for periods 1980–1990, 1991-1997 and 1998-2003 respectively and zero otherwise. The OLS and IV regressions give similar results.[14]

For emerging markets, the time-varying effects of net capital flows on reserves are significant at the one percent level. In the 1980s, reserve holdings decreased with net capital flows. This would indicate that, before the financial integration took off, net capital flows were used to finance current account deficits. In contrast, during the two subsequent periods, net capital flows had little or even a positive effect on reserves. During the 1991–97 period, there was a substantial net flow of capital into emerging markets but this did not lead to higher reserve levels. For the aftermath of the Asian crisis (1998–2003), however, the relatively high coefficient implies that net capital flows led to a substantial accumulation of reserves. For advanced countries, the time-varying effects of net capital flows were quite different from that for emerging markets. Net capital flows had a significant positive effect on reserves in the 1980s. However, in the two subsequent periods the effect was negative but not statistically significant.

As shown in Figure 1, for emerging markets, net capital flows fell drastically during 1997–98, reversed in 2001, and increased sharply thereafter. To see if the strong effect during the 1998–03 period is mainly due to net capital flows in the latter half of this period we used four time dummies with the net capital flow variable in regression model 2: $D_{(80\text{-}90)}$, $D_{(91\text{-}97)}$, $D_{(98\text{-}00)}$,

[13] The sample period was divided into two sub-periods. Time dummies, D_1 and D_2, that take the value of one for sub-periods 1980–1990 and 1991–2003 respectively and zero otherwise, are interacted with the net capital flow variable. In preliminary regressions (not reported) to examine the effect of financial integration, we found significant differential effects of net capital flows on reserves between the two sub-periods. For the pooled sample, net capital flows do not have an effect on reserves in both sub-periods. However, for the two country groups the effects were significant and differed across the groups. For emerging markets, net capital flows had a significant negative effect on reserve accumulation during 1980–1990, whereas, for advanced countries, the effect was significantly positive.

[14] Three alternative instruments were considered—the interest rate spread, defined as the domestic Treasury-bill rate (adjusted for exchange rate depreciation) minus LIBOR, as a proxy for the country-risk premium; sovereign ratings lagged one-period; and, the lagged values of GDP growth. For advanced countries, when the net capital flow variable was regressed on all the above-mentioned instruments, only the lagged net capital flow variables turned out to be significant. For emerging markets, lagged GDP growth and lagged sovereign ratings were also highly significant and were added to the set of instruments for the group. The extended set of instruments did not change the relationship or the coefficients appreciably and for simplicity the lagged capital flow variables were retained.

and $D_{(01\text{-}03)}$ took on the value 1 for 1980–90, 1991–97, 1998–00, and 2001–03, respectively and were zero otherwise.

Table 3 summarizes the results of regression model 2. The strong effect of net capital flows during 1998–03 for emerging markets comes mainly from the latter half, 2001–03. For advanced countries, the results are hardly affected by dividing the sample period into four instead of three periods. In the pooled sample, net capital flows appear to have a marginally significant effect (at the 5 percent level) on reserves for 2001–03. Thus, controlling for the heterogeneity of country groups, we find evidence on the differential effect of net capital flows associated with financial integration. The results suggest that reserve accumulation in emerging markets and advanced countries showed starkly different sensitivities to net capital flows over time.

In Tables 2 and 3, the effects of other regressors are similar to those in the baseline regressions. In contrast with the baseline regressions, however, exchange rate variability becomes insignificant for emerging markets, perhaps suggesting that the availability of funds rather than the exchange regime was more important for emerging market reserve accumulation. In addition, the sovereign rating becomes significant for emerging markets, too.

Table 4 presents the results of regression model 3, which uses the Lane and Milesi-Ferretti measure of financial integration:

$$\left(\frac{IR}{GDP}\right)_{i,t} = \alpha_i + \beta_S SIZE_{i,t} + \beta_\sigma \sigma_{i,t} + \beta_{IM}\left(\frac{IM}{GDP}\right)_{i,t} + \beta_G GROWTH_{i,t} + \beta_{SR} SR_{i,t} + \beta_{CF} \log(GLOB)_{i,t} \times \left(\frac{CF}{GDP}\right)_{i,t} + \varepsilon_{i,t}, \tag{3}$$

where $GLOB_{i,t}$ denotes the ratio of the sum of foreign assets and liabilities to GDP for country i at time t, and a country's net capital flow variable is interacted with the logarithm of the country-specific financial integration measure. Here also, the effect of net capital flow variable is significantly positive for emerging markets but significantly negative for advanced countries. This finding reinforces the earlier results: the coefficient of the net capital flow variable drifts up over time (from negative to positive) for emerging markets and shifts down over time (from positive to negative) for the advanced countries. Also, compared to model 2, exchange rate variability, openness, and sovereign ratings have very similar effects on reserves, and the effects of size and growth are either insignificant or weak for advanced countries.

C. Dynamic Panel Regressions for International Reserve Holdings

Dynamic panel data regressions are characterized by two sources of persistence over time: autocorrelation due to the presence of lagged dependent variables, and individual effects capturing the heterogeneity across countries. First differencing the equation removes the fixed effects and produces an equation that can be estimated by instrumental variables. We employ Arellano and Bond's (1991) Generalized Method of Moments (GMM) estimator in the presence of lagged dependent variables, and endogenous and strictly exogenous variables.

Two lags of the dependent variable are included to capture the dynamics of international reserve holdings. Since exchange rate variability is defined as the average over the sample period, it is just like a fixed effect. The population variable is highly persistent over time and not suitable for a dynamic setting. Hence, variables for fixed country effects, population, and exchange rate variability are dropped from the dynamic panel model. All other time-varying variables are first differenced and included as regressors in the dynamic panel model:

$$\Delta\left(\frac{IR}{GDP}\right)_{i,t} = \sum_{j=1}^{2}\rho_j\Delta\left(\frac{IR}{GDP}\right)_{i,t-1} + \beta_{IM}\Delta\left(\frac{IM}{GDP}\right)_{i,t} + \beta_{SR}\Delta SR_{i,t} + \beta_G\Delta GROWTH_{i,t} + \sum_{j=1}^{k}\beta_{CF,j}D_i \times \Delta\left(\frac{CF}{GDP}\right)_{i,t} + u_{i,t}. \quad (4)$$

The dynamic panel counterpart of equation (3) is represented as:

$$\Delta\left(\frac{IR}{GDP}\right)_{i,t} = \sum_{j=1}^{2}\rho_j\Delta\left(\frac{IR}{GDP}\right)_{i,t-1} + \beta_{IM}\Delta\left(\frac{IM}{GDP}\right)_{i,t} + \beta_{SR}\Delta SR_{i,t} + \beta_G\Delta GROWTH_{i,t} + \beta_{CF}\Delta\left[\log(GLOB)_{i,t} \times \left(\frac{CF}{GDP}\right)_{i,t}\right] + u_{i,t}. \quad (5)$$

In these regressions, the rating variable and the net capital flow variable interacted with time dummies or the financial globalization measure are treated as endogenous.[15]

Table 5 reports the GMM estimation results of regression models specified in (4) and (5). The sovereign ratings (considering that reserves can improve sovereign ratings), output growth, and net capital flows are assumed to be endogenous. The one-period lagged dependent variable has a statistically significant coefficient of around 0.8 for both country groups, indicating substantial persistence in the change in reserve ratios. The coefficient on the two-period lagged dependent variable is significantly negative for emerging markets but positive for advanced countries, implying different dynamics for the two country groups. Not surprisingly, the same coefficient for the pooled sample is statistically insignificant because of offsetting dynamics for the two country groups.

For the pooled sample, net capital flows again have an insignificant effect on reserves. In regression (4), however, net capital flows have a positive effect (statistically significant) on reserves during the 1991–97 and 2001–03 periods for emerging markets, and no effect for the advanced countries. In regression (5), the capital flow variable has a positive effect for emerging markets and a negative effect for advanced countries. All covariates have the expected signs. These results are generally in line with those obtained in the earlier OLS and IV regressions, except that output growth is statistically significant for both country groups in the dynamic panel

[15] The Arellano-Bond estimator assumes (by construction) first-order autocorrelation of the residuals. If the model is correctly specified, there should not be any second-order autocorrelation among the residuals. Removing fixed effects by construction, dynamic panel data models do not explain the time-invariant, cross-country variations.

regressions. The Wald test statistics indicate that the regressors are jointly significant for all regressions (at the one percent level). The Arellano-Bond test for the null of no autocorrelation of order 1 in residuals is strongly rejected, and that for order 2 is not rejected. Thus, the Arellano-Bond serial correlation tests do not indicate misspecification.

D. Effects of Other Factors and Robustness Checks

As additional factors that may affect reserve holdings, we introduce the world interest rate, the type of exchange rate regime, the fiscal stance, and the financial dimension of international transactions. As summarized in Tables 6–8, after controlling for these factors, our main results remain robust.[16] Hence, the following focuses on how each of them helps explain reserve holdings.

World interest rate shocks

Countries may economize on reserve holding if world interest rates are relatively high. To examine how reserve holdings respond to the world interest rates at different levels of financial integration, we include LIBOR as a proxy for the world interest rate (*WIR*) in regression model 2. The opportunity cost of reserve holdings defined as the spread between the country's external financing cost and the return on reserves (see Rodrik, 2006)—which is related to the return on US treasuries to the extent that reserves are reinvested in liquid assets—depends on country-risk premium. The country-risk premia for emerging markets are sizable, volatile, and positively correlated with the world interest rate. For advanced countries they are typically small and much less volatile. Hence, LIBOR may be a better measure of opportunity cost of reserves for emerging markets than the advanced countries.

Table 6 reports the results with world interest rates. For the emerging markets, the world interest rate tends to have a significant impact in the more recent periods, but not in the 1980s. This may reflect an increased sensitivity to the world interest rate as emerging markets have become more integrated into world markets. In contrast, for the advanced countries, the effect of world interest rates is much weaker or insignificant. This suggests that the opportunity cost of reserve holdings is more important for emerging markets countries, and its importance increases with financial integration. The negative coefficient on the world interest rate implies that lower world interest rates in recent years may have reinforced the accumulation of reserves.

Exchange rate regimes

Our regressions so far have controlled for exchange rate variability, but this has been a time-invariant country characteristic. Exchange rate variability, however, can change when a country picks a different exchange rate regime or changes its exchange rate management: for example, a

[16] To examine the effect of outliers in terms of the reserves-to-GDP ratio, Hong Kong and Singapore were excluded from the advanced country group. Our key findings for this group remain robust to their exclusion, though openness and growth become statistically insignificant and the size variable becomes statistically less significant.

transition economy can experience a substantial change in exchange rate variability as it moves from a high-inflation state to a low-inflation state.

Figure 5 depicts the group means of the reserves to GDP ratios under different exchange rate regimes. It is based on the classifications used by Reinhart and Rogoff (2004a); regimes are classified into three groups: a fixed regime (index = 1), an intermediate regime (index = 2), and a floating regime (index = 3).[17] Two observations are noteworthy. First, for emerging markets, more flexible regimes have lower reserves, consistent with the conventional wisdom. For advanced countries, floating regimes are associated with the lowest level of reserves, but the intermediate regimes have the highest reserves-to-GDP ratio. This may reflect that more reserves are required for ameliorating exchange rate volatility under a closely managed float. Second, the time-varying link between reserves and regimes suggests that factors other than exchange rate regimes importantly affect reserves. The reserves-to-GDP ratio shows an upward trend under all regimes for emerging markets but only under the intermediate regime for advanced countries.

To examine whether the choice of exchange rate regime has an effect on reserves, we extend regression model 2 by including dummy variables for the intermediate and the floating regimes. The results in Table 7 suggest that, controlling for country characteristics, the exchange regime does not systematically affect reserve holdings for emerging markets. By contrast, the reserve-to-GDP ratios for advanced countries tend to be higher with more flexible regimes.

Fiscal factor

To see how the fiscal stance affects reserve holdings, we include the (overall) fiscal balance to GDP ratio as an endogenous variable in the dynamic panel regressions—the results are shown in Table 8 (columns 2–4). For emerging markets, the coefficient of the fiscal balance is positive but not statistically significant. For advanced countries, however, the coefficient is negative and statistically significant. This result suggests that for emerging markets the positive effect of the political-economy factor is strong enough to offset the negative effect of a precautionary motive to reduce the risk of a crisis, whereas for advanced countries the latter dominates the former.

Financial dimension of international transactions

So far we have used the logarithm of population as a proxy for the volume of international transactions. The population variable is a crude measure for international transactions. To better account for the volume of financial transactions, the M2-to-GDP ratio is included in the dynamic panel regression model. Table A5 (columns 5–7) shows that the M2-to-GDP ratio has a statistically significant positive effect on international reserves for both groups of countries.

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[17] Our index corresponds to the Reinhart-Rogoff classification as follows: index value 1 has categories from "no separate legal tender" to "de facto peg", index value 2 has categories from "pre-announced crawling peg" to "managed floating," and index value 3 has categories from "freely floating" to "freely falling." We exclude sample observations that pertain to the category of "dual market in which parallel market data is missing."

V. CONCLUSION

This paper has shown that, in recent years, despite increasing financial integration and a move toward more flexible exchange rates, emerging markets have used capital inflows to build up considerable reserve stocks. This is probably a precautionary response to the capital account crises of the last decade, during which emerging markets faced with sudden reversals in capital flows had to pay extremely high borrowing costs and/or appeal to the IMF for financial support.

An important issue in the context of global financial stability (see, for example, IMF, 2005) is how to assess the accumulation of international reserves and put the savings of emerging market countries to better use without compromising their financial stability. Since reserve holdings decline with higher sovereign ratings, better and continued access to international financial markets will help reduce the need to stockpile reserves. The development of financial markets (for example, regional bond markets) will hopefully provide for improved sovereign liquidity management in the face of volatile capital flows and rapid changes in asset prices.

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Table 1. Baseline Regressions

Variable	Pooled		Emerging		Advanced	
	OLS	IV	OLS	IV	OLS	IV
SIZE	0.198***	0.209***	0.284 ***	0.286***	0.094***	0.101**
	(6.55)	(6.72)	(7.62)	(6.09)	(2.28)	(2.26)
σ	–0.114***	–0.112***	–0.104**	–0.103***	–1.596***	–1.800***
	(–2.90)	(–2.96)	(–2.63)	(–2.70)	(–3.99)	(–3.38)
IM/GDP	0.022***	0.020***	0.024***	0.021***	0.122*	0.121*
	(3.60)	(3.20)	(3.64)	(2.59)	(1.61)	(1.64)
SR	–0.004***	–0.005***	–0.003*	–0.003	–0.010***	–0.009***
	(–3.29)	(–3.35)	(–1.89)	(–1.36)	(–3.30)	(–2.85)
GROWTH	–0.013	–0.012	–0.002	0.002	–0.027**	–0.028**
	(–1.07)	(–1.02)	(–0.08)	(0.06)	(–2.05)	(–2.08)
CF /GDP	0.033*	0.011	0.116	–0.068	0.013	0.026
	(1.79)	(0.19)	(1.33)	(0.26)	(0.65)	(0.50)
$\overline{R}^2$	0.924 [0.167]	0.924 [0.165]	0.810 [0.351]	0.811 [0.351]	0.952 [0.776]	0.952 [0.755]
No. of observations	736	736	303	303	435	435
Hansen's test [1]		χ^2 (2)=0.253 [0.881]		χ^2 (2)=2.000 [0.368]		χ^2 (2)=0.617 [0.734]

Notes: The international reserves-to-GDP ratio (*IR/GDP*) is regressed on the log of population (*SIZE*), exchange rate variability (σ), openness (*IM/GDP*), sovereign rating (*SR*), GDP growth (*GROWTH*), and net capital flow (*CF*) or current account (*CA*). Regressions use Ordinary Least Squares (OLS) or Instrumental Variables (IV) and include fixed-country effects. $\overline{R}^2$ is the adjusted *R*-squares, and the figure in square brackets excludes variance explained by the fixed-country effects. The *t*-ratios in parentheses are based on standard errors robust to the presence of arbitrary heteroscedasticity. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 2. Regression Model 1: The Effects of Capital Flows over Three Subperiods

	Pooled		Emerging		Advanced	
Variable	OLS	IV	OLS	IV	OLS	IV
SIZE	0.198***	0.214***	0.273***	0.293***	0.084**	0.076*
	(6.49)	(6.38)	(7.91)	(6.46)	(2.15)	(1.77)
σ	–0.107***	–0.100**	–0.070	–0.051	–1.504***	–1.623***
	(–2.72)	(–2.61)	(–1.55)	(–1.05)	(–3.90)	(–3.28)
IM/GDP	0.022***	0.020***	0.020***	0.018***	0.129*	0.137*
	(3.51)	(3.24)	(3.39)	(2.78)	(1.70)	(1.86)
SR	–0.004***	–0.005***	–0.005***	–0.009***	–0.012***	–0.012***
	(–3.33)	(–3.63)	(–2.91)	(–2.89)	(–3.66)	(–3.28)
GROWTH	–0.011	–0.010	–0.002	–0.006	–0.028**	–0.031**
	(–0.92)	(–0.81)	(0.11)	(–0.22)	(–2.17)	(–2.34)
$D_{(80\text{-}90)}$*(*CF /GDP*)	0.042**	0.078***	–0.668***	–0.982***	0.053**	0.055**
	(2.30)	(3.20)	(–3.72)	(–4.52)	(2.50)	(1.98)
$D_{(91\text{-}97)}$*(*CF /GDP*)	–0.026	–0.059	0.013	0.079	–0.029	–0.049
	(–0.56)	(–0.74)	(0.15)	(0.31)	(–0.48)	(–0.48)
$D_{(98\text{-}03)}$*(*CF /GDP*)	–0.080	0.135	0.539***	0.948***	–0.070	–0.155
	(–1.46)	(1.19)	(4.70)	(2.57)	(–1.06)	(–1.30)
$\overline{R}^2$	0.925 [0.185]	0.925 [0.153]	0.838 [0.359]	0.828 [0.361]	0.953 [0.782]	0.952 [0.780]
No. of observations	766	736	303	301	463	435
Hansen's test [1]		χ^2 (6)=2.993		χ^2 (6)=2.953		χ^2 (6)=3.324
		[0.810]		[0.815]		[0.762]

Notes: The reserves-to-GDP ratio (*IR/GDP*) is regressed on the log of population (*SIZE*), exchange rate variability (σ), openness (*IM/GDP*), sovereign rating (*SR*), GDP growth (*GROWTH*), and the net capital flows (*CF*) variable interacted with time dummies (*D*). Regressions use Ordinary Least Squares (OLS) and Instrumental Variables (IV) and include fixed-country effects. $\overline{R}^2$ is the adjusted *R*-squares, and the figure in square brackets excludes variance explained by the fixed-country effects. The *t*-ratios in parentheses are based on standard errors robust to the presence of arbitrary heteroscedasticity. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

[1] Hansen's test is an overidentification test for all instruments. Under the null hypothesis that the model is correctly specified and the instruments are valid, the test statistic is distributed as a chi-square with the degree of freedom equal to the number of overidentifying restrictions (with *p*-values in square brackets). The net capital flows variable is instrumented by its lagged values up to order three.

Table 3. Regression Model 2: The Effects of Capital Flows over Four Subperiods

Variable	Pooled		Emerging		Advanced	
	OLS	IV	OLS	IV	OLS	IV
SIZE	0.201***	0.213***	0.272***	0.286***	0.084**	0.089**
	(6.53)	(6.09)	(7.97)	(6.70)	(2.15)	(1.98)
σ	–0.084**	–0.072***	–0.008	0.033	–1.504***	–1.696***
	(–2.10)	(–1.83)	(–0.20)	(0.81)	(–3.90)	(–3.31)
IM/GDP	0.021***	0.018***	0.017***	0.012**	0.129*	0.124*
	(3.31)	(2.87)	(2.99)	(2.22)	(1.70)	(1.67)
SR	–0.004***	–0.005***	–0.005***	–0.008***	–0.012***	–0.011***
	(–3.12)	(–3.25)	(–3.03)	(–3.23)	(–3.49)	(–2.96)
GROWTH	–0.014	–0.014	–0.020	–0.031	–0.028**	–0.029**
	(–1.18)	(–1.16)	(–0.91)	(–1.02)	(–2.17)	(–2.25)
$D_{(80\text{-}90)}$*(*CF /GDP*)	0.052***	0.090***	–0.652***	–1.006***	0.054**	0.050*
	(2.58)	(3.24)	(–3.63)	(–4.49)	(2.39)	(1.87)
$D_{(91\text{-}97)}$*(*CF /GDP*)	–0.042	–0.091	0.016	0.013	–0.030	–0.004
	(–0.87)	(–1.04)	(0.19)	(0.06)	(–0.48)	(–0.03)
$D_{(98\text{-}00)}$*(*CF /GDP*)	–0.052	–0.104	0.216**	0.340	–0.077	0.035
	(–0.92)	(–0.94)	(2.14)	(1.35)	(–0.86)	(0.37)
$D_{(01\text{-}03)}$*(*CF /GDP*)	0.155*	0.178*	0.803***	1.171***	–0.065	–0.101
	(1.69)	(1.56)	(6.66)	(3.55)	(–0.66)	(–0.85)
$\overline{R}^2$	0.926 [0.190]	0.926 [0.166]	0.851 [0.375]	0.846 [0.372]	0.953 [0.783]	0.953 [0.782]
No. of observations	766	736	303	301	463	435
Hansen's test [1]		χ^2 (8)=5.403		χ^2 (8)=9.324		χ^2 (8)=7.711
		[0.714]		[0.316]		[0.462]

Notes: The reserves-to-GDP ratio (*IR/GDP*) is regressed on the log of population (*SIZE*), exchange rate variability (σ), openness (*IM/GDP*), sovereign rating (*SR*), GDP growth (*GROWTH*), and net capital flow (*CF*) variables interacted with time dummies (*D*). Regressions use Ordinary Least Squares (OLS) and Instrumental Variables (IV) and include fixed-country effects. $\overline{R}^2$ is the adjusted *R*-squares, and the figure in brackets excludes variance explained by the fixed-country effects. The *t*-ratios in parentheses are based on standard errors robust to the presence of arbitrary heteroscedasticity. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

[1] Hansen's test is an overidentification test for all instruments. Under the null hypothesis that the model is correctly specified and the instruments are valid, the test statistic is distributed as a chi-square with the degree of freedom equal to the number of overidentifying restrictions (with *p*-values in square brackets). The net capital flows variable is instrumented by its lagged values up to order three.

Table 4. Regression Model 3: Capital Flows and Financial Integration

	Pooled		Emerging		Advanced	
Variable	OLS	IV	OLS	IV	OLS	IV
SIZE	0.186***	0.155***	0.281***	0.276***	0.045	–0.012
	(6.60)	(5.58)	(7.77)	(7.18)	(1.37)	(–0.40)
σ	–0.122***	–0.201***	–0.053*	–0.015	–1.438***	–1.273***
	(–3.06)	(–4.21)	(–1.69)	(–0.32)	(–4.14)	(–4.17)
IM/GDP	0.021***	0.019***	0.030***	0.037***	0.133*	0.146**
	(3.37)	(3.15)	(5.45)	(4.82)	(1.82)	(2.08)
SR	–0.005***	–0.006***	–0.005***	–0.008***	–0.013***	–0.015***
	(–3.71)	(–4.45)	(–3.25)	(–2.63)	(–4.19)	(–4.44)
GROWTH	–0.010	–0.010	–0.012	–0.028	–0.022*	–0.017
	(–0.86)	(–0.86)	(–0.54)	(–0.83)	(–1.78)	(–1.34)
GLOB(CF /GDP)*	–0.070	–0.260***	1.000***	1.881**	–0.175**	–0.373***
	(–1.30)	(–3.90)	(4.87)	(2.67)	(–3.09)	(–5.73)
$\overline{R}^2$	0.926 [0.217]	0.930 [0.234]	0.844 [0.344]	0.826 [0.338]	0.955 [0.797]	0.951 [0.794]
No. of observations	754	737	296	287	463	461
Hansen's test [1]		χ^2 (2)=0.723		χ^2 (2)=2.789		χ^2 (2)=0.405
		[0.697]		[0.248]		[0.817]

Notes: The international reserves-to-GDP ratio (*IR/GDP*) is regressed on the log of population (*SIZE*), exchange rate variability (σ), openness (*IM/GDP*), sovereign rating (*SR*), GDP growth (*GROWTH*), and net capital flow (*CF*) interacting with the logarithm of the globalization measure (*GLOB*). Regressions using Ordinary Least Squares (OLS) and Instrumental Variables (IV) are performed for emerging markets, advanced countries, and the pooled sample. All regressions include fixed-country effects. $\overline{R}^2$ is the adjusted *R*-squares (accounting for the fixed-country effects), and the figure in brackets excludes variance explained by the fixed-country effects. The *t*-ratios in parentheses are based on standard errors robust to the presence of arbitrary heteroscedasticity. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

[1] Hansen's test is an overidentification test of all instruments. Under the null hypothesis that the model is correctly specified and the instruments are valid, the test statistic is distributed as chi-squared in the number of overidentifying restrictions (with *p*-values in square brackets). Each net capital flow variable is instrumented by its lagged values up to order three.

Table 5. Dynamic Panel Regressions

	Three sub-periods			Four sub-periods			Globalization measure		
Variable	Pooled	Emerging	Advanced	Pooled	Emerging	Advanced	Pooled	Emerging	Advanced
$\Delta(IR/GDP)_{-1}$	0.853***	0.812***	0.783***	0.842***	0.809***	0.783***	0.847***	0.763***	0.758***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\Delta(IR/GDP)_{-2}$	–0.050	–0.141***	0.105	–0.0424	–0.146***	0.105*	–0.055	–0.151***	0.106
	[0.434]	[0.007]	[0.107]	[0.504]	[0.002]	[0.101]	[0.399]	[0.001]	[0.110]
$\Delta(IM/GDP)$	0.004**	0.010***	0.011	0.003**	0.009***	0.013	0.003**	0.011***	0.010
	[0.018]	[0.000]	[0.791]	[0.015]	[0.000]	[0.754]	[0.017]	[0.000]	[0.796]
ΔSR	–0.003***	–0.004***	–0.005**	–0.003***	–0.005***	–0.005**	–0.003***	–0.004***	–0.006**
	[0.002]	[0.001]	[0.048]	[0.002]	[0.000]	[0.048]	[0.004]	[0.020]	[0.019]
$\Delta GROWTH$	–0.052***	–0.087***	–0.026**	–0.053***	–0.103***	–0.026**	–0.048***	–0.070***	–0.022***
	[0.000]	[0.000]	[0.018]	[0.000]	[0.000]	[0.018]	[0.000]	[0.004]	[0.005]
$D_{(83\text{-}90)}*\Delta CF/GDP$	0.009	–0.124	0.012	0.014	–0.122	0.012			
	[0.641]	[0.531]	[0.505]	[0.470]	[0.523]	[0.514]			
$D_{(91\text{-}97)}*\Delta(CF/GDP)$	0.079*	0.299***	0.041	0.071	0.292***	0.041			
	[0.059]	[0.003]	[0.312]	[0.110]	[0.002]	[0.322]			
$D_{(98\text{-}03)}*\Delta(CF/GDP)$	0.023	0.411***	–0.613						
	[0.704]	[0.000]	[0.345]						
$D_{(98\text{-}00)}*\Delta(CF/GDP)$				–0.054	0.200***	–0.063			
				[0.318]	[0.008]	[0.387]			
$D_{(01\text{-}03)}*\Delta(CF/GDP)$				0.065	0.582***	–0.060			
				[0.388]	[0.000]	[0.342]			
$\Delta[GLOB*(CF/GDP)]$							–0.045	0.529***	–0.077*
							[0.291]	[0.002]	[0.088]
Wald test: *p*-value	$\chi^2(8)$=662.2	$\chi^2(8)$=293.3	$\chi^2(8)$=512.9	$\chi^2(9)$=745.1	$\chi^2(9)$=345.7	$\chi^2(9)$=514.9	$\chi^2(6)$=636.7	$\chi^2(6)$=462.6	$\chi^2(6)$=193.6
No. of observations	696	272	424	696	272	424	686	266	424
Arellano-Bond tests									
Autocov. of order 1	–4.50	–3.04	–3.18	–4.55	–3.30	–3.18	–4.53	–3.36	–3.20
	(0.000)	(0.002)	(0.002)	(0.000)	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)
Autocov. of order 2	–0.55	–0.93	0.00	–0.27	–1.33	0.01	–0.28	–0.65	–0.32
	(0.585)	(0.352)	(0.999)	(0.788)	(0.184)	(0.999)	(0.781)	(0.513)	(0.752)

Notes: The first-difference of the reserves-to-GDP ratio ($\Delta(IR/GDP)$) is regressed on two lags of the dependent variable ($\Delta(IR/GDP)_{-1}$ and $\Delta(IR/GDP)_{-2}$), and the first-differences of openness, sovereign rating, and GDP growth ($\Delta(IM/GDP)$, ΔSR, and $\Delta GROWTH$), and the first-difference of net capital flows variable ($\Delta(CF/GDP)$) interacted with time dummies (D) or the financial integration measure. GMM regressions, treating sovereign rating, output growth, net capital flows (or the financial integration measure) as endogenous. The *p*-values in square brackets are based on heteroscedasticity-robust standard errors. Significance at the one, five, and ten percent level is given by ***, ** , and *, respectively. The statistics for the Arellano-Bond tests are based on the null hypothesis of no autocorrelation of order 1 and 2 (with *p*-values in parentheses).

Table 6. Regression Model 2 with World Interest Rates

	Pooled		Emerging		Advanced	
Variable	OLS	IV	OLS	IV	OLS	IV
SIZE	0.214***	0.236***	0.248***	0.275***	0.173***	0.213***
	(5.43)	(5.52)	(4.60)	(3.49)	(3.04)	(3.49)
σ	–0.061	–0.053	0.012	0.044	–2.048***	–2.596***
	(–1.55)	(–1.37)	(0.31)	(1.16)	(–4.36)	(–3.95)
IM/GDP	0.019***	0.017***	0.015***	0.010**	0.153	0.148*
	(3.11)	(2.66)	(2.78)	(2.03)	(1.80)	(1.79)
SR	–0.004***	–0.004***	–0.004***	–0.007***	–0.013***	–0.012***
	(–2.84)	(–3.15)	(–2.51)	(–2.83)	(–3.89)	(–3.55)
GROWTH	–0.031**	–0.032**	–0.021	–0.030	–0.049***	–0.053***
	(–2.44)	(–2.47)	(–0.98)	(–1.05)	(–2.86)	(–3.02)
$D_{(80\text{-}90)}$**WIR*	–0.001*	–0.001	–0.002	–0.002	–0.000	0.001
	(–1.92)	(–1.33)	(–0.87)	(–0.90)	(–0.25)	(0.82)
$D_{(91\text{-}97)}$**WIR*	–0.006***	–0.006***	–0.008***	–0.006**	–0.004**	–0.003
	(–3.97)	(–3.55)	(–3.19)	(–2.04)	(–1.97)	(–1.18)
$D_{(98\text{-}00)}$**WIR*	–0.004***	–0.005***	–0.005***	–0.005***	–0.004*	–0.004
	(–3.21)	(–3.13)	(–2.71)	(–2.99)	(–1.87)	(–1.36)
$D_{(01\text{-}03)}$**WIR*	–0.006**	–0.007**	–0.006*	–0.009**	–0.009**	–0.008*
	(–2.23)	(–2.43)	(–1.78)	(–2.36)	(–2.13)	(–1.74)
$D_{(80\text{-}90)}$**(CF /GDP*)	0.055***	0.098***	–0.652***	–0.954***	0.066***	0.070***
	(2.73)	(3.61)	(–4.13)	(–4.59)	(2.92)	(2.61)
$D_{(91\text{-}97)}$**(CF /GDP*)	0.001	–0.065	0.118	–0.026	–0.031	–0.007
	(0.02)	(–0.68)	(1.24)	(–0.09)	(–0.49)	(–0.07)
$D_{(98\text{-}00)}$**(CF /GDP*)	–0.039	–0.078	0.166	0.253	–0.072	0.038
	(–0.69)	(–0.69)	(1.52)	(1.03)	(–0.83)	(0.42)
$D_{(01\text{-}03)}$**(CF /GDP*)	0.164*	0.167	0.669***	0.973***	–0.056	–0.079
	(1.93)	(1.62)	(5.29)	(2.92)	(–0.61)	(–0.74)
$\bar{R}^2$	0.929 [0.215]	0.929 [0.176]	0.862 [0.472]	0.857 [0.458]	0.955 [0.787]	0.955 [0.787]
No. of observations	766	736	303	301	463	435
Hansen's test [1]		χ^2 (8)=7.81		χ^2 (8)=9.07		χ^2 (8)=7.58
		[0.452]		[0.336]		[0.476]

Notes: The reserves-to-GDP ratio (*IR/GDP*) is regressed on the log of population (*SIZE*), exchange rate variability (σ), openness (*IM/GDP*), sovereign rating (*SR*), GDP growth (*GROWTH*), world interest rate (*WIR*) variables interacting with time dummies (*D*), and net capital flow (*CF*) variables interacting with *D*. Regressions use Ordinary Least Squares (OLS) and Instrumental Variables (IV) and include fixed-country effects. $\bar{R}^2$ is the adjusted *R*-squares (accounting for the fixed-country effects), and the figure in square brackets excludes variance explained by the fixed-country effects. The *t*-ratios in parentheses are based on standard errors robust to the presence of arbitrary heteroscedasticity. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

[1] Hansen's test is an overidentification test of all instruments. Under the null hypothesis that the model is correctly specified and the instruments are valid, the test statistic is distributed as chi-squared in the number of overidentifying restrictions (with *p*-values in square brackets). Each net capital flow variable is instrumented by its lagged values up to order three.

Table 7. Regression Model 2 with Exchange Rate Regimes

	Pooled		Emerging		Advanced	
Variable	OLS	IV	OLS	IV	OLS	IV
SIZE	0.216***	0.230***	0.275***	0.304***	0.103***	0.111***
	(7.05)	(6.59)	(8.12)	(7.12)	(2.63)	(2.44)
σ	–0.089**	–0.080**	–0.014	0.026	–1.562***	–1.761***
	(–2.22)	(–2.01)	(–0.35)	(0.60)	(–3.97)	(–3.37)
IM/GDP	0.024***	0.022***	0.010	0.017**	0.149*	0.148**
	(3.82)	(3.46)	(1.44)	(2.18)	(1.96)	(1.99)
SR	–0.003**	–0.004**	–0.004***	–0.009***	–0.010***	–0.009**
	(–2.34)	(–2.56)	(–2.66)	(–3.39)	(–3.09)	(–2.48)
GROWTH	–0.015	–0.016	–0.022	–0.048	–0.028**	–0.032**
	(–1.26)	(–1.35)	(–1.01)	(–1.53)	(–2.24)	(–2.45)
$D_{(80\text{-}90)}$*(*CF /GDP*)	0.069***	0.090***	–0.464***	–0.752**	0.065***	0.063***
	(3.62)	(3.86)	(–2.80)	(–2.44)	(3.03)	(2.47)
$D_{(91\text{-}97)}$*(*CF /GDP*)	–0.031	–0.059	0.015	0.177	–0.008	0.019
	(–0.65)	(–0.68)	(0.18)	(0.74)	(–0.13)	(0.17)
$D_{(98\text{-}00)}$*(*CF /GDP*)	–0.049	–0.099	0.180*	0.458*	–0.071	0.055
	(–0.87)	(–0.92)	(1.78)	(1.82)	(–0.80)	(0.58)
$D_{(01\text{-}03)}$*(*CF /GDP*)	0.148*	0.166	0.750***	1.301***	–0.065	–0.093
	(1.66)	(1.52)	(6.63)	(3.95)	(–0.66)	(–0.80)
Intermediate regime dummy	0.017***	0.018***	0.005	0.005	0.021***	0.024***
	(2.90)	(3.01)	(0.40)	(0.40)	(3.18)	(3.52)
Floating regime dummy	0.017*	0.019**	0.011	0.011	0.031***	0.036***
	(1.95)	(2.03)	(0.72)	(0.72)	(3.09)	(2.79)
$\bar{R}^2$	0.926 (0.240)	0.927 (0.222)	0.809 (0.269)	0.792 (0.275)	0.953 (0.827)	0.953 (0.827)
No. of obs.	751	721	285	283	463	463
Hansen's test [1]		χ^2 (8)=4.33		χ^2 (8)=12.43		χ^2 (8)=7.64
		[0.826]		[0.133]		[0.469]

Notes: The reserves-to-GDP ratio (*IR/GDP*) is regressed on the log of population (*SIZE*), exchange rate variability (σ), openness (*IM/GDP*), sovereign rating (*SR*), GDP growth (*GROWTH*), world interest rate (*WIR*) variables interacting with time dummies (*D*), and net capital flow (*CF*) variables interacting with *D*. Regressions use Ordinary Least Squares (OLS) and Instrumental Variables (IV) and include fixed-country effects. $\bar{R}^2$ is the adjusted *R*-squares (accounting for the fixed-country effects), and the figure in square brackets excludes variance explained by the fixed-country effects. The *t*-ratios in parentheses are based on standard errors robust to the presence of arbitrary heteroscedasticity. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

[1] The Hansen test is a test of overidentifying restrictions. The null hypothesis is that the model is correctly specified and the instruments are valid (with *p*-values in square brackets). Under the null, the test statistic is distributed as chi-squared in the number of overidentifying restrictions. Each net capital flow variable is instrumented by its lagged values up to order three.

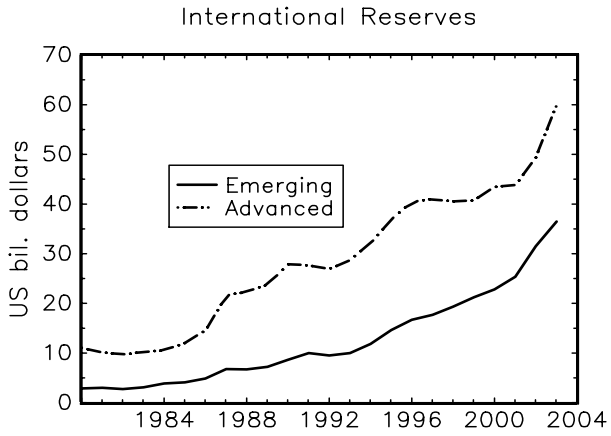
Table 8. Dynamic Panel Regressions with Fiscal Balance or M2

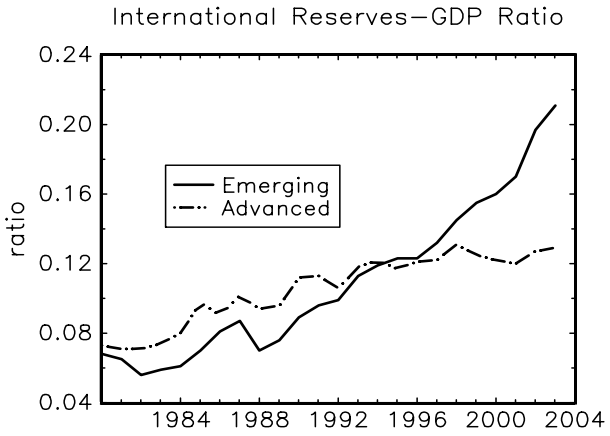
	With Fiscal Balances			With M2		
Variable	Pooled	Emerging	Advanced	Pooled	Emerging	Advanced
$\Delta(IR/GDP)_{-1}$	0.834***	0.809***	0.763***	0.826***	0.742***	0.773***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\Delta(IR/GDP)_{-2}$	–0.042	–0.145***	0.105	–0.058	–0.134***	0.075
	[0.485]	[0.003]	[0.115]	[0.295]	[0.008]	[0.356]
$\Delta(IM/GDP)$	0.003***	0.009***	0.029	0.003	0.009***	0.028
	[0.008]	[0.000]	[0.446]	[0.201]	[0.000]	[0.599]
ΔSR	–0.003***	–0.005***	–0.005**	–0.003***	–0.005***	–0.002
	[0.009]	[0.000]	[0.046]	[0.000]	[0.000]	[0.536]
$\Delta GROWTH$	–0.051***	–0.103***	–0.022**	–0.061***	–0.091***	–0.025**
	[0.001]	[0.000]	[0.032]	[0.000]	[0.000]	[0.016]
$D_{(80\text{-}90)}*\Delta(CF/GDP)$	0.025	–0.117	0.031**	0.231**	–0.084	0.266***
	[0.176]	[0.534]	[0.042]	[0.049]	[0.653]	[0.002]
$D_{(91\text{-}97)}*\Delta(CF/GDP)$	0.069	0.292***	0.024	0.160**	0.288***	0.072
	[0.134]	[0.003]	[0.527]	[0.013]	[0.001]	[0.346]
$D_{(98\text{-}00)}*\Delta(CF/GDP)$	–0.051	0.200***	–0.058	–0.020	0.227***	–0.147
	[0.312]	[0.007]	[0.403]	[0.854]	[0.001]	[0.336]
$D_{(01\text{-}03)}*\Delta(CF/GDP)$	0.062	0.581***	–0.066	0.142	0.565***	–0.194
	[0.403]	[0.000]	[0.245]	[0.381]	[0.000]	[0.109]
$\Delta(F/GDP)$	–0.092	0.018	–0.127**			
	[0.130]	[0.868]	[0.016]			
$\Delta(M2/GDP)$				0.042**	0.076***	0.029*
				[0.014]	[0.000]	[0.058]
Wald test	$\chi^2(10)=841.5$	$\chi^2(10)=351.6$	$\chi^2(10)=823.0$	$\chi^2(10)=1000.8$	$\chi^2(10)=1016.0$	$\chi^2(10)=2392.6$
No. of observations	682	272	410	576	271	305
Arellano-Bond tests						
Autocov. of order 1	–4.58	–3.29	–3.15	–4.17	–3.16	–2.68
	(0.000)	(0.001)	(0.002)	(0.000)	(0.002)	(0.008)
Autocov. of order 2	–0.32	–1.33	0.03	–0.76	–1.38	0.28
	(0.746)	(0.183)	(0.977)	(0.448)	(0.169)	(0.780)

Notes: The first-differenced reserves-to-GDP ratio ($\Delta(IR/GDP)$) is regressed on two lags of the dependent variable ($\Delta(IR/GDP)_{-1}$ and $\Delta(IR/GDP)_{-1}$), the first-differenced openness, sovereign rating, and GDP growth ($\Delta(IM/GDP)$, ΔSR, and $\Delta GROWTH$), the first-differenced net capital flow variable ($\Delta(CF/GDP)$) interacting with time dummies (D), and the first-differenced fiscal stance or M2 ($\Delta(F/GDP)$ or $\Delta(M2/GDP)$). GMM regressions, treating sovereign rating, output growth, net capital flow, and fiscal balance (or M2) as endogenous variables, are performed for emerging markets, advanced countries, and the pooled sample. The *p*-values in square brackets are based on heteroscedasticity-robust standard errors. Significance at the one, five, and ten percent level is given by ***, ** , and *, respectively. The *s*tatistics for the Arellano-Bond tests are based on the null hypothesis of no autocorrelation of orders 1 and 2 (with *p*-values in parentheses).

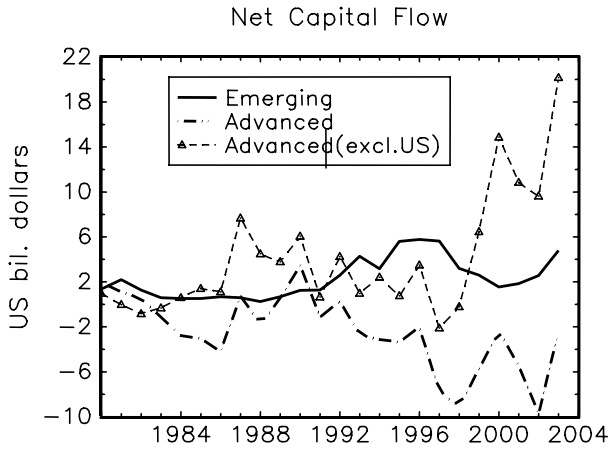
Figure 1. Foreign Reserves, Net Capital Flows, and Current Accounts

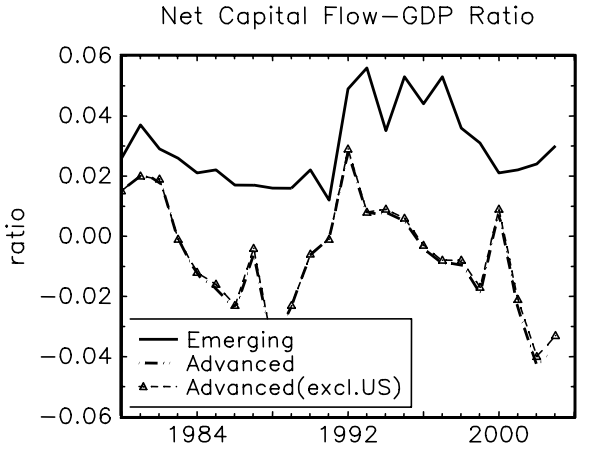
A. International Reserves



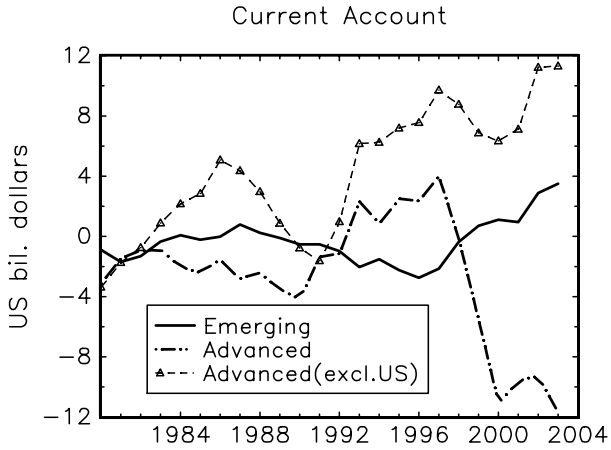


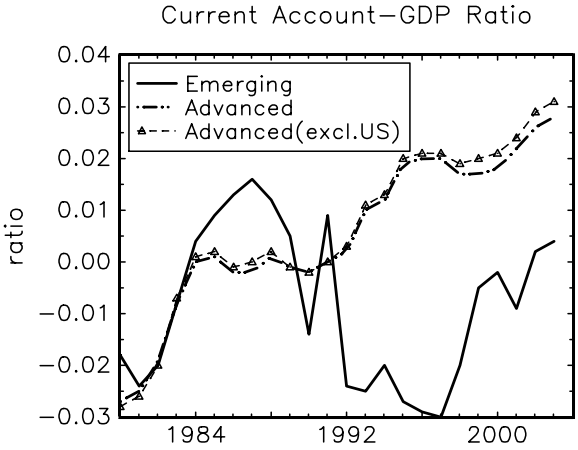
B. Net Capital Flows





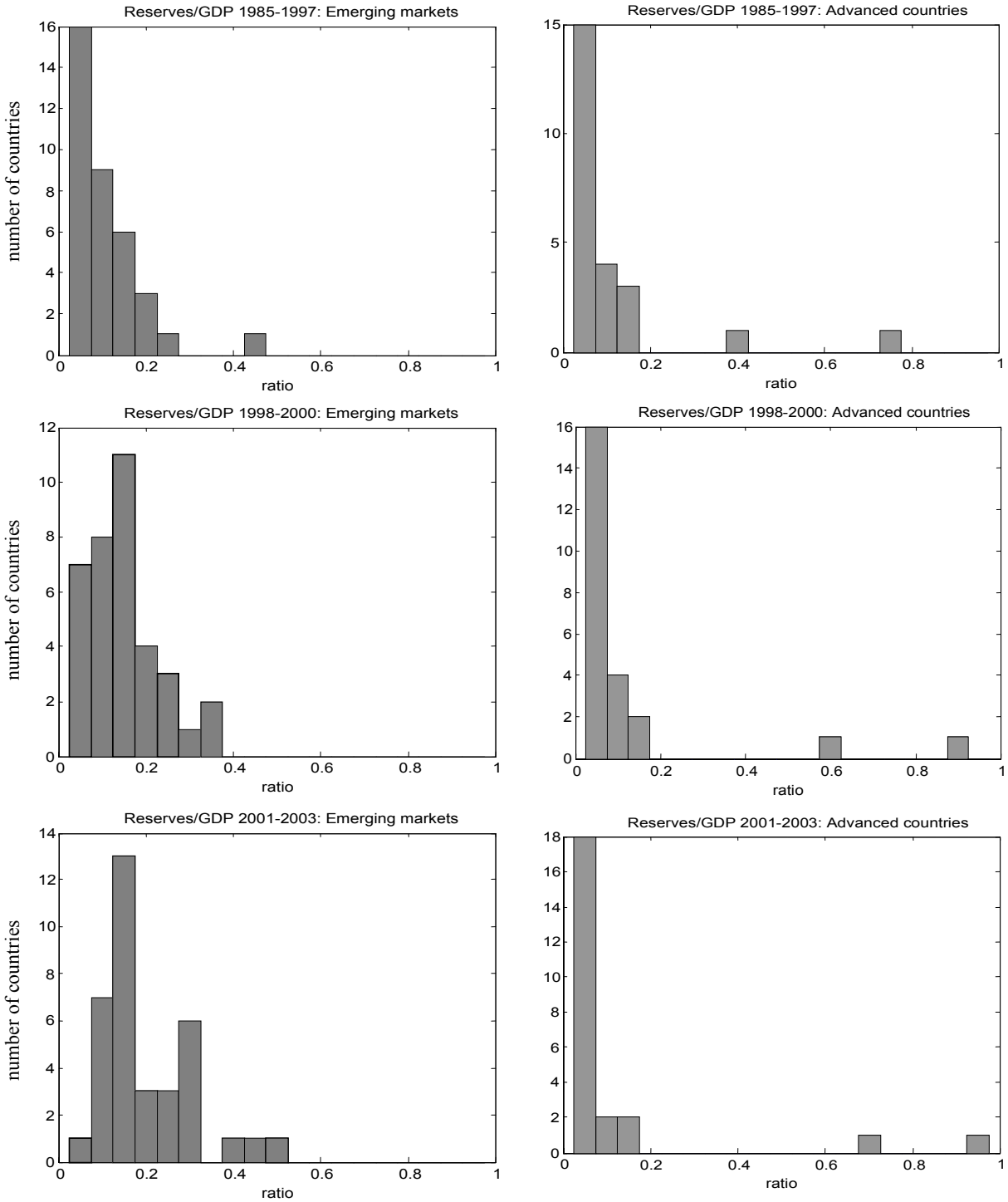
C. Current Accounts





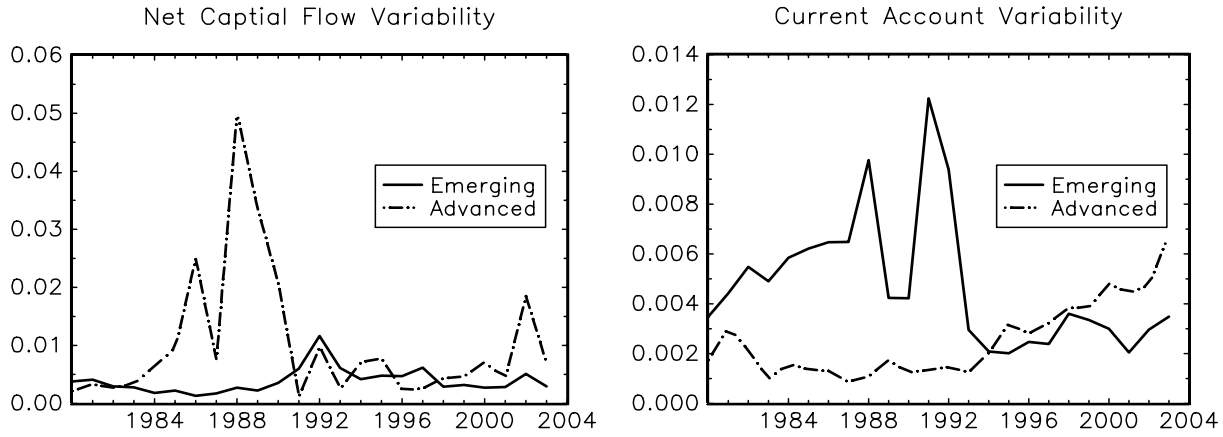
Notes: The figure depicts the cross-section averages of variables. Dotted lines with symbols in panels B and C indicate the cross-section average of variables excluding the U.S.

Figure 2. Reserves-to-GDP Ratio: Changes in the Distribution



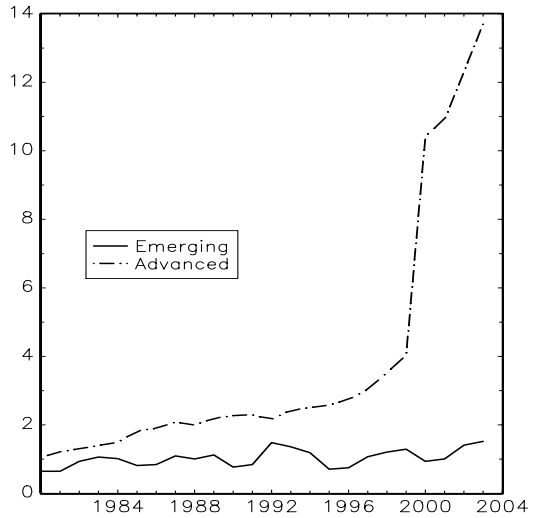
Notes: The first sample period starts from 1985 since observations for some emerging markets are not available in the first half of the 1980s. The grid size is 0.05.

Figure 3. Variability in Net Capital Flows and Current Accounts



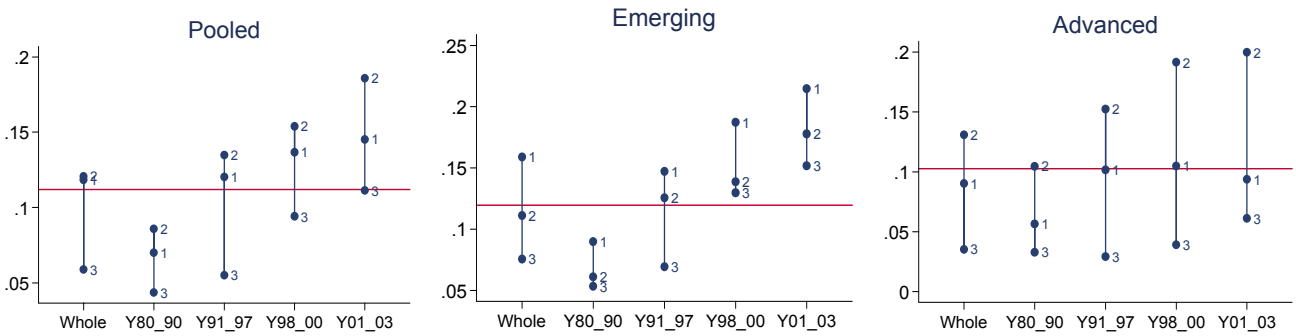
Notes: The figure depicts the cross-section average of (net capital flows/GDP)^2 in column 1 and that of (current account/GDP)^2 in column 2 for emerging markets (solid lines) and advanced countries (dashed lines) over time.

Figure 4. Financial Globalization Measure



Notes: The figure depicts the cross-section average of the ratio of sum of foreign assets and liabilities to GDP (source: Lane and Milesi-Ferretti, 2006) for emerging market and advanced county groups.

Figure 5. Reserves-to-GDP Ratio by Exchange Rate Regime Type



Notes: The figure depicts the group means of the reserve-to-GDP ratio by exchange rate regime type over subsample periods. Regimes are indexed as follows: fixed regime = 1; intermediate regime = 2; and floating regime = 3. The subsample periods are: Whole (1980–03); Y80_90 (1980–90); Y91_97 (1991–97); Y98_00 (1998–00); and Y01_03 (2001–03).

Appendix

A. Country Group List

Emerging market group (36 countries)	Advanced country group (24 countries)
Argentina	Australia
Brazil	Austria
Bulgaria	Belgium
Chile	Canada
China	Denmark
Colombia	Finland
Croatia	France
Czech Republic	Germany
Egypt	Greece
Estonia	Hong Kong SAR
Hungary	Ireland
India	Italy
Indonesia	Japan
Israel	Luxembourg
Jordan	Netherlands
Kazakhstan	New Zealand
Latvia	Norway
Lithuania	Portugal
Malaysia	Singapore
Mexico	Spain
Pakistan	Sweden
Peru	Switzerland
Philippines	United Kingdom
Poland	United States
Romania	
Russia	
Slovak republic	
Slovenia	
South Africa	
South Korea	
Taiwan Province of China	
Thailand	
Turkey	
Ukraine	
Uruguay	
Venezuela	

Notes: Our country groups correspond to the groups "emerging market countries" and "industrial countries" in the IMF Research Department's *Global Data Source*. Our emerging market group is similar to the "emerging market countries" except that it includes Croatia, Egypt, Jordan, Kazakhstan, and Uruguay but excludes Hong Kong and Singapore. Our advanced country group includes Hong Kong and Singapore, in addition to "industrial countries."

B. Descriptive Statistics

Table A1. Descriptive Statistics

A. Emerging markets

Variable	Units	N	Mean	Std	Min	Max
Reserve/GDP	Ratio	725	0.116	0.101	0.002	0.755
GDPdollar	Billion USD	864	121.9	177.2	0.904	1,410
GDP per capita	USD	864	3,329	3,087	168.7	19,004
GDP growth	USD, fraction	862	0.063	0.199	-0.960	1.261
ln (Population)		864	3.171	1.568	0.338	7.168
Current account	Billion USD	864	–0.307	6.6	–33.3	44.6
Reserves excl. gold	Billion USD	725	13.9	29.6	0.045	408.2
Reserves incl. gold	Billion USD	722	14.7	30.1	0.020	412.2
Exchange rate vol		864	0.358	1.0	0.000	10.9
Net capital flow	Billion USD	864	2.3	6.8	-19.4	79.0
Export/GDP	Ratio	703	0.317	0.193	0.047	1.246
Import/GDP	Ratio	625	0.660	1.414	0.000	13.18
S&P rating	Number (1-23)	382	13.7	3.6	2.0	23.0
Fiscal balance/GDP	Ratio	864	–0.030	0.043	–0.263	0.113
M2/GDP	Ratio	722	0.462	0.283	0.001	1.920

B. Advanced countries

Variable	Units	N	Mean	Std	Min	Max
Reserve/GDP	Ratio	542	0.106	0.166	0.006	1.0
GDPdollar	Billion USD	576	722.4	1541	3.7	10,985
GDP per capita	USD	576	19,013	9,479	2,380	57,371
GDP growth	USD, fraction	575	0.064	0.117	-0.245	0.483
ln (Population)		576	2.570	1.411	–1.010	5.673
Current account	Billion USD	576	–2.6	49.6	-541.8	136.4
Reserves excl. gold	Billion USD	542	28.8	49.4	0.352	663.3
Reserves incl. gold	Billion USD	536	32.0	51.2	0.047	664.6
Exchange rate vol		576	0.004	0.009	0.000	0.007
Net capital flow	Billion USD	576	4.0	47.3	–119.5	538.8
Export/GDP	Ratio	511	0.408	0.371	0.068	2.051
Import/GDP	Ratio	576	0.426	0.339	0.069	1.744
S&P rating	Number (1-23)	488	22.0	1.8	14.0	23.0
Fiscal balance/GDP	Ratio	550	–0.027	0.057	–0.393	0.152
M2/GDP	Ratio	406	0.927	0.618	0.270	3.430

Notes: The descriptive statistics are based on annual panel data sets that comprise 36 emerging markets and 24 advanced countries for 1980–2003. The reserves-to-GDP ratio is based on international reserves excluding gold. Population is in million persons, and all other variables except S&P rating are measured on the basis of U.S. dollar (USD).

Table A2. Correlations among Variables

A. Pooled sample

	Reserve/GDP	Ex_vol	Import/GDP	SP	GDP growth	CF/GDP	CA/GDP	WIR	Fiscal/GDP
Ex_vol	0.05								
Import/GDP	0.30	0.35							
SR	–0.09	–0.17	–0.10						
GDP growth	0.03	–0.01	0.01	0.04					
CF/GDP	–0.05	0.17	0.05	–0.15	0.06				
CA/GDP	0.44	–0.20	0.05	0.18	–0.09	–0.40			
WIR	–0.21	–0.08	–0.06	0.33	–0.08	–0.06	–0.05		
Fiscal/GDP	0.40	–0.04	0.10	0.27	0.17	–0.10	0.27	0.02	
M2/GDP	0.10	–0.12	0.01	0.36	0.00	–0.18	0.22	0.06	–0.01

B. Emerging markets

	Reserve/GDP	Ex_vol	Import/GDP	SP	GDP growth	CF/GDP	CA/GDP	WIR	Fiscal/GDP
Ex_vol	0.02								
Import/GDP	0.13	0.34							
SR	0.54	0.02	0.16						
GDP growth	0.06	–0.01	0.00	0.13					
CF/GDP	–0.04	0.30	0.08	0.11	0.31				
CA/GDP	0.26	–0.26	–0.04	–0.10	–0.19	–0.71			
WIR	–0.14	–0.04	0.06	0.15	–0.10	–0.10	0.04		
Fiscal/GDP	0.25	–0.01	0.05	0.38	0.22	0.19	–0.09	0.13	
M2/GDP	0.17	–0.11	0.12	0.16	0.05	0.00	0.11	–0.11	–0.05

C. Advanced countries

	Reserve/GDP	Ex_vol	Import/GDP	SP	GDP growth	CF/GDP	CA/GDP	WIR	Fiscal/GDP
Ex_vol	0.07								
Import/GDP	0.87	–0.03							
SR	–0.18	0.01	–0.17						
GDP growth	0.03	0.03	0.03	–0.06					
CF/GDP	–0.10	–0.04	–0.10	0.07	–0.04				
CA/GDP	0.61	0.11	0.54	0.16	–0.01	–0.27			
WIR	–0.19	0.16	–0.17	0.20	–0.09	0.14	–0.22		
Fiscal/GDP	0.50	–0.01	0.49	0.04	0.14	–0.21	0.44	–0.11	
M2/GDP	0.17	0.00	0.19	–0.14	–0.03	–0.09	0.16	–0.08	–0.11

Notes: The pooled sample includes both emerging and advanced countries for 1980–2003. Simple correlation coefficients among variables: reserves-to-GDP ratio, imports-to-GDP ratio, exchange rate volatility (Ex_vol), S&P rating (SR), net capital flow (CF)-to-GDP ratio, current account (CA)-to-GDP ratio, world interest rate (WIR), overall fiscal balance-to-GDP ratio (Fiscal/GDP), and M2-to-GDP ratio.