

This chapter analyzes international capital flows over the past 30 years to assess their predictability and their likely response to changes in the global macroeconomic environment. It finds that capital flows exhibit low persistence and that their volatility has increased over time. Across economies, net flows to emerging market economies are somewhat more volatile than those to advanced economies; across types of flow, debt-creating flows are somewhat more volatile and less persistent than others. Net capital flows to emerging market economies have been strongly correlated with changes in global financing conditions, rising sharply during periods with relatively low global interest rates and low risk aversion (or greater appetite for risk) and falling afterward. Furthermore, economies that have a direct foreign financial exposure to the United States experience an additional decline in their net capital flows in response to U.S. monetary tightening over and above what is experienced by economies that have no such direct U.S. financial exposure. This negative additional effect is larger when the U.S. rate hike is unanticipated and sharper for emerging market economies that are more integrated with global financial and foreign exchange markets, but smaller for economies with greater financial depth and relatively strong growth performance. Finally, the additional response to U.S. monetary tightening is deeper in an environment of low global interest rates and low risk aversion. These findings suggest that the eventual unwinding of globally accommodative financing conditions will, on the margin, dampen net flows to emerging market economies that have a direct financial exposure to the United States relative to those that do not, although strong growth performance in these economies can offset this negative additional effect. Thus, as economies further integrate with global financial markets, it is important to adopt policies to preserve domestic economic and financial strength to cope with variable capital flows.

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International capital flows have been on an unprecedented roller-coaster ride in recent years.¹ After a remarkable surge in the run-up to the global crisis, gross inflows dropped precipitously in its wake (Milesi-Ferretti and Tille, 2010), but soon regained their upward momentum (Figure 4.1). The fluctuations in net flows were much sharper for emerging market economies (EMEs) compared with advanced economies (AEs)—in the latter, gross outflows largely offset gross inflows, generating smoother movements in net flows (Figure 4.2). By contrast, in EMEs, gross inflows and net flows both fell dramatically during the crisis and rebounded sharply afterward. For many EMEs, net flows in the first three quarters of 2010 had already outstripped the averages reached during 2004–07 (Figure 4.3) but were still lower than their precrisis highs.

Policymakers in many EMEs have eyed the recent turnaround in capital flows with mixed enthusiasm. Although external capital can provide the financing and/or spur the currency appreciation needed to strengthen domestic demand in recipient economies, net flows may increase at a pace that policymakers find difficult to manage, or they may fluctuate unpredictably, exacerbating domestic economic or financial boom-bust cycles.

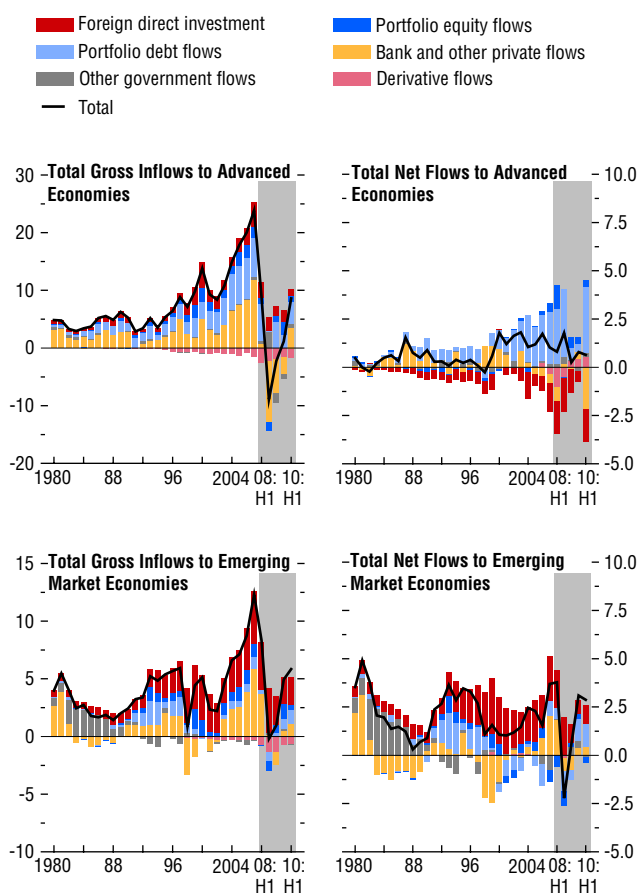
Consequently, a key question confronting policymakers is what will happen to capital flows when easy global financing conditions characterized by

¹The chapter uses “capital flows” to describe cross-border financial transactions recorded in economies’ external financial accounts, as described in the sixth edition of the IMF’s *Balance of Payments and International Investment Position Manual*. Consistent with the manual, inflows arise when external liabilities are incurred by the recipient economy (inflows with a positive sign) and external liabilities are reduced (inflows with a negative sign). Outflows are purchases of external assets from the viewpoint of the purchasing economy (outflows with a negative sign), as well as the deleveraging of its assets (outflows with a positive sign). Net flows are the sum of gross inflows and outflows, where outflows are recorded with a negative sign. Reserve asset accumulation, which may be influenced by non-market-driven factors, is excluded from the computation of net flows as defined in this chapter.

Figure 4.1. The Collapse and Recovery of Cross-Border Capital Flows

(Percent of aggregate GDP)

After an unprecedented rise during the run-up to the financial crisis and a precipitous fall in its wake, international capital flows rebounded to both advanced and emerging market economies.



Sources: CEIC; Haver Analytics; IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: See Appendix 4.1 for a list of the economies included in the advanced and emerging market economy aggregates. Data are plotted on an annual basis until 2007 and on a semiannual basis thereafter (indicated by gray shading). Semiannual data are calculated as the sum of capital flows over the two relevant quarters divided by the sum of nominal GDP (both in U.S. dollars) for the same period. Total flows may not equal the sum of the individual components because of a lack of data on the underlying composition for some economies.

low global interest rates and low risk aversion come to an end. Will capital flows reverse course with the resumption of monetary tightening in the United States or in other major AEs?

To inform this debate, this chapter analyzes the nature of net private cross-border capital flows over the past 30 years across advanced, emerging market, and other developing economies.² It examines how variable such flows are and how likely they are to respond to changes in the global macroeconomic environment. Its core focus is the behavior of net flows to EMEs, comparing the EME experience with that of other economies. In particular, this chapter addresses the following questions:

- After the global crisis, what was the nature of the capital flow recovery across advanced and emerging market economies? In terms of its size and composition, how did the postcrisis upturn in flows to EMEs compare with the surge before the crisis and with historical trends? Was the recovery in net flows broadly similar across regions, economies, and types of flow?
- How volatile and variable are net flows? Are flows to some economies more volatile or less persistent than flows to others? Have these statistical properties changed over time and do they vary by type of flow?

²A growing body of literature considers gross rather than net capital flows to uncover the extent to which cross-border capital movement is driven by foreign investors or domestic residents (see Forbes and Warnock, 2010). Although the behavior of gross inflows and outflows is interesting, an analysis of their determinants would require careful modeling of the nonstationarities that are pervasive in the gross flows data. This chapter focuses on net flows, which are both stationary and a natural counterpart to the current account, which lies at the heart of the external rebalancing debate. As in Chapter 4 of the October 2007 *World Economic Outlook*, we focus on net “private” capital flows, defined from the point of view of the recipient sector. Thus, capital flows as considered here exclude all flows to the general government and monetary authorities within the “other investment” component of the financial account given that the latter is expected to be largely driven by nonmarket factors (such as bilateral sovereign loans or transactions with the IMF). However, this concept of capital flows still includes portfolio flows to the government. For the full list of economies included in the advanced, emerging market, and other developing economy groups, see Appendix 4.1. We exclude offshore financial centers (also listed in Appendix 4.1) from the main analysis given that capital flows to these economies may reflect factors unrelated to the domestic economy.

- How did net flows, and their components, behave during previous episodes of low global interest rates and low risk aversion? How much of the variation in net flows can be explained by common—such as global or regional—versus domestic factors?
- Does an economy’s direct financial exposure to the United States affect the sensitivity of its net capital flows to U.S. monetary policy changes? To what extent is this sensitivity associated with the structural and economic characteristics of the recipient economy, such as its degree of global financial integration, domestic financial depth, exchange rate regime, and growth performance? Does this sensitivity vary by the type of flow or the underlying global economic and financial environment?

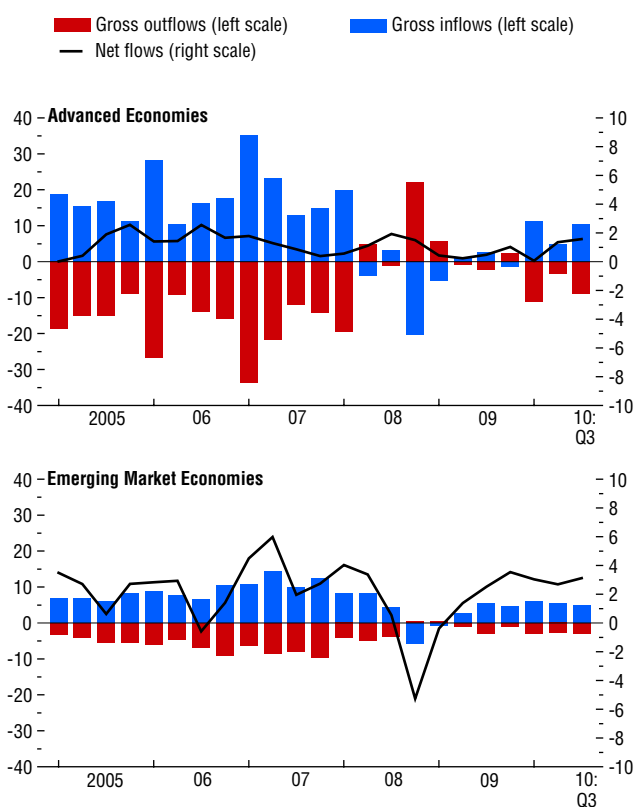
In answering these questions, this chapter makes several contributions to the voluminous literature on capital flows. First, in its descriptive analysis, it expands on earlier work on the volatility and persistence of capital flows (for example, Becker and Noone, 2009; Levchenko and Mauro, 2007; Claessens, Dooley, and Warner, 1995) for a large sample of economies over a longer and more recent time period. Second, it examines how net flows to EMEs behaved during and in the aftermath of periods when the global economic environment was similar to today’s: loose global monetary conditions and relatively low risk aversion. This is the foremost economic scenario in many policymakers’ minds, but it has not been adequately explored.³ Third, the chapter identifies how differences in economies’ direct financial exposure to the United States affect the responses of their capital flows to changes in U.S. monetary policy, while taking into account all possible global factors. This is accomplished by means of two innovations:

- The existing literature that examines the “push” (global) and “pull” (domestic) drivers of capital flows has generally attempted to estimate the total effect on capital flows of a selected set of global

³Exceptions include Calvo and others (2001), who document the pattern of capital flows to EMEs during various U.S. growth and monetary policy cycles, and the IMF’s May 2010 *Regional Economic Outlook* for the Western Hemisphere, which contrasts the behavior of capital inflows to Latin America during periods of low global interest rates and low risk aversion.

Figure 4.2. The Evolution of Gross and Net Capital Flows
(Percent of aggregate GDP)

Emerging market economies experienced much sharper fluctuations in net capital flows than advanced economies, despite the similarity in the behavior of gross capital inflows and outflows for the two groups.



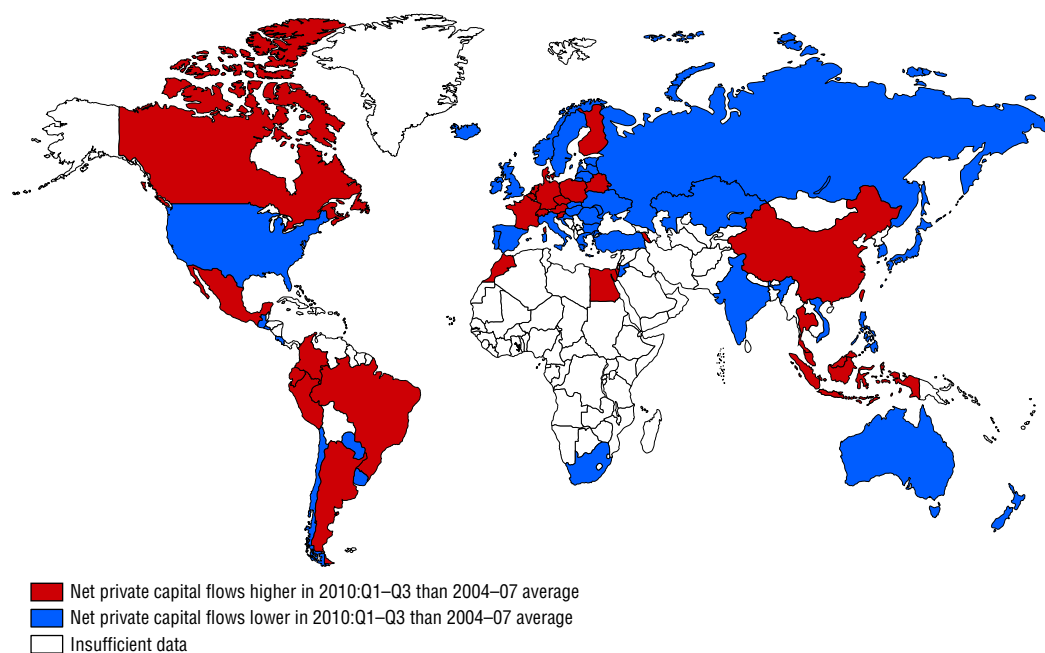
Sources: CEIC; Haver Analytics; IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Net flows, which do not include reserve accumulation, may not equal the sum of gross inflows and gross outflows because of a lack of data on gross flows for some economies.

Figure 4.3. The Recovery of Net Private Capital Flows

(Change in net private capital flows in percent of GDP between 2010:Q1–Q3 and 2004–07 average unless noted otherwise)

Net private capital flows in the first three quarters of 2010 in many emerging market economies already outstripped the averages reached during 2004–07.



Sources: CEIC; Haver Analytics; IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Net private capital flows are defined as the sum of net foreign direct investment, net portfolio, net derivative, and net other investment flows, excluding other investment flows to the general government and monetary authorities. The 2004–07 average is computed as the average of net private capital flows as a percent of GDP across the four years based on annual data. The 2010:Q1–Q3 number is derived from quarterly data as the sum of net private capital flows over the relevant quarters divided by the sum of nominal GDP (both in U.S. dollars). Due to data limitations, the calculations for several of the economies for which quarterly data are available are based on net total capital flows (including other investment flows to the official sector). These economies are China, Costa Rica, Ecuador, Egypt, India, Jordan, Malaysia, Morocco, New Zealand, Singapore, the Slovak Republic, and Uruguay. The postcrisis capital flows data for Peru are for 2010:H1 due to a lack of data for 2010:Q3.

drivers, such as U.S. interest rates, risk aversion, and so on. This type of analysis may fall short because it cannot control for every possible global factor affecting cross-border capital movements. Instead of trying to identify all push factors or the overall effect of U.S. monetary policy changes, this chapter tries to identify the difference in the effect of U.S. monetary policy on net flows to economies according to their direct financial exposure to the United States. At the same time, the estimation controls for all possible global factors that may affect capital movements equally across economies at each point in time.

- The literature also typically treats U.S. monetary policy as exogenous to capital flows to other economies. Although U.S. policy is not set in response

to net flows to other economies, the impact of U.S. interest rate changes on net flows elsewhere may depend on when information about a U.S. move is available to the market. Capital flows may occur at the time news arrives about the change in U.S. monetary policy rather than at the time of the actual change. Moreover, if U.S. monetary policy responds countercyclically to U.S. economic developments (which likely exert an independent influence on global flows), capital flows may be muted in response to U.S. interest rate changes. As a result, the estimated effect of realized changes in the interest rate on capital flows may underestimate the magnitude of the effect of U.S. monetary policy. This chapter draws on the approach of Kuttner (2001) in an attempt to isolate the unanticipated

component of U.S. monetary policy changes. Throughout the estimation analysis, the chapter distinguishes between the difference in the effect on capital flows of an unanticipated and exogenous change in the U.S. policy rate as opposed to an actual (realized) change.

What Are the Main Findings?

- The postcrisis recovery in net capital flows was more impressive in terms of its pace than its level. Nevertheless, for many EMEs that were not at the center of the global crisis, levels were comparable with those during previous episodes of large net flows. The composition of the upturn was somewhat different, however, with a higher share of debt-creating flows and a lower share of foreign direct investment (FDI) compared with historical trends.
- Net flows have become slightly more volatile for all economies over time. They also exhibit low persistence. The volatility of net flows is generally higher in EMEs and other developing economies (ODEs) than in AEs. By contrast, there are no obvious differences in the persistence of net flows across economies. Bank and other private flows have typically been the most volatile, and portfolio debt the least persistent, but the differences in volatility and persistence across types of flow are not always statistically significant for all economies. FDI is only slightly more stable and more persistent than debt-creating flows to EMEs.
- Historically, net flows to EMEs have tended to be higher under low global interest rates, low global risk aversion, and stronger growth performance in EMEs compared with AEs. The pattern is most pronounced when global interest rates and risk aversion are both low. Nevertheless, common factors—both global and regional—account for a relatively small share of the total variation in net flows to EMEs, highlighting the importance of domestic factors.
- Advanced and emerging market economies that are directly financially exposed to the United States face an additional decline in their net capital flows in response to U.S. monetary policy tightening over and above what is experienced by economies with no such U.S. direct financial exposure. The

negative additional effect of a hike in the U.S. rate that is unanticipated is larger than that of a realized rate increase. Thus, positive U.S. monetary policy surprises may induce investors to revise up their expectations for future U.S. monetary policy, thereby resulting in a sharper retrenchment of their positions in economies that are directly financially exposed to the United States than under actual U.S. monetary policy changes that were partly or wholly anticipated. This negative additional effect for financially exposed EMEs is larger for EMEs that are more integrated with global financial markets and those with relatively flexible exchange rate regimes, but smaller for EMEs with greater domestic financial depth and strong growth performance. Finally, of particular relevance to today's environment is the finding that the negative additional effect on net flows to financially exposed EMEs due to U.S. monetary policy tightening is larger during periods of low global interest rates and low global risk aversion. This may reflect the fact that cross-border investors are more likely to chase returns when global financial asset returns are low and risk appetite is high.

The chapter's findings suggest that capital flows are generally fickle—from the point of view of the recipient economy—and sensitive to AEs' monetary policy changes, which are outside the control of domestic policymakers. While the general perception that capital flows toward EMEs broadly represent a secular trend is likely true (see Figure 4.1), the main findings of the chapter point to the sensitivity of capital flows to the global cycle, such as changes in global financial conditions. Drawing on event studies, it is reasonable to expect that future U.S. monetary tightening would be associated with a dampening of net flows to EMEs. Moreover, the regression analysis indicates that economies with greater direct financial exposure to the United States will experience greater additional declines in net flows because of U.S. monetary tightening, compared with economies with lesser U.S. financial exposure. It is important to note that the chapter does not address whether higher capital flow volatility induces higher macroeconomic volatility across EMEs, nor does it try to identify the source of capital flow volatility—whether it is driven by specific types of market participants (for example, banks, insurance and pension funds, or hedge funds). How-

ever, the analysis does indicate that the variability of capital flows is as much an issue for AEs as for EMEs. Moreover, despite increasing globalization and major changes in international capital market structures over the past two decades, the intrinsic variability of net flows has not shifted much over time.⁴ Thus, as EMEs further integrate with global financial markets, it is key that they maintain domestic economic and financial strength and stability—via strong macroeconomic policies, prudential regulation of the financial sector, and other macrofinancial measures—to better manage capital flow variability.

The rest of the chapter is organized as follows. The first section describes how the postcrisis recovery in net flows to EMEs until the first three quarters of 2010 compared with previous capital flow upturns. It then documents the historical evolution of the volatility and persistence of net capital flows and compares these trends across economies. The second section discusses the behavior of net flows to EMEs during periods of low global interest rates and low risk aversion. It then uses a global factor model to compute the relative importance of common factors versus economy-specific factors in explaining the variation in net flows across economies. The third section presents a regression analysis of the difference in the effect of U.S. monetary policy changes on net flows between economies that are directly financially exposed to the United States and those that are not. The fourth section summarizes the findings and discusses the key policy lessons from the analysis.

Trends in Net Capital Flows: Size, Composition, Volatility, and Persistence

To set the stage, this section describes the resurgence of net capital flows to EMEs in the wake of the global financial crisis. Did net capital flows recover equally across regions and across types of flow? How did the recovery compare with previous episodes of large net capital flows to EMEs? Next, the section discusses how the volatility and persistence of net flows have evolved over time and across economies.

⁴For instance, Chapter 2 of the April 2007 *Global Financial Stability Report* documents the growing role of institutional investors in international asset allocation since the mid-1990s.

What Is Different about the Recent Recovery?

Net capital flows to EMEs staged a strong comeback beginning in mid-2009 but more in pace than in level (Figure 4.4). All EMEs experienced a sharp recovery in net flows in a strikingly short span of time. Nevertheless, unlike during the run-up to the crisis, when net flows rushed to all EME regions, the strength of the postcrisis recovery was uneven. To compare the recent recovery against historical experience, we identify two periods of strong net capital flows to EMEs—before the Asian crisis (1991–97) and before the recent global crisis (2004–07).⁵ Although aggregate net flows to emerging Asia and Latin America during the first three quarters of 2010 were already above the precrisis (2004–07) averages, these levels did not always exceed record highs (Figure 4.5). For example, postcrisis net flows to Latin America were weaker than during 1991–97, when these economies financed larger current account deficits. For emerging Europe, which was hit hard by the crisis, as well as other emerging economies (from the Commonwealth of Independent States, the Middle East, and Africa), recent net flows have been anemic compared with either 2004–07 or 1991–97 averages.

Interestingly, the disaggregated data indicate that the recovery was stronger in larger economies, pulling up the regional aggregates (Figure 4.6). Net flows rose in a fairly broad-based manner to emerging Asia and the newly industrialized Asian economies (NIEs), but the experience was mixed for Latin America and other emerging economies. As noted, net flows were depressed for most of emerging Europe compared with 2004–07 averages, with a few exceptions.

In terms of composition, the recovery was driven primarily by portfolio debt flows and, for emerging Asia and Latin America, also by bank and other private flows (see Figure 4.5). The share of FDI in net flows fell during the first three quarters of 2010 compared with previous episodes of large net flows to EMEs (1991–97 and 2004–07). The relatively smaller share of bank and other private flows compared with portfolio debt flows for most regions may reflect ongoing deleveraging in external asset posi-

⁵These periods were characterized by net capital flows to EMEs that were higher than the 1990–2009 median level (see also Chapter 4 of the October 2007 *World Economic Outlook*).

tions by the AE banks that were at the epicenter of the global financial crisis.⁶ In the absence of recent data, it is difficult to tell, however, whether this trend has continued into 2011.

If the recent pattern continues, it would imply a shift away from the historical trend of a declining share of debt-creating flows, especially in EMEs (Figures 4.7 and 4.8).⁷ More specifically, the importance of bank and other private flows has fallen over the past three decades for all economies. This could reflect, in part, a natural shift toward nonbank means of financing as a result of deepening domestic capital markets and greater financial integration. Although the share of portfolio debt did increase over time, this did not offset the decline in bank and other private flows until after the global crisis.⁸

How Stable Are Net Capital Flows?

This section investigates the volatility and persistence properties of capital flows. If capital flows were steady and persistent, they would likely be easier to predict. Following the literature, we measure volatility with the standard deviation of net flows scaled by GDP over a 10-year rolling window using annual data, while gauging their persistence through a regression of net flows scaled by GDP on their past level (that is, the AR(1) coefficient), also over a 10-year rolling window.⁹

⁶Chuhan, Perez-Quiros, and Popper (1996) also document that bank flows generally remain depressed for several years following a financial crisis.

⁷Following Becker and Noone (2009), we calculate the relative importance of a particular type of flow as the absolute value of the net flows of that type divided by the sum of the absolute value of the net flows of all types of flow.

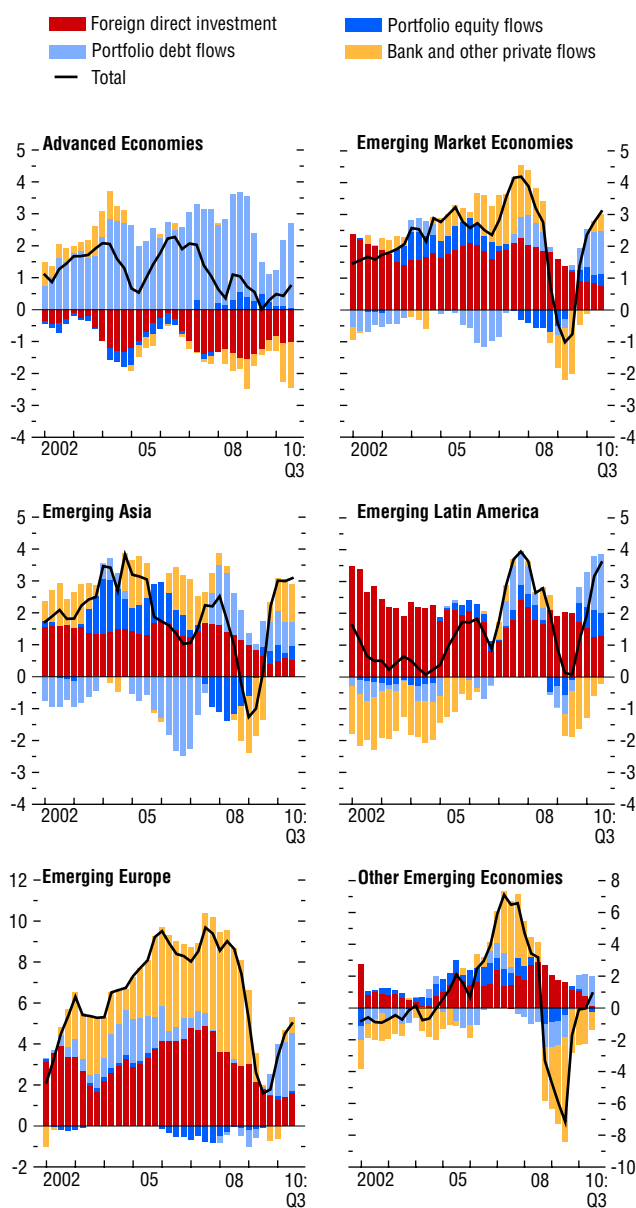
⁸The historically declining share of debt-creating flows supports the findings of Faria and others (2007) and Dell’Ariccia and others (2007), who note a shift in recent years in the composition of external assets and liabilities of high- and middle-income economies away from debt instruments.

⁹An alternative measure of volatility, namely the coefficient of variation, which divides the standard deviation by the mean, is not appropriate to use in this context because the mean of net flows can be zero or negative. However, to account for the effect that a potential trend increase in net flows might have on their standard deviation, we also compute the standard deviation of the detrended series. The results are broadly unchanged with this alternative measure.

Figure 4.4. The Recovery of Net Capital Flows and Their Composition

(Percent of aggregate GDP, four-quarter moving average)

The postcrisis rebound in net private capital flows was uneven across regions, with the pace of recovery faster for regions that were more resilient in the recent crisis (Asia, Latin America) than others.

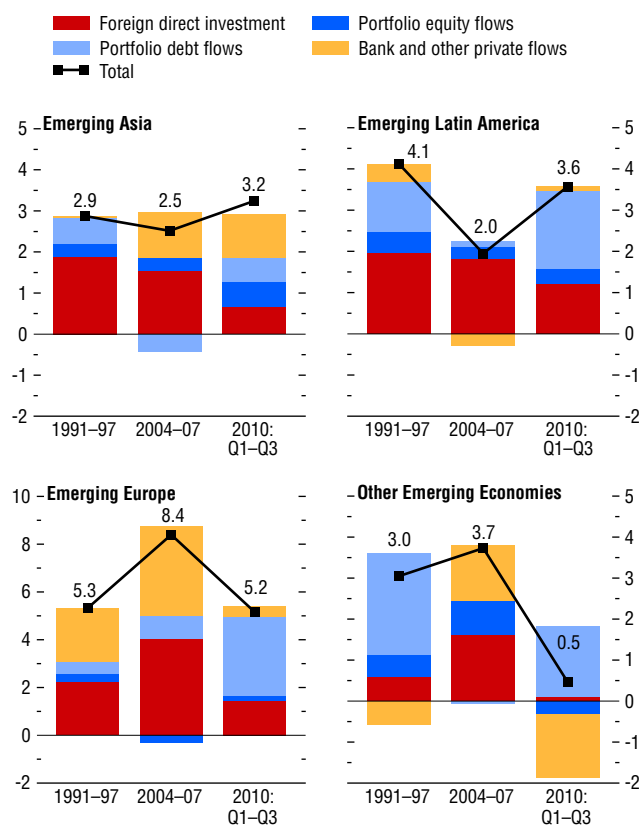


Sources: CEIC; Haver Analytics; IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: See Appendix 4.1 for a list of the economies included in the regional aggregates. The group and regional aggregates exclude offshore financial centers. Total net private capital flows do not equal the sum of the plotted components, because net derivative flows are not plotted and there is a lack of data on the underlying composition for some economies.

Figure 4.5. The Size and Composition of Net Private Capital Flows during Waves of Large Capital Flows to Emerging Market Economies
(Percent of aggregate GDP)

The recent recovery was led by portfolio debt flows, followed by bank and other private flows. In contrast with previous periods, the share of foreign direct investment was smaller.



Sources: CEIC; Haver Analytics; IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: The 1991-97 and 2004-07 numbers are computed as the sum of net flows over the relevant years divided by the sum of regional nominal GDP during the same period using annual data. The 2010:Q1-Q3 numbers are calculated as the sum of net flows over the three relevant quarters divided by the sum of regional nominal GDP during the same period. The total does not equal the sum of the plotted components, because net derivative flows are not plotted and there is a lack of data on the underlying composition for some economies. Waves of large capital flows to emerging market economies are defined as periods during which capital flows are larger than the 1990-2009 median. The regional aggregates exclude offshore financial centers.

Are net flows volatile?

Net flows have become marginally more volatile over time across all economies, with volatility in EMEs higher than in AEs (Figure 4.9, left panel). The rise in the median volatility of net private flows has been most pronounced in AEs, although the pattern of a slow rise in volatility is also evident for both EMEs and ODEs. The standard deviation of net flows to EMEs has been about 30 percent higher than of those to AEs, although the differences in the medians are generally not statistically significant.¹⁰

In terms of composition, bank and other private flows have been the most volatile in all economies (Figure 4.9, right panel).¹¹ However, it is hard to discern systematic differences in volatility among the remaining components. In AEs, both bank and other private and portfolio debt flows appear equally volatile, whereas FDI and portfolio equity flows are somewhat less so, with the differences between the latter two (and the former two) generally not statistically significant. Similarly, in EMEs, the standard deviations of FDI versus portfolio debt flows are not statistically different from each other. In general, the increase in the volatility of the overall net financial account has been accompanied by an upward trend in the volatility of all individual components, although much more prominently for AEs than for others.¹²

Note, however, that despite higher volatility of the individual components of net flows in AEs compared with EMEs, alternative flows have served as broad substitutes for AEs, helping lower their total

¹⁰These estimates are slightly lower than what has been found in recent studies, such as Becker and Noone (2009), Levchenko and Mauro (2007), Broner and Rigobon (2006), and Prasad and others (2003). The volatility of net capital flows was also computed for the median EME across alternative regions (see Appendix 4.2). There appears to be little systematic difference in the volatility of total flows across the emerging market regions, although there is some suggestive evidence that the volatility of flows to emerging Europe is slightly higher and that the volatility of flows to other emerging market economies has risen in recent periods.

¹¹These findings relate to the literature that stresses that an economy's propensity to experience a crisis is dependent on the composition of its capital flows and external liabilities (Frankel and Rose, 1996; Frankel and Wei, 2005; Levchenko and Mauro, 2007; Tong and Wei, 2010; and Ghosh, Ostry, and Tsangarides, 2010).

¹²The results for equity flows for this and subsequent sections should be treated with caution because very few EMEs and ODEs report any data on these flows prior to the 2000s.

volatility (Figure 4.10). This mutual substitutability is negligible for EMEs and ODEs.

Are net flows persistent?

The persistence of net flows is generally low, and it is only marginally higher in AEs than in EMEs and ODEs (Figure 4.11, left panel). There are no significant differences in persistence between these economies, even though there appears to be a cyclical component in persistence over time, especially for net flows to AEs.¹³ Portfolio debt flows are the least persistent across all economies (Figure 4.11, right panel). Persistence is somewhat higher for FDI than for other flows, although it has fallen since the early 2000s for AEs and EMEs. In AEs, the persistence among various types of flow is essentially indistinguishable.

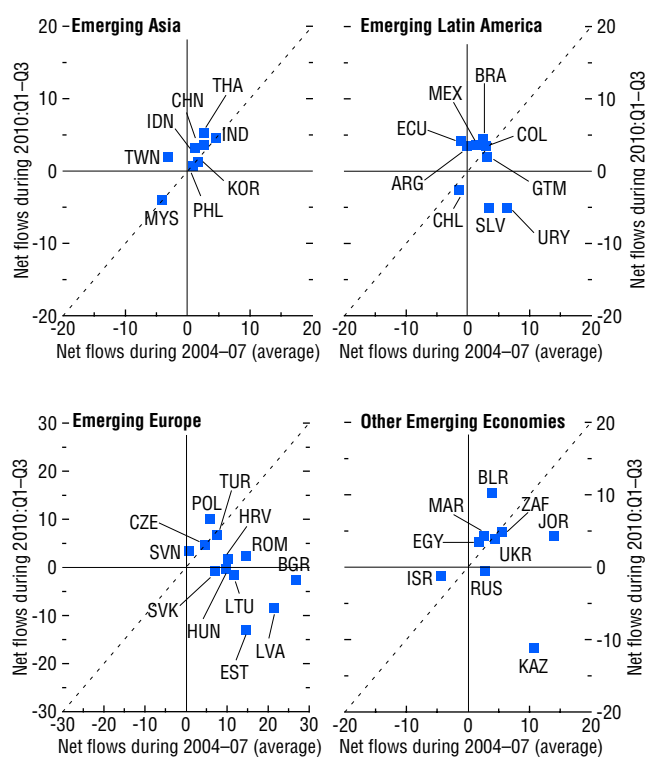
The findings in this section suggest that the accepted wisdom about the stability of some kinds of capital flows, such as FDI, compared with others should be regarded with caution, especially for EMEs (for example, Sarno and Taylor, 1999; Chuhan, Perez-Quiros, and Popper, 1996). Bank and other private flows were found to be the most volatile and portfolio debt flows the least persistent. However, FDI is only slightly more stable than other types of flow—for EMEs, the differences in volatility between FDI and portfolio debt flows, and the differences in persistence between FDI and bank and other private flows, are not generally statistically significant. Moreover, like other types of flow, FDI volatility has increased and persistence has fallen over time, although this pattern is more evident in AEs than in EMEs. This could reflect changing FDI characteristics. For instance, the share of financial FDI—direct borrowing by a subsidiary from a parent bank or firm—may have increased relative to nonfinancial FDI, raising its total volatility.¹⁴ Moreover, for all economies—

¹³The persistence of total net private capital flows also does not vary substantially across the four emerging market regions (see Appendix 4.2). Although net flows to emerging Asia appear to have been the most persistent and net flows to the “other emerging market” economies the least persistent, these differences are not statistically significant and have become smaller over time.

¹⁴See ECB (2004) and BCGFS (2004) for evidence of an increase in financial FDI in EMEs, and Ostry and others (2010) for the impact of a rising share of financial FDI on macroeconomic volatility.

Figure 4.6. Regional Variation in Net Private Capital Flows to Emerging Market Economies (Percent of GDP)

The nature of the recovery was diverse within each region. Net flows rose strongly in a majority of economies within emerging Asia, while falling short of precrisis averages in most economies within emerging Europe. The experience was more mixed for Latin America and other emerging market economies.



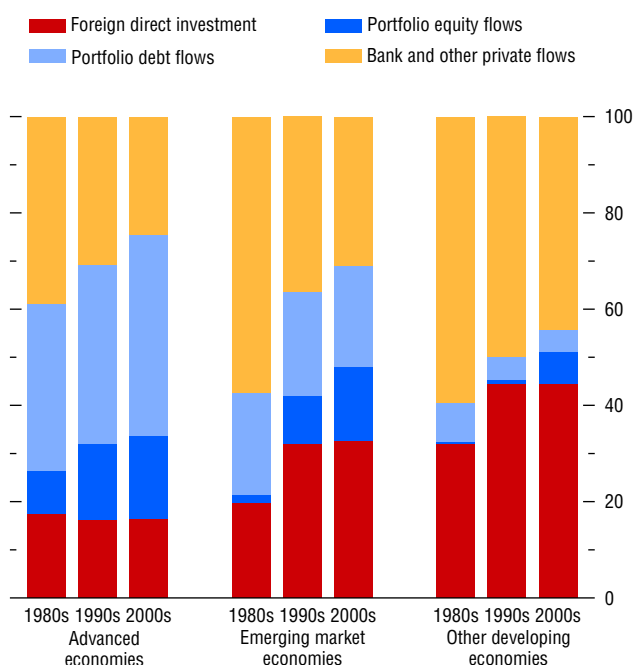
Sources: CEIC; Haver Analytics; IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Emerging Asia (CHN: China; IND: India; IDN: Indonesia; KOR: Korea; MYS: Malaysia; PHL: Philippines; TWN: Taiwan Province of China; THA: Thailand). Emerging Latin America (ARG: Argentina; BRA: Brazil; CHL: Chile; COL: Colombia; ECU: Ecuador; GTM: Guatemala; MEX: Mexico; SLV: El Salvador; URY: Uruguay). Emerging Europe (BGR: Bulgaria; CZE: Czech Republic; EST: Estonia; HRV: Croatia; HUN: Hungary; LVA: Latvia; LTU: Lithuania; POL: Poland; ROM: Romania; SVK: Slovak Republic; SVN: Slovenia; TUR: Turkey). Other Emerging Economies (BLR: Belarus; EGY: Egypt; JOR: Jordan; ISR: Israel; KAZ: Kazakhstan; MAR: Morocco; RUS: Russia; UKR: Ukraine; ZAF: South Africa).

Figure 4.7. The Relative Importance of Various Types of Flow

(Percent of total)

The importance of bank and other private flows has declined over time and across advanced, emerging market, and other developing economies in favor of rising portfolio and foreign direct investment flows. Bank and other private flows, however, remain a substantial component of the net financial account.



Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: The relative importance of a particular type of flow is calculated as the absolute value of the net flows of that type to the economies of the group divided by the sum of the absolute value of the net flows of all four types of instruments to the economies in the group. Ratios are calculated for each decade with annual data, computing both numerator and denominator over the years in each decade. Derivative flows, which comprise a very small share of the financial account, are excluded from the calculation. The group aggregates exclude offshore financial centers.

despite the trend decline in debt-creating flows—net flows have still become more volatile and continue to exhibit low persistence.

Capital Flows and the Global Environment

Do net capital flows exhibit regular patterns in response to the global environment? To answer this question, we first examine how net capital flows to EMEs behaved when global conditions were similar to today’s economic environment of relatively low global interest rates, falling risk aversion, and strong growth performance in EMEs.¹⁵ Next, we assess the relative strength of common (global and regional) as compared with economy-specific factors in explaining the variation in EME capital flows across economies.

Are Net Capital Flows Correlated with Underlying Global Conditions?

Historically, most periods of loose global monetary conditions have overlapped with periods of high growth disparity between EMEs and AEs, but not with periods of low global risk aversion (Figure 4.12).¹⁶ This seems to indicate that monetary policy has been largely countercyclical or that accommodative monetary policy has coincided with weak economic prospects and/or low expected inflation in AEs (see Calvo and others, 2001). In contrast, during the recent global crisis, risk appetite did not always move in tandem with low interest rates, especially under conditions of financial stress. There

¹⁵However, common patterns between capital flows and underlying conditions should not be interpreted as causal links.

¹⁶Periods of low global interest rates, low global risk aversion, and strong EME growth performance are defined as periods when the global real interest rate, risk aversion, and growth differential between AEs and EMEs are lower than their median values over the entire 1980–2009 period (see also the IMF’s May 2010 *Regional Economic Outlook* for the Western Hemisphere). The global real interest rate is computed as the GDP-weighted average of the real European Central Bank financing rate (and the Bundesbank base rate prior to 1999) and the U.S. real federal funds rate. Risk aversion is proxied by the Chicago Board of Options Exchange Volatility Index (VIX) level. The growth differential between emerging market and advanced economies is the difference between the weighted average real GDP growth rates of each group (excluding offshore financial centers).

were two relatively long periods when all three conditions coincided: (1) the run-up to the Asian crisis (1991–96, excluding 1994 due to a lower growth differential and 1995 due to higher global interest rates) and (2) the run-up to the recent global crisis (2004–07). With falling risk aversion since late 2010, the period ahead may also yield a similar confluence of the above three conditions.

Total net capital flows to EMEs during each type of episode were larger than the year before or after and largest when all three types of episodes coincided (Figure 4.13).¹⁷ The sharpest increase (and decline) occurred around periods of low risk aversion—net flows increased by 2¼ percentage points of GDP from the year preceding the period and fell by 1¼ percentage points afterward. Conversely, the increase was smaller when the underlying condition was characterized by only low global interest rates. Net flows to EMEs tended to be strongest when global interest rates and risk aversion were both low (Figure 4.14), whereas when risk aversion was high but global interest rates were low, net flows were only marginally above where they were when both conditions were tight.

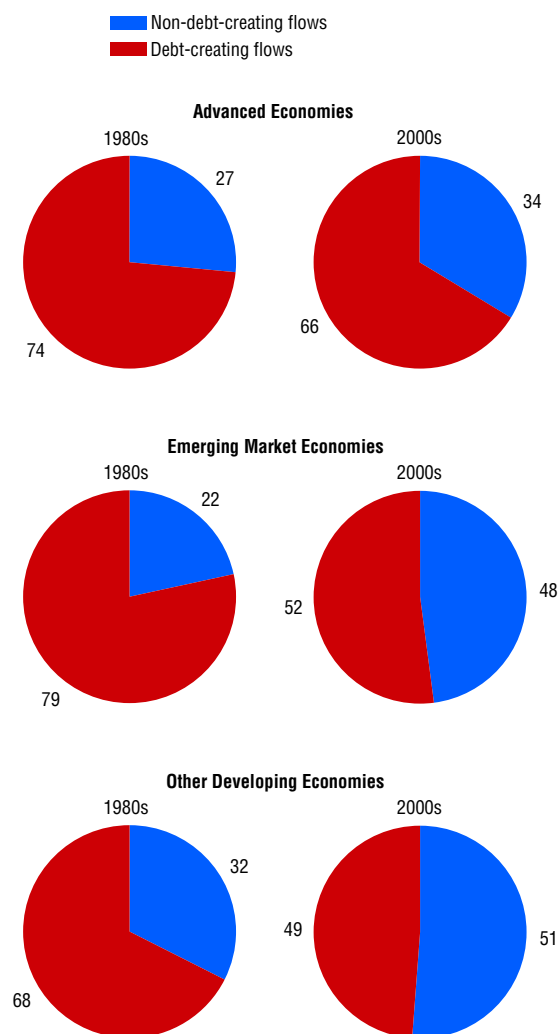
The stated dynamics in capital flows around alternative events were driven mostly by bank and other private flows (see Figures 4.13 and 4.14). The rise in these flows was typically the sharpest during the event and declined most dramatically afterward. In particular, bank and other private flows appear to be strongly correlated with changes in global risk aversion. Although all other types of flow tended to increase during the alternative events, their behavior in the aftermath varied. Portfolio debt and equity flows typically remained elevated at the end of periods characterized by a relatively strong growth performance in EMEs, but fell at the end of easy global financing conditions (that is, low global interest rate and low risk aversion). This could reflect the countercyclical nature of portfolio flows to EMEs: higher net flows at the end of strong growth performance may have helped meet recipient economies' larger financing needs. Conversely, FDI generally remained strong even after the end of loose global financing conditions, but

¹⁷Net flows are averaged across years for multiyear events.

Figure 4.8. Historical Trends: A Shift away from Debt-Creating Flows

(Percent of total)

Debt-creating flows have become relatively less important over time across all economies, reflecting the decline in net bank and other private flows.

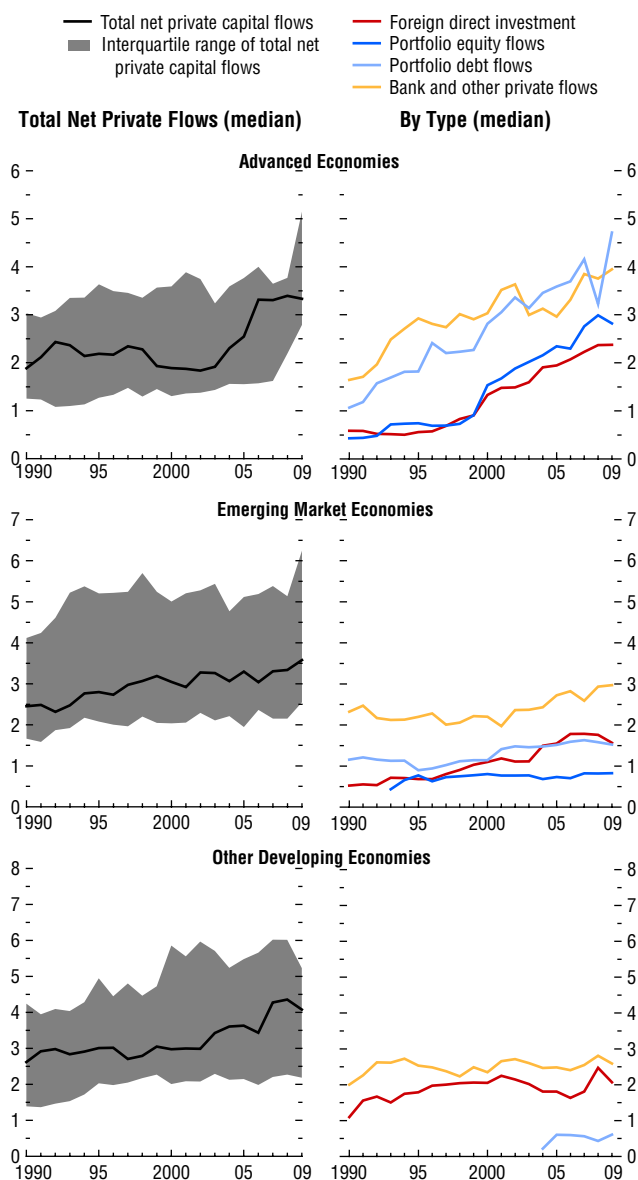


Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Debt-creating flows include portfolio debt and bank and other private flows. The relative importance of a particular type of flow is calculated as the absolute value of the net flows of that type divided by the sum of the absolute value of the net flows of all four types of instruments. Ratios are calculated for each decade with annual data, computing both numerator and denominator over the years in each decade. The group aggregates exclude offshore financial centers. The sum of the shares may not equal 100 because decimals are rounded.

Figure 4.9. The Volatility of Net Private Capital Flows
(Standard deviation of net capital flows in percent of GDP)

The volatility of net private capital flows has been creeping up over time across all economies and across most types of flow. Emerging market and other developing economies have generally experienced higher volatility in their net financial account than advanced economies. Net bank and other private flows have consistently been the most volatile type of flow.



Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Using annual data, the volatility of any particular flow is computed as its standard deviation over the prior 10-year window for each economy (for example, the 1990 value corresponds to the standard deviation during 1981–90). The median is plotted only if the standard deviation for the particular 10-year window and type of flow can be calculated for at least one-fifth of the economies in the group. The groups exclude offshore financial centers.

fell at the end of strong growth episodes in EMEs. Overall, the rise and fall in FDI during and after alternative events appear less prominent than the rise and fall in other types of flow.¹⁸

To summarize, the event studies demonstrate an inverted V-shaped pattern of net capital flows to EMEs around events outside the policymakers’ control, underscoring the fickle nature of capital flows from the perspective of the recipient economy. Thus, net flows to EMEs have tended to be temporarily higher during periods with low global interest rates and low risk aversion. Moreover, the rise in net flows to EMEs has been much greater during periods characterized by both low global interest rates and low risk aversion. The dynamics in net flows appear to be driven largely by bank and other private flows. Other types of flow also tended to increase during the events but did not always fall at the end of events.

How Much of the Variation in Net Capital Flows Is Due to Global and Regional Factors?

A global factor model is used to discern the relative importance of common factors—global and regional—versus economy-specific factors in explaining the variation in net flows to EMEs. A large or growing share of the total variation of net flows explained by common factors would imply that capital flows are increasingly determined outside the domestic economy.

The estimated model underscores the dominance of economy-specific factors, captured by the model residual, in explaining the variation in capital flow movements in EMEs (Figure 4.15).¹⁹ However, it also shows that the share explained by common factors was higher in the past two decades—increasing from less than 15 percent in the 1980s, to about 23 percent in the 1990s, and to more than 30 percent

¹⁸A number of robustness checks—for example, excluding the 10 largest EMEs or including offshore financial centers—did not change this picture. The similarity in the pattern of net capital flows across all EME regions suggests that the association between global events and capital flows to EMEs is not driven by only a few systemically important economies.

¹⁹Appendix 4.3 describes the specifics of the model.

in the 2000s.²⁰ As a comparison, for AEs, the share explained by common factors is much smaller, hovering at about 10 percent, and lower in the past decade compared with the 1990s.

Within the set of common factors in EMEs, the relative importance of regional factors appears to have increased since the mid-1990s. This could be related to widespread liberalization of capital accounts in many EMEs during the 1990s, the subsequent Asian crisis in the late 1990s, increasing cross-border financial links within emerging Europe since the mid-1990s, and the overall surge in global capital flows since the 1990s, which has had a strong regional component. In particular, the larger weight of regional factors in EMEs than in AEs emphasizes greater sensitivity on the part of cross-border investors to regional differences among EMEs than among AEs.

In conclusion, although common factors appear to be more important for EMEs than AEs in explaining the variation in net flows, the variation is still predominantly explained by economy-specific factors. This provides suggestive evidence in favor of a secular trend of capital flows to recipient economies driven by the economies' structural characteristics. Thus, any formal analysis of the role of global cyclical variables as causes of capital flows must control for these economy-specific characteristics.

Does Direct Financial Exposure Affect the Response of Net Private Capital Flows to Changes in U.S. Monetary Policy?

This section attempts to estimate how direct financial exposure to the United States affects the impact of U.S. monetary policy changes on net private capital flows to EMEs. Following the literature, we focus on the U.S. policy interest rate as a proxy for global monetary conditions given the systemic importance of the United States in the global economy.²¹

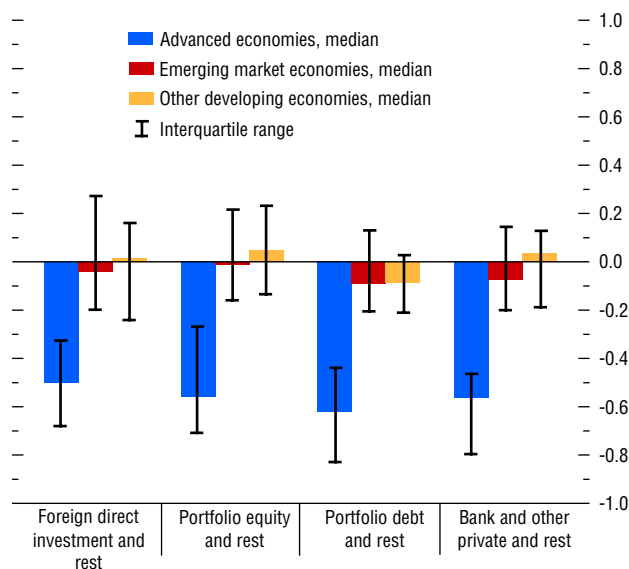
²⁰These estimates are similar to the findings of Levchenko and Mauro (2007) for a diverse group of EMEs but are lower than those of Calvo, Leiderman, and Reinhart (1993) for Latin America.

²¹That said, a key robustness test separately controls for the changes in the euro area interest rate in the baseline regression (see Appendix 4.4 for details).

Figure 4.10. Correlations between Net Flows of Various Types and the Rest of the Financial Account

(Pearson correlation coefficient of different flow types in percent of GDP)

In advanced economies, various types of flow have served as broad substitutes within the financial account—helping dampen the volatility of total net flows. This has not been the case in emerging market and other developing economies.



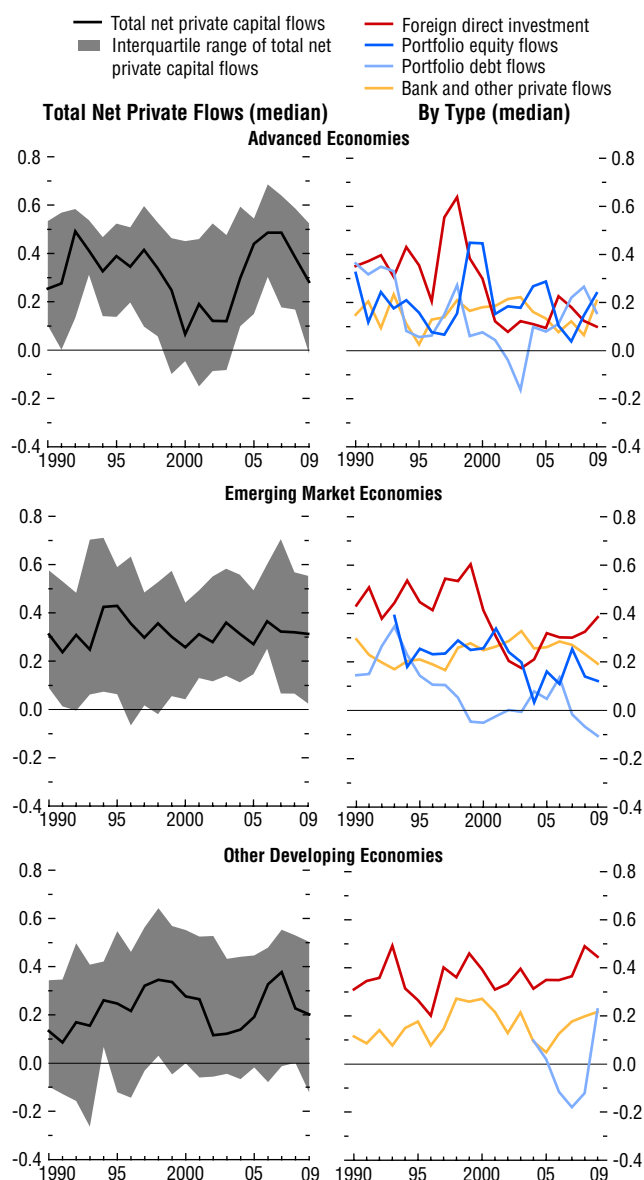
Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: The vertical bars represent the median correlation (across economies) between the net flows in percent of GDP of a particular type of flow and the remainder of the financial account computed with annual data during 1980–2009. The groups exclude offshore financial centers.

Figure 4.11. The Persistence of Net Private Capital Flows

(AR(1) regression coefficients of net private capital flows in percent of GDP)

The persistence of net private capital flows is generally low, with no significant differences across economy groups. Among the various types, net portfolio debt flows appear to be the least persistent.



Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Using annual data, the persistence of any particular flow is its AR(1) regression coefficient computed over the prior 10-year window for each economy (for example, the 1990 value corresponds to the AR(1) coefficient during 1981–90). The median is plotted only if the AR(1) coefficient for the particular 10-year window and type of flow can be calculated for at least one-fifth of the economies in the group. The groups exclude offshore financial centers

Methodology

We adopt a panel regression framework with fixed effects that controls for all time-invariant economy-level idiosyncrasies and structural characteristics. The sample comprises 50 economies (30 EMEs and 20 AEs), with data on capital flows at a quarterly frequency during 1989:Q1–2010:Q3.²² Although many studies have examined the role of U.S. monetary policy (among other global factors) in driving capital flows to other economies, this chapter builds on the existing literature in two prominent ways.

- It identifies how differences in economies’ direct financial exposure to the United States affect the impact of U.S. monetary policy changes on their net capital flows, after controlling for all common events, including any common effect of U.S. monetary policy changes. Previous studies have attempted to estimate the total effect of U.S. monetary policy on capital flows simply by including U.S. interest rates in a selected set of global control variables. By opting to explicitly outline the set of global variables considered, such studies preclude the use of time dummies as a proxy for a general, global common factor.²³ This exposes these analyses to an omitted-variables problem: how can the effects of common events that could have large impacts on capital flows (for example, 1989 Brady Plan, 1997–98 Asian crisis, September 11 terrorist attacks) be distinguished from U.S. monetary policy changes with which they may have coincided? To get around this issue, we first include in the regression time dummies that capture the average effect of all global factors on net flows (including U.S. monetary policy), without identifying what these factors might be. We then exploit the fact that certain economies are more directly financially exposed to the United States than others (see Appendix 4.4), to focus on the narrower question of how differences in direct financial exposure translate into differences in the effect of U.S. monetary policy. Specifically, the change in

²²The sample size drops due to the unavailability of data on quarterly capital flows, GDP, or domestic explanatory variables for some economies.

²³Inclusion of both time dummies that control for all time-specific events and other global variables that vary only across time but not across economies would subject the panel regression to a perfect collinearity problem.

U.S. interest rate is multiplied by a measure of each economy's direct U.S. financial exposure to identify the difference in the effect of U.S. monetary policy changes on net flows to financially exposed versus unexposed economies. An economy's U.S. direct financial exposure is measured by the share of its U.S. assets plus liabilities in total external assets plus liabilities.

- The chapter distinguishes between realized and unanticipated changes in U.S. real interest rates, a distinction not yet made in this literature.²⁴ Because the actual or realized U.S. monetary policy change may be partly anticipated, capital flows may adjust at the time of information arrival—reflecting investors' forward-looking behavior—rather than at the time of the actual (realized) rate change, which would attenuate any estimated effect of monetary policy changes on capital flows. Moreover, if U.S. monetary policy responds countercyclically to U.S. economic developments (which likely exert an independent influence on global flows), then capital flows may be muted in response to U.S. interest rate changes. In order to overcome this problem, we construct a series of unanticipated U.S. monetary policy changes using the approach in Kuttner (2001), aggregating them to quarterly frequency using the method in Bluedorn and Bowdler (2011).²⁵ To further ensure that the changes in U.S. monetary policy are not confounded with the effects of growth innovations, we also control for surprise in U.S. growth changes.²⁶

²⁴In the related international finance literature, the effects of U.S. monetary policy volatility or surprises on a variety of variables have been analyzed. These include world stock prices (see Laeven and Tong, 2010), emerging market bond spreads (see Hartelius, Kashiwase, and Kodres, 2008), U.S. capital flows (see Fratzscher, Saborowski, and Straub, 2010), and domestic monetary and exchange rate policies (see Miniane and Rogers, 2007; Bluedorn and Bowdler, 2010).

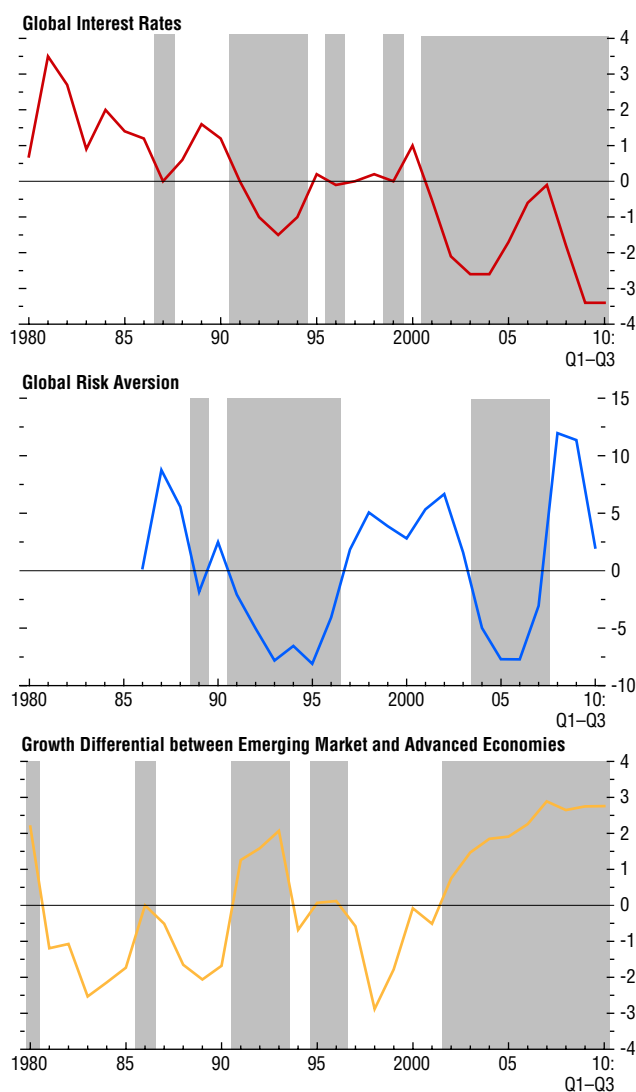
²⁵Specifically, the change in the federal funds futures price (dependent on market expectations of U.S. policy) around scheduled meetings of the Federal Open Market Committee yields the “surprise” or unanticipated component of the realized U.S. policy rate change. These daily changes are then mapped to quarters (see Appendix 4.4 for the details).

²⁶To compute the surprise U.S. growth component, we take the difference between the U.S. growth outcome in a given quarter and the one-step-ahead forecast growth taken from the Survey of Professional Forecasters in the previous quarter. These are weighted by the bilateral trade share of each economy with the United States.

Figure 4.12. Historical Periods of Easy External Financing and High Growth Differential between Emerging Market and Advanced Economies

(Deviations from median in percentage points)

There are two long periods during which easy external financing conditions—low interest rates in the advanced economies and low risk aversion—coincided with high growth differential between emerging market and advanced economies: the run-up to the Asian crisis (1991–96, excluding 1994–95) and the run-up to the global financial crisis (2004–07).

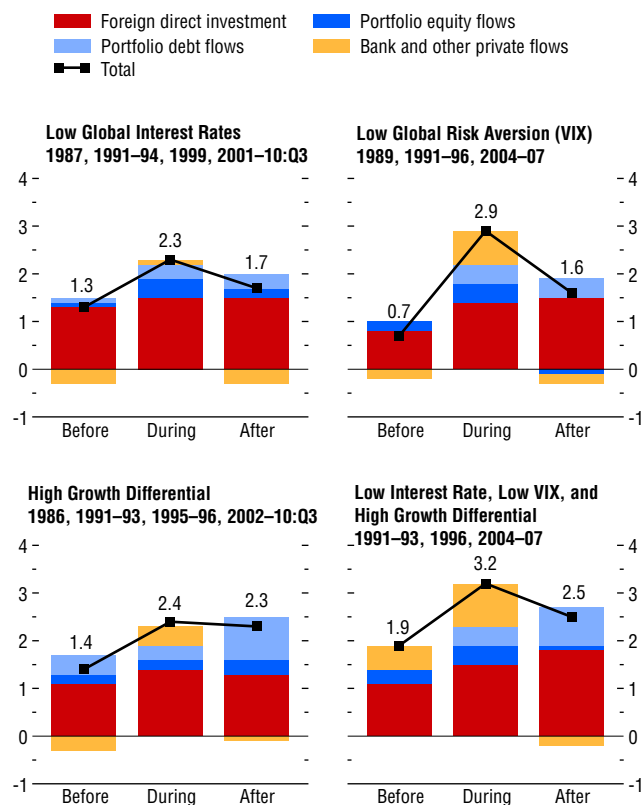


Sources: Haver Analytics; and IMF staff calculations.

Note: Global interest rates are proxied by a GDP-weighted average of the real European Central Bank financing rate (the Bundesbank base rate prior to 1999) and the real U.S. federal funds rate. One-year-ahead expected inflation is subtracted from the nominal rates of each economy to measure the ex ante real interest rates. Global risk aversion is measured by the level of the Chicago Board of Options Exchange Volatility Index (VIX), which proxies for the market's expectation of stock market volatility over the following 30 days. The growth differential between emerging market and advanced economies is measured as the difference between the weighted average real GDP growth rate of each group (excluding offshore financial centers), where the weights are the economy's share in the group aggregate nominal GDP in U.S. dollars. Shaded areas represent periods of easy external financing or high growth differential.

Figure 4.13. Net Private Capital Flows during Periods of Easy External Financing and High Growth Differential between Emerging Market and Advanced Economies
(Percent of GDP)

Net private capital flows to emerging market economies peaked during periods when three conditions prevailed: low global interest rates, low global risk aversion, and high growth differential between emerging market and advanced economies. Flows were generally larger than the year before or after and were largest when all three conditions coincided. The sharpest increase (and subsequent decline) occurred around periods of low risk aversion.



Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Net private capital flows exclude derivative flows. The values for each bar correspond to the average across years for each multiyear period during which the condition prevailed, where the annual data are calculated as the sum of net capital flows across economies divided by the sum of nominal GDP (both in U.S. dollars) across the same group of economies. The group aggregates exclude offshore financial centers.

Our baseline reduced-form specification is thus

$$y_{i,t} = \alpha_i + \alpha_t + \sum_{s=0}^8 \beta_s (\omega_i \times \Delta r_{us,t-s}) + \sum_{s=0}^8 \lambda_s (\delta_i \times \Delta g_{us,t-s}) + X_{i,t-1} \gamma + \varepsilon_{i,t}, \quad (4.1)$$

where i indexes economies and t indexes time (quarterly date); $y_{i,t}$ is the ratio of net capital flows to GDP; α_i represents economy-specific fixed effects and α_t time-fixed effects; ω_i denotes the U.S. direct financial exposure weight; $\Delta r_{us,t}$ is the U.S. monetary policy change measure—here, either the realized or the unanticipated rate change; δ_i represents U.S. direct trade exposure weights; $\Delta g_{us,t}$ is the U.S. growth forecast error; $X_{i,t-1}$ is a vector of lagged additional controls including the domestic short-term real (ex post) interest rate, domestic real GDP growth, *International Country Risk Guide* (ICRG) composite risk level, log nominal GDP to control for size and domestic aggregate demand, liquid liabilities to GDP to control for domestic financial market depth (Beck, Demirgüç-Kunt, and Levine, 2000 and 2009), a de facto pegged exchange rate regime indicator (Reinhart and Rogoff, 2004; Ilzetzki, Reinhart, and Rogoff, 2008), and an index of the economy’s de jure capital account openness (Chinn and Ito, 2006 and 2008; Aizenman, Chinn, and Ito, 2010); and $\varepsilon_{i,t}$ is a mean zero error term. Therefore, $\beta_0 \times \omega$ represents the difference in the immediate effect of a U.S. monetary policy change on net flows to an economy that has a direct financial exposure of ω to the United States versus an economy with no direct financial exposure.

Are Net Capital Flows to Economies with Direct Financial Exposure to the United States Sensitive to U.S. Monetary Policy?

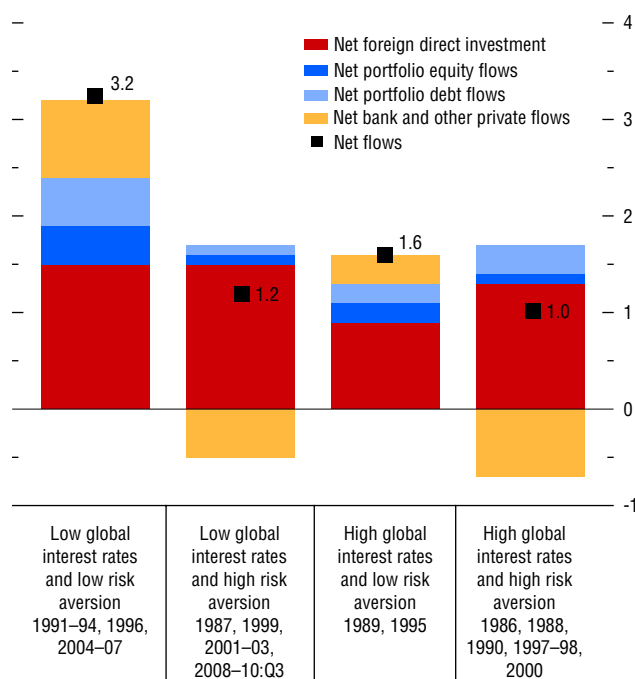
A key finding is that economies with direct financial exposure to the United States experience a negative additional effect on their net flows due to U.S. monetary tightening, over and above what is experienced by economies with no direct U.S. financial exposure. This means the relative impact of U.S. monetary policy changes is stronger (weaker) for economies with greater (lesser) direct financial exposure to the United States. This difference in the effect of U.S. monetary policy is referred to as the “additional” effect throughout, as it is always measured vis-à-vis an economy with no direct U.S. financial

exposure. Moreover, the additional impact of monetary policy estimated using unanticipated changes is larger than the corresponding impact estimated using an equivalent realized rate change (Figure 4.16). For the full sample, for an economy with average direct financial exposure to the United States (about 16 percent), a 1 standard deviation unanticipated rise in the U.S. real interest rate—approximately equivalent to 5 basis points—causes a statistically significant additional reduction in net flows on the order of ½ percentage point of GDP in the first quarter. When cumulated, this increases to 1¼ percentage points of GDP after two years.²⁷ The cumulated effect shows the cumulative difference in the dynamic effects of a permanent U.S. rate hike on net flows for an economy with average financial exposure to the United States relative to an economy with no direct financial exposure. These additional effects are much weaker for an equivalent realized rate change (12 basis point increase), reducing relative net flows by less than one-tenth of a percentage point of GDP on impact and about ½ percentage point of GDP after two years. The reason may be that, when U.S. monetary policy changes come as a surprise, forward-looking investors may undertake a greater reassessment of the prospective returns from alternative cross-border investments because of changing expectations about the future path of U.S. policy and its economy. Such surprise policy changes thus trigger a sharper portfolio rebalancing (and hence a sharper change in net flows)

²⁷The uncumulated impulse responses show the additional effect of a temporary U.S. policy rate rise on net flows for an economy at the sample's average direct financial exposure to the United States (0.16 for the full sample, 0.17 for EMEs, and 0.14 for AEs) relative to an economy with no direct financial exposure. The cumulated responses show the cumulative difference in the effect when the U.S. rate hike is permanent over the next eight quarters (for the economy with average direct financial exposure to the United States relative to an economy with no direct financial exposure to the United States). Given that U.S. interest rates are currently at historically low levels, the cumulated additional response corresponding to a permanent U.S. rate change appear more relevant, and these are therefore the focus of the remaining part of the regression analysis. That said, the long-term additional effect of a U.S. monetary policy change is considered significant when the sum of the partial coefficients corresponding to eight lags on the U.S. variable is statistically significant, whether driven by the statistical significance of each individual quarter leading up to two years or driven by only some of them.

Figure 4.14. Net Private Flows to Emerging Market Economies under Alternative Financing Conditions
(Percent of GDP)

Net capital flows to emerging market economies tended to be strongest when global monetary and risk conditions were both slack, whereas under high risk aversion (but low global interest rates), flows were only marginally above net flows when both conditions were tight.



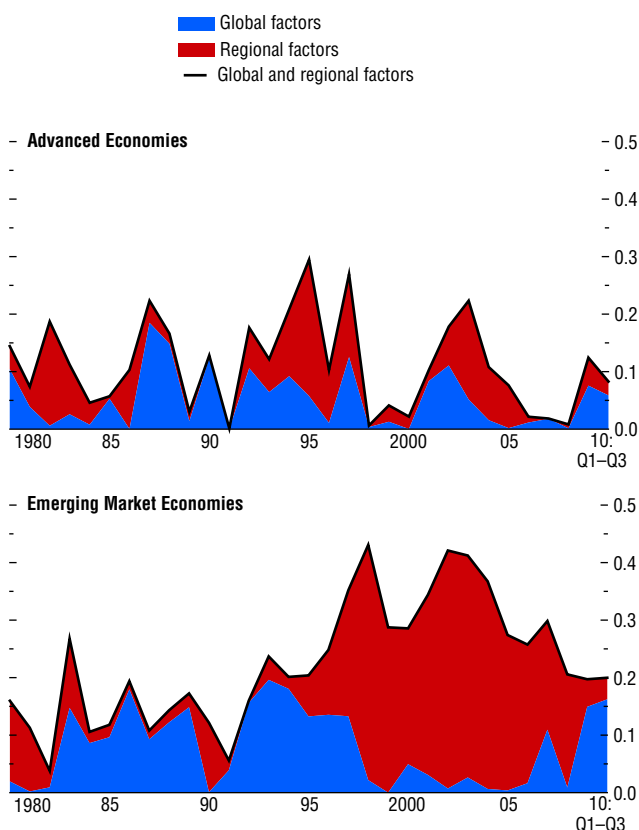
Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Net private capital flows exclude derivative flows. The values for each bar correspond to the average across years for each multiyear period during which the condition prevailed, where the annual data are calculated as the sum of net capital flows across economies divided by the sum of nominal GDP (both in U.S. dollars) across the same group of economies. The group aggregates exclude offshore financial centers.

Figure 4.15. Common Factors Underlying the Variation in Net Private Capital Flows to Advanced and Emerging Market Economies

(R-squared)

Global and regional factors explain only a small share of the variation in net private capital flows to advanced and emerging market economies, underscoring the importance of economy-specific factors. However, the share explained by regional factors in emerging market economies has increased over time, suggesting a greater sensitivity on the part of foreign investors to regional differences among emerging market economies than among advanced economies.



Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: The blue area corresponds to the share of variation in net flows in percent of GDP across economies within each group that is explained by global factors (time dummies) relative to a specification with only a constant (without time dummies). The red area corresponds to the additional variation of net flows in percent of GDP explained by regional factors (regional time dummies). The black line is the total variation in net flows jointly explained by global and regional factors. Both samples exclude offshore financial centers. For additional information on the estimation procedure, see Appendix 4.3.

among economies that are directly financially exposed to the United States.

The negative additional effect of U.S. monetary policy tightening continues to hold for the subsample comprising only EMEs and the subsample with only AEs excluding the United States. In both subsamples, the additional effect of an unanticipated rate change exceeds that of a realized rate change, confirming that focusing only on realized rate changes results in an underestimation of the impact of U.S. monetary policy changes on net flows to economies that are directly financially exposed to the United States. For an EME with average direct financial exposure to the United States (17 percent), an unanticipated rate change entails an immediate additional fall of ½ percentage point of GDP, cumulating to 2 percentage points of GDP after two years (compared with an EME with no direct financial exposure to the United States). These short- and long-term additional effects are both statistically significant. Again, the cumulated additional effect is smaller (½ percentage point of GDP) for a realized rate change, although statistically significant after the first year. The immediate and cumulated additional effects on net flows to financially exposed AEs are similar to those for EMEs.

The above results hold up under a number of robustness tests, which are discussed in more detail in Appendix 4.4. These include estimating an explicitly dynamic model that includes lagged values of net capital flows as regressors; restricting the sample to the largest 10 economies; including offshore financial centers in the sample; adding more control variables (such as euro area growth forecast errors, euro area real interest rate changes, global risk-aversion changes); introducing a structural break in 1997; and estimating the model for the period before 2008. The core result continues to hold—there is a negative additional effect on capital flows to EMEs that are directly financially exposed to the United States from a tightening in U.S. monetary policy compared with those that have no direct U.S. financial exposure. In particular, this sensitivity holds up even after the late 1990s, a period that witnessed major changes in global capital markets (as documented in Chap-

ter 2 of the April 2007 *Global Financial Stability Report*).

Some of the other notable relationships between capital flows to EMEs and the domestic control variables include a positive association between net flows and real GDP growth, size of the economy (which proxies for the role of domestic demand), financial depth, lower risk levels, and pegged regimes, although only the first two relationships are statistically significant (see Appendix 4.4). Surprisingly, net flows to EMEs are negatively correlated with real domestic interest rates. This could reflect EMEs' experience with sudden stops or reversals in capital flows that occur even when EME policymakers raise domestic interest rates to prevent a turnaround in net flows. Indeed, there is no negative relationship between net flows and domestic real interest rates for AEs, which have historically experienced fewer financial crises.²⁸

Does the Sensitivity of Capital Flows to U.S. Monetary Policy Depend on the Characteristics of the Recipient Economy?

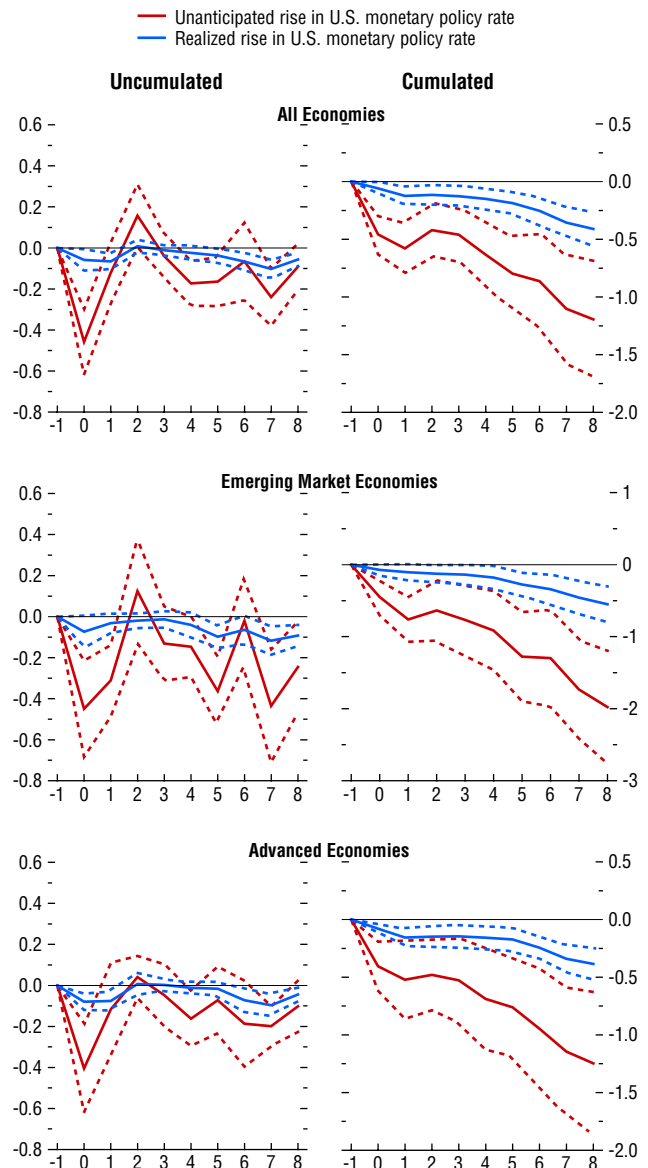
This section investigates whether the additional effect of U.S. monetary policy changes on net flows to EMEs that are directly financially exposed to the United States is sensitive to the structural and economic characteristics of these economies. Specifically, we examine how the additional effects vary according to differences in integration with global financial markets, domestic financial depth, foreign exchange rate regime, and domestic economic growth. It is important to stress that the results should not be interpreted as assigning a causal role to these structural and economic characteristics on the sensitivity of net flows to EMEs to U.S. monetary policy. For each specific characteristic, the results show the additional effects (immediate

²⁸Unlike studies that find an important role for U.S. real activity in driving flows to developing economies (see Mody, Taylor, and Kim, 2001), our results suggest that a U.S. growth surprise does not significantly affect net flows to economies with a direct trade exposure to the United States. This result continues to hold if the U.S. growth surprise is complemented by a growth forecast error from the euro area. This finding is more in line with Taylor and Sarno (1997) and Calvo, Leiderman, and Reinhart (1993), who find a bigger role for U.S. monetary policy than for U.S. real activity indicators.

Figure 4.16. Difference in the Response of Net Private Capital Flows to U.S. Monetary Tightening across Economies

(Percent of GDP)

An unanticipated U.S. monetary tightening has an immediate and statistically significant negative additional effect on net flows to economies that are directly financially exposed to the United States compared with economies that are not. The additional impact under a realized U.S. rate hike is much smaller.



Source: IMF staff calculations.

Note: See Appendix 4.1 for the sample of economies included in the analysis. The dependent variable is total net private capital flows in percent of GDP. The x-axis shows the number of quarters after an impulse. Impulses at quarter zero are normalized to a 1 standard deviation unanticipated rate rise for the economy at the group's average financial exposure. The underlying impulse is indicated in the legend. Dashed lines indicate one standard error bands. The regression specification and the set of control variables are given in Appendix 4.4.

and cumulated) on net flows to an economy with average direct financial exposure to the United States compared with net flows to an economy that has no direct U.S. financial exposure.

The role of financial globalization

The negative additional effect of an unanticipated tightening in U.S. monetary policy tends to be stronger for EMEs that are more integrated with global financial markets (Figure 4.17, first and second columns). Financial globalization is proxied by two measures—greater capital account openness and greater foreign penetration (holdings) in the domestic debt market. There is a sharp negative additional effect of U.S. rate hikes on financially integrated economies, whereas the additional effect on economies that are less globalized is not statistically significant.²⁹ Realized rate changes resemble unanticipated rate changes in terms of their additional effects on net flows but are of smaller magnitude.

The role of domestic financial depth/intermediation

Net flows to directly financially exposed EMEs with low domestic financial depth are more sensitive to U.S. rate changes than others (Figures 4.17, third column). For both types of economies—those with higher and lower financial depth—U.S. rate hikes have a negative additional impact on net flows. But this additional effect is statistically significant only for economies with lower financial depth. This result is surprising if one expects financial depth to be correlated with financial globalization. The sensitivity of net flows to U.S. rate hikes in financially shallow economies could reflect the behavior of domestic investors (that is, gross outflows) rather than foreign investors (gross inflows), given that the latter will likely be low in financially shallow economies (Calderon and Kubota, 2009). Note, however, that the measure for financial depth is not tantamount to financial openness but proxies the size of domestic financial intermediation (Beck, Demirgüç-Kunt, and Levine, 2000 and 2009). In fact, some large

economies—for example, China and India—with proportionately larger financial sectors (but closed capital accounts) also belong to this group.

The role of the exchange rate regime

The additional response of net flows to U.S. monetary policy tightening in directly financially exposed economies with nonpegged exchange rate regimes is sharper than in those with pegged regimes (Figure 4.17, fourth column).³⁰ In particular, for relatively flexible regimes, an unanticipated U.S. rate hike has a negative additional effect on net flows that is significant in the long term. The corresponding effect of a realized rate increase is significant in the short and long term but is of a smaller magnitude. For pegged regimes, the initial and cumulated additional effects are never statistically significant, whether or not U.S. rate hikes are unanticipated.

The disparate experiences of peggers and others could reflect a number of factors. First, several economies in the sample that had relatively pegged exchange rate regimes over the sample period also had relatively more closed capital accounts during this period (for example, Argentina, Morocco, Russia, and a majority of Asian economies). Conversely, several of the nonpeggers also have relatively open capital accounts (for example, Brazil, Indonesia, Mexico). Second, as a caveat, a nonpegged regime need not imply that the exchange rate path itself is fully flexible—for instance, if the exchange rate is managed, then the lack of sufficient exchange rate adjustment could give rise to a one-way bet and exaggerate the consequent adjustment in capital flows.

The role of domestic economic growth

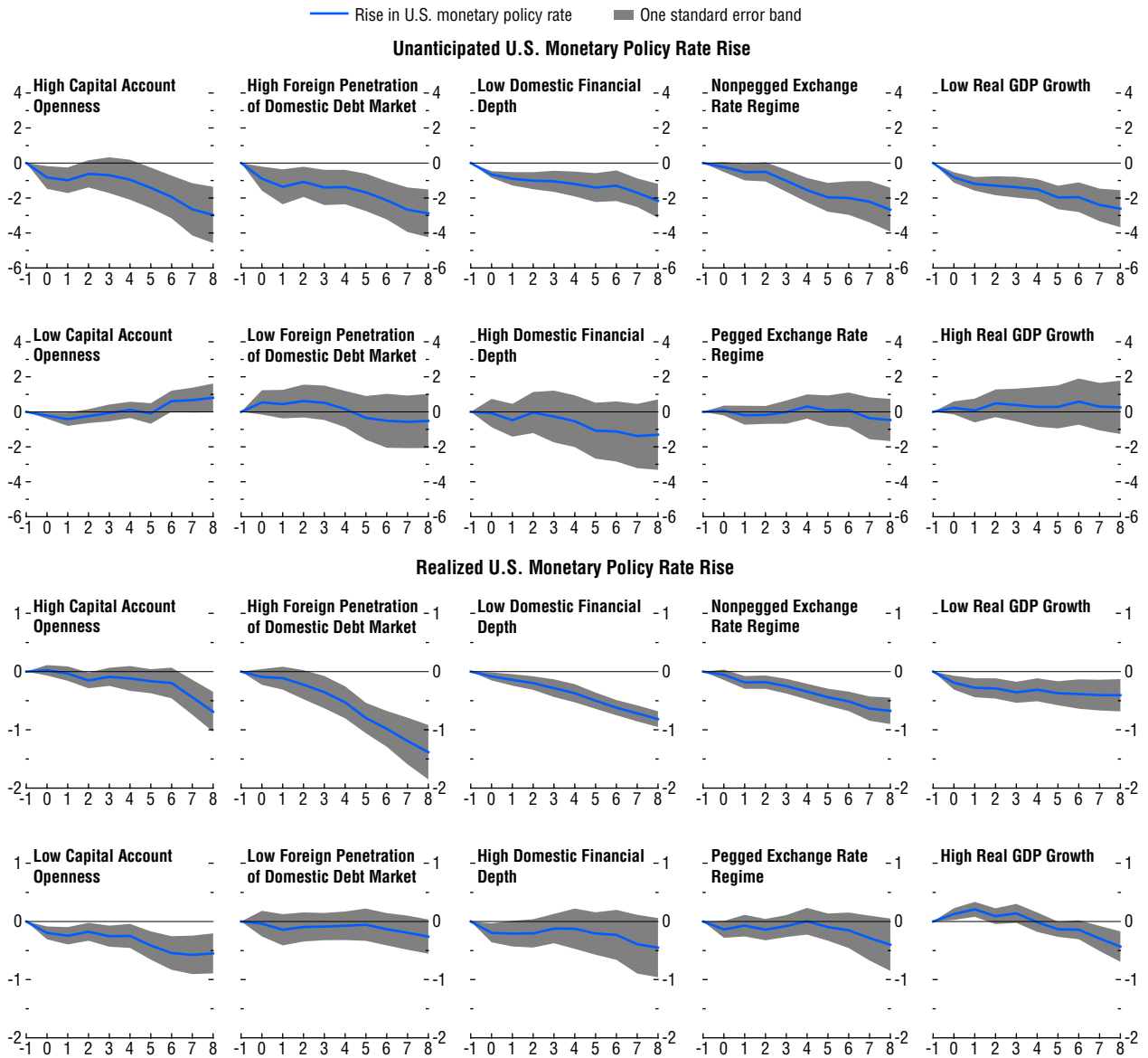
Directly financially exposed economies with relatively weak growth performance appear to face a sharper negative additional effect of an unanticipated U.S. monetary tightening (Figure 4.17, right column). In contrast, the additional impact of unan-

²⁹This result also supports the findings of Milesi-Ferretti and Tille (2010) that economies with a high degree of financial integration experienced deeper declines in capital inflows during the global financial crisis. Examples of economies in the sample with high financial openness using both measures include Hungary and Peru.

³⁰Pegged regimes are defined as those without a separate legal tender or where the exchange rate is fixed by a currency board or a fixed or crawling peg arrangement under which the exchange rate (or the band around it) does not move more than ± 2 percent. This corresponds to categories 1 and 2 in Reinhart and Rogoff's de facto exchange rate classification (2004). All other regimes, which are likely more flexible, are defined as nonpegged.

Figure 4.17. Difference in the Response of Emerging Market Economy Net Private Capital Flows to U.S. Monetary Tightening by Selected Economic Characteristics
(Percent of GDP)

The sensitivity of net flows to an unanticipated U.S. monetary tightening is greater for directly financially exposed emerging market economies that are more globally financially integrated and have shallower financial markets, more flexible exchange rates, or lower domestic growth (compared with financially unexposed economies). A similar pattern holds for the sensitivity of net flows in response to a realized U.S. monetary tightening.

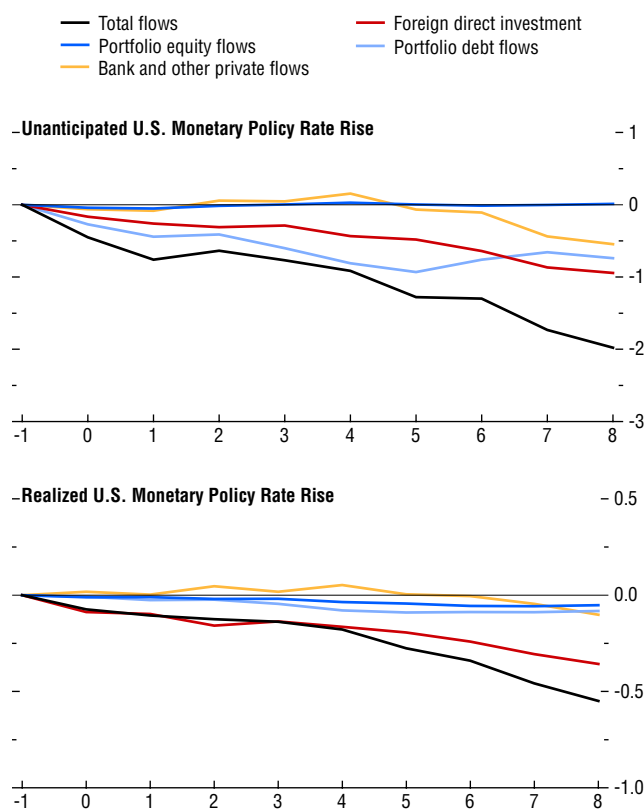


Source: IMF staff calculations.

Note: See Appendix 4.1 for the sample of emerging market economies. The dependent variable is total net private capital flows in percent of GDP, for emerging market economies with the selected characteristic. Sample splits are based on being above or below the median for the characteristic. The x-axis shows the number of quarters after an impulse. The impulse at quarter zero is a permanent U.S. monetary policy rate rise, normalized to a 1 standard deviation unanticipated rate rise for the economy at the group's average financial exposure. The regression specification and the set of control variables are given in Appendix 4.4.

Figure 4.18. Difference in the Response of Emerging Market Economy Net Private Capital Flows to U.S. Monetary Tightening by Type of Flow
(Percent of GDP)

The negative additional effect of an unanticipated U.S. monetary tightening on net flows to directly financially exposed emerging market economies is most evident for portfolio debt flows and absent for portfolio equity flows. Foreign direct investment shows a strong additional response, whereas the responses of bank and other private flows are delayed. For a realized U.S. monetary tightening, only foreign direct investment shows a strong additional response.



Source: IMF staff calculations.

Note: See Appendix 4.1 for the sample of emerging market economies. The dependent variable is total net private capital flows in percent of GDP. The x-axis shows the number of quarters after an impulse. The impulse at quarter zero is a permanent U.S. monetary policy rate rise, normalized to a 1 standard deviation unanticipated rate rise for the economy at the group's average financial exposure. The regression specification and the set of control variables are given in Appendix 4.4.

anticipated U.S. rate hikes on net capital flows is not significant for directly financially exposed economies with strong growth performance. Economies with strong growth may be adopting the right mix of macroeconomic and prudential policies to attract capital flows, which offsets the negative additional effect of U.S. unanticipated rate hikes. The opposite may be true for low-growth economies.

These findings illustrate how the average additional effect of U.S. rate hikes on net flows to EMEs that are directly financially exposed to the United States masks important differences within the sample. Unlike AEs—which are more homogeneous in terms of their structural characteristics (with most economies characterized as having open financial markets, flexible exchange rate regimes, and financial depth)—EMEs are much more diverse. That diversity, combined with the differences in their direct financial exposure to the United States, yields the differential responses to U.S. monetary policy changes.

Do Different Types of Flow Respond Differently to U.S. Monetary Policy?

The negative additional effect of an increase in the U.S. interest rate on net capital flows is most pronounced for portfolio debt flows and statistically significant in the short and long term with the unanticipated rate change (Figure 4.18). For FDI and bank and other private flows, the additional impact of U.S. monetary tightening on net flows to directly financially exposed EMEs is negative but not always statistically significant. Finally, equity flows are not sensitive to changes in U.S. monetary policy. The relatively higher sensitivity of FDI to U.S. monetary policy, after portfolio debt flows, could reflect an increasing share of financial FDI over time in directly financially exposed economies, which behaves more like debt-creating flows (Ostry and others, 2010).

Does the Global Economic Environment Affect the Impact of U.S. Monetary Policy on Net Flows to Directly Financially Exposed Economies?

A finding most relevant to the world's current circumstances is that the additional effect of U.S. interest rate changes on capital flows to economies

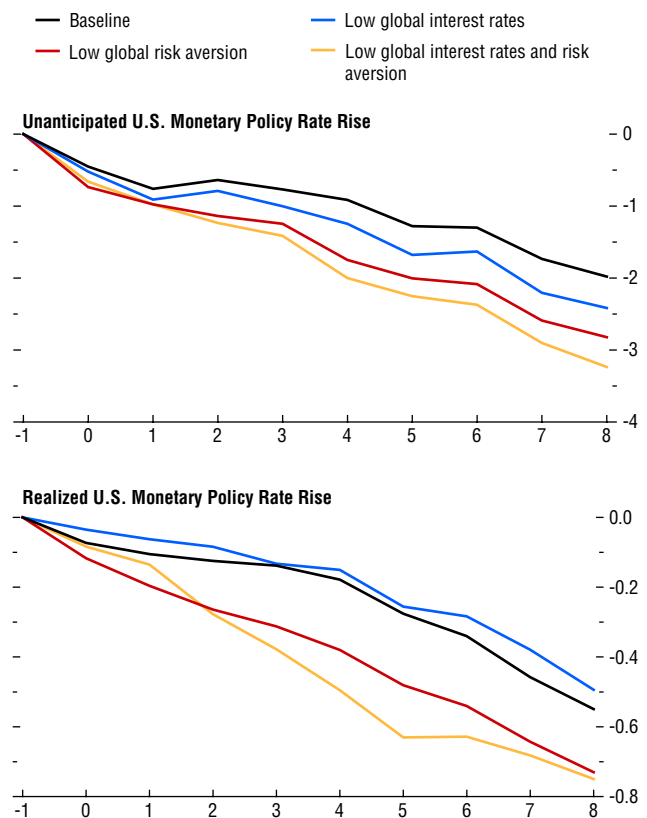
that are directly financially exposed to the United States is deeper when global financial conditions—both interest rates and risk aversion—are relatively easy. For a typical EME with an average direct financial exposure, the additional effect of an unanticipated U.S. rate increase in a low-interest-rate environment is more protracted than under the baseline (Figure 4.19). This result implies that the current global economic environment, whereby loose U.S. monetary conditions—sustained via interest rate cuts and quantitative easing—would induce greater sensitivity of net capital flows to financially exposed EMEs to U.S. monetary policy changes. During periods of low risk aversion, the effect is even sharper and statistically significant in the short and long term. Finally, the additional impact of U.S. rate hikes on net flows is deepest in an underlying environment of both low global interest rates and low risk aversion, with the effect again statistically significant in the short and long term. These results could reflect the fact that capital flows are more prone to respond to return-chasing incentives when global financial asset returns are generally low while the appetite for taking risks is high (low risk aversion) and relate to the recent literature highlighting the role of global risk perception in driving capital flow volatility and sudden stops and surges.³¹ The additional effects of a realized rate change are also similar under the alternative circumstances, although with smaller magnitudes and significant only in the long term.

In summary, economies directly financially exposed to the United States experience a negative additional impact on their net capital flows because of U.S. monetary tightening that is proportional to their level of exposure. The estimated additional effect is larger when the U.S. policy change is measured by the unanticipated component of the corresponding U.S. interest rate move, while the effect is underestimated when U.S. policy changes are proxied with the actual or realized rate change. The additional negative effect of a U.S. rate hike may be stronger in the current environment of relatively

³¹For example, see Forbes and Warnock (2010) and the IMF's May 2010 *Regional Economic Outlook* for the Western Hemisphere.

Figure 4.19. Difference in the Response of Emerging Market Economy Net Private Capital Flows to U.S. Monetary Tightening under Alternative Global Economic Conditions
(Percent of GDP)

The underlying macroeconomic background plays an important role in determining the responsiveness of net flows to U.S. rate hikes for emerging markets with direct financial exposure to the United States. Compared with the baseline, the additional fall in net flows is deeper during periods with low global interest rates, even more during periods of low global risk aversion, and finally, the deepest when both global interest rates and risk aversion are low.



Source: IMF staff calculations.

Note: See Appendix 4.1 for the sample of emerging market economies. The dependent variable is total net private capital flows in percent of GDP. The x-axis shows the number of quarters after an impulse. The impulse at quarter zero is a permanent U.S. monetary policy rate rise, normalized to a 1 standard deviation unanticipated rate rise for the economy at the group's average financial exposure. The regression specification and the set of control variables are given in Appendix 4.4. The low global interest rates and low risk aversion periods are taken from Figure 4.12. See the main text for full details on the selection of the periods.

loose global monetary conditions and low global risk aversion. Also, differences in financial openness, financial depth, exchange rate regime, and economic growth among directly financially exposed EMEs are associated with different sensitivities of net flows to U.S. monetary policy changes.

Policy Implications and Conclusions

Net capital flows are generally fickle from domestic policymakers' point of view. Flows have become more volatile over time, and their persistence has generally been low. EMEs tend to experience greater overall capital flow volatility than AEs. Bank and other private flows across economies are the most volatile and portfolio debt the least persistent, but the statistical properties across the remaining types of flow are not distinguishable. Historically, changes in global financing conditions were associated with temporary tides of net flows to EMEs, with flows rising during periods of low global interest rates and risk aversion and falling afterward. Finally, using a novel identification strategy, the analysis indicates that economies that have a direct foreign financial exposure to the United States experience an additional decline in their net capital flows in response to U.S. monetary tightening over and above what is experienced by economies that have no such exposure. This additional impact is larger when the changes in the U.S. policy rate are unanticipated and if they occur in an environment of low global interest rates and low risk aversion.

How should the above results inform policymakers' expectations? First, given the direct financial exposure of most economies vis-à-vis the United States (some large, some small), it is reasonable to expect that eventual monetary tightening in the United States will have a negative additional impact on their capital flows, especially in an environment of low global interest rates and risk aversion. The extent of the impact will depend on the degree of their direct financial exposure to the United States. Second, the variability of capital flows is pervasive across all economies and will likely continue in a climate of increasing financial globalization. Whether and by how much net

flows to economies would actually change at any given time will depend on the overall effect of all other drivers, including any common effect of U.S. monetary policy change, and on whether or not the change in U.S. monetary policy is anticipated.

How should policymakers manage volatile capital flows? Notwithstanding the benefits of financial globalization, the recent literature stresses its associated risks (Kose and others, 2006) and also highlights the importance of deep and liquid domestic financial markets (*Global Financial Stability Report*, October 2007), greater exchange rate flexibility and prudential regulation (*Global Financial Stability Report*, April 2010), fiscal restraint (*World Economic Outlook*, October 2007), and strong institutions (Papaioannou, 2009) to reduce these risks. In the face of variable capital flows, as documented in this chapter, the key is to ameliorate their impact on domestic economic and financial stability. In particular, as discussed in Chapter 1 of this *World Economic Outlook* and in IMF (2011), it is important to adopt strong macroeconomic policies, prudential financial supervision, and other macroprudential measures to sustain strong growth and better cope with the restive nature of capital flows.

Appendix 4.1. Classification of Economies and Data Sources

Classification of Economies

We started with the largest possible sample of economies with data on capital flows (see below for sources). Economies are included in the annual (quarterly) sample if they have at least 10 (5) years of data on capital flows and GDP. The advanced economies (AEs) in the sample correspond to the IMF 1990 *World Economic Outlook* (WEO) definition of industrial economies. For emerging market economies (EMEs), in the absence of an official definition, we take the same sample of emerging market and developing economies used in the regional analysis in Chapter 2 of the *World Economic Outlook* under emerging Asia, emerging Europe, Latin America and the Caribbean, Commonwealth of Independent States (CIS), Middle East and North Africa, and sub-Saharan Africa, but

exclude relatively low-income economies (eligible for assistance under the IMF's Poverty Reduction and Growth Trust) and those that are relatively small (with nominal GDP in U.S. dollars averaged over 1990–2009 of less than the median GDP based on all developing and emerging market economies in the sample). This results in a sample of EMEs that are largely covered by the universe of external sources, such as Morgan Stanley Capital International, *The Economist*, and Dow Jones & Company. In addition, economies that are classified as AEs today but were not in 1990 are included in the sample of EMEs. These economies include Cyprus, the Czech Republic, Malta, Estonia, the Slovak Republic, Slovenia, and the newly industrialized Asian economies. All non-emerging-market and non-advanced economies are defined as other developing economies. The statistical analyses, event studies, and regressions exclude offshore financial centers as defined by the Financial Stability Forum (Table 2 in IMF, 2000). These economies include Antigua and Barbuda, Bahrain, Barbados, Belize, Costa Rica, Cyprus, Hong Kong SAR, Lebanon, Luxembourg, Malta, Mauritius, Panama, Seychelles, Singapore, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Switzerland, and Vanuatu. To ensure comparability over time, the descriptive analysis, event studies, and global factor model are based on a constant set of economies, with the exception of central and eastern European and CIS economies, which are included starting in 1994. Because data availability differs depending on the time horizon and frequency level, the set of economies included in the various figures may differ slightly. The analytical and regional groupings of economies are presented in Table 4.1.

Data Sources

The chapter uses primarily the IMF's Balance of Payments Statistics (BPS), WEO, and International Financial Statistics (IFS) databases. Additional data sources are listed in Table 4.2.

Annual data on capital flows are taken from the IMF BPS database. In particular, net private capital flows correspond to the sum of net foreign direct

investment flows (line 4500), net portfolio flows (line 4600), net derivative flows (line 4910), and net other investment flows (line 4700), excluding other investment flows to the general government and monetary authorities. Gross and net capital flows, as well as their components, are reported in nominal U.S. dollars and are normalized by nominal GDP in U.S. dollars. The latter series is taken from the World Bank World Development Indicators database and extended with data from the WEO database.

Quarterly data on capital flows are also primarily taken from the IMF BPS database and extended with data from other sources, such as Haver Analytics, the CEIC EMED database, and national sources (China and Australia). Quarterly nominal GDP (not seasonally adjusted) series in local currency and the average nominal exchange rate vis-à-vis the U.S. dollar are extracted from the IFS and are extended with alternative sources when needed.

Global real interest rates are proxied by a GDP-weighted average of the real European Central Bank financing rate (and the Bundesbank base rate prior to 1999) and the real U.S. federal funds rate, all taken from Haver Analytics. The one-quarter-ahead expected inflation rate used to construct the ex ante real rate for the United States corresponds to the forecasts of the GDP deflator change from the Survey of Professional Forecasters, published by the Federal Reserve Bank of Philadelphia, whereas the ex ante real rate for Europe is calculated using the one-year-ahead forecast of consumer price index inflation from *Consensus Forecasts*. Global risk aversion is measured by the Chicago Board of Options Exchange Volatility Index level.

We use two measures to track changes in U.S. monetary policy: the realized changes are constructed from the St. Louis Federal Reserve's FRED database, series DFF at a daily frequency, and the unanticipated changes are constructed from data on the daily settlement prices of the Chicago Board of Trade's federal funds futures contracts from Datastream, series CFF. The change in one-quarter-ahead expected inflation from the Survey of Professional Forecasters is subtracted from the realized nominal rate change to derive the real rate change used. See Appendix 4.4 for more details on

Table 4.1. Economy Groupings

Advanced Economies	Emerging Asia	Other Emerging Economies	Other Developing Economies
United States (111)*	Sri Lanka (524)	South Africa (199)*†	Bolivia (218)
United Kingdom (112)*†	Taiwan Province of China (528)*	Israel (436)*†	Haiti (263)
Austria (122)*†	Hong Kong SAR (532)*	Jordan (439)*†	Honduras (268)
Belgium (124)*†	India (534)*†	Kuwait (443)	Nicaragua (278)
Denmark (128)*†	Indonesia (536)*†	Lebanon (446)	Paraguay (288)
France (132)*†	Korea (542)*†	Oman (449)	Antigua and Barbuda (311)
Germany (134)*†	Malaysia (548)*†	Saudi Arabia (456)	Barbados (316)
Italy (136)*†	Philippines (566)*†	Syrian Arab Republic (463)	Dominica (321)
Luxembourg (137)*	Singapore (576)*	United Arab Emirates (466)	Grenada (328)
Netherlands (138)*†	Thailand (578)*†	Egypt (469)*†	Jamaica (343)
Norway (142)*†	China (924)*†	Pakistan (564)	St. Kitts and Nevis (361)
Sweden (144)*†	Emerging Latin America	Algeria (612)	St. Lucia (362)
Switzerland (146)*	Argentina (213)*†	Libya (672)	St. Vincent and the Grenadines (364)
Canada (156)*†	Brazil (223)*†	Morocco (686)*†	Suriname (366)
Japan (158)*†	Chile (228)*†	Tunisia (744)	Bahrain (419)
Finland (172)*†	Colombia (233)*†	Azerbaijan (912)	Bangladesh (513)
Greece (174)*†	Costa Rica (238)*	Belarus (913)*	Maldives (556)
Iceland (176)*†	Dominican Republic (243)	Kazakhstan (916)*	Nepal (558)
Ireland (178)*†	Ecuador (248)*†	Russia (922)*†	Vietnam (582)
Portugal (182)*†	El Salvador (253)*†	Ukraine (926)*†	Botswana (616)
Spain (184)*†	Guatemala (258)*†		Cameroon (622)
Australia (193)*†	Mexico (273)*†		Cape Verde (624)
New Zealand (196)*†	Panama (283)		Ethiopia (644)
	Peru (293)*†		Ghana (652)
	Uruguay (298)*†		Côte d'Ivoire (662)
	Venezuela (299)		Kenya (664)
	Emerging Europe		Lesotho (666)
	Malta (181)*		Mauritius (684)
	Turkey (186)*†		Mozambique (688)
	Cyprus (423)*		Nigeria (694)
	Bulgaria (918)*†		Rwanda (714)
	Czech Republic (935)*†		Seychelles (718)
	Slovak Republic (936)*		Sierra Leone (724)
	Estonia (939)*		Swaziland (734)
	Latvia (941)*		Tanzania (738)
	Hungary (944)*†		Uganda (746)
	Lithuania (946)*		Solomon Islands (813)
	Croatia (960)*		Fiji (819)
	Slovenia (961)*		Papua New Guinea (853)
	Poland (964)*†		Albania (914)
	Romania (968)*†		

Note: See Appendix 4.1 for details on the economy groupings. The numbers in parentheses after the economy name denote the economy's IFS code. * indicates advanced and emerging market economies included in the analysis at a quarterly frequency. † indicates economies included in the quarterly regression sample (smaller due to unavailability of domestic explanatory variables for some economies).

Table 4.2. Data Sources

Variable	Source
Annual	
Capital Flows (net; gross assets and liabilities)	Balance of Payments Statistics (BPS) Database, National Sources
Nominal GDP in U.S. Dollars	World Bank World Development Indicators (WDI) Database, World Economic Outlook (WEO) Database
Liquid Liabilities	Beck, Demirgüç-Kunt, and Levine (2000, 2009)
Bilateral Exports and Imports	Direction of Trade Statistics Database
Capital Account Openness Index	Chinn and Ito (2006, 2008)
Exchange Rate Regime Indicator	Reinhart and Rogoff (2004); Ilzetki, Reinhart, and Rogoff (2008)
Foreign Penetration in Debt Market	Bank for International Settlements Database
External Assets and Liabilities	BPS Database: IMF International Investment Position Statistics
Quarterly	
Capital Flows (net; gross assets and liabilities)	BPS Database, Haver Analytics, CEIC, National Sources
Nominal GDP in U.S. Dollars	International Financial Statistics (IFS) Database, Haver Analytics, CEIC EMED Database, National Sources
Real GDP growth (year over year)	WEO database
Federal Funds Futures Contract Settlement Prices	Chicago Board of Trade, Datastream (series CFF)
Realized U.S. Interest Rate	Federal Reserve (FRED series DFF)
U.S. Growth Forecast	Federal Reserve Bank of Philadelphia Survey of Professional Forecasters
U.S. External Assets and Liabilities on a Bilateral Basis	U.S. Treasury International Capital System Database, Bureau of Economic Analysis Foreign Direct Investment Statistics
Short-Term Interest Rate	Haver Analytics (G-10, EMERGE, IFS), Eurostat, Datastream
Consumer Price Index	IFS Database
Composite Risk Level	PRS Group International Country Risk Guide
Investors' Risk Aversion	Chicago Board of Options Exchange Volatility Index, Haver Analytics
European Central Bank Financing Rate	Haver Analytics
Bundesbank Base Rate	Haver Analytics

the construction of the unanticipated and realized changes in the U.S. federal funds rate.

Data on direct financial exposure to the United States, used to construct economy-specific weights (which are interacted with U.S. monetary policy measures for the regression analysis), are from three sources: (1) the U.S. Treasury International Capital System (TICS) database on bilateral assets and liabilities of the United States vis-à-vis other countries; (2) U.S. Bureau of Economic Analysis (BEA) Foreign Direct Investment (FDI) Statistics; and (3) the IMF's International Investment Position (IIP) statistics from the BPS database. The U.S. TICS database contains information on the U.S. bilateral international asset and liability positions for all instruments covered in the BPS, except for FDI information, which is collected by the BEA. These bilateral series are used to construct the numerator of the weight; the denominator is constructed using the external asset and liability positions by economy, taken from the IMF IIP. See

Appendix 4.4 for full details on how the weights are constructed.

Two series are used to compute the U.S. growth forecast error. For any given quarter, the U.S. growth forecast corresponds to the median forecast from the previous quarter for the current quarter's seasonally adjusted, quarter-over-quarter real GDP growth rate from the Survey of Professional Forecasters. The actual seasonally adjusted, real quarter-over-quarter GDP growth rate is taken from the WEO database. Direct trade exposure to the United States (which is interacted with growth surprises in the United States) is constructed from the IMF Direction of Trade Statistics (DOTS) database. It is the sum of an economy's exports to and imports from the United States divided by total imports and exports of the economy. The trade exposure weights used in the regression analysis correspond to the average of the above weights between 2000 and 2009.

Domestic short-term nominal interest rates are from Haver Analytics (G-10, EMERGE, IFS), Eurostat, Datastream, and IMF IFS databases. Year-over-year inflation is calculated from consumer price indices in the IMF IFS database and subtracted from the short-term rates to derive an ex post real rate. Nominal interest rate series are adjusted to exclude periods during which interest rates appeared to be set administratively. In addition, periods of hyperinflation, defined as year-over-year consumer price index growth rates greater than 100 percent, are not included in the analysis. The domestic year-over-year real GDP growth series are taken from the WEO database, and the composite risk rating of the country is the average of the political, economic, and financial risk rating from the *International Country Risk Guide*. The liquid liabilities series are taken from the Financial Structure Database (Beck, Demirgüç-Kunt, and Levine, 2000 and 2009) and extended until 2010 using the growth rate of broad money from the IMF IFS database and other sources. The degree of capital account openness is measured using the Chinn and Ito (2008) index of openness of capital account transactions, constructed from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. The de facto exchange rate regime is taken from Reinhart and Rogoff (2004), updated with Ilzetki, Reinhart, and Rogoff (2008). The series on capital account openness and exchange rate regime were available until 2008 and 2007, respectively, and were extended until 2009 under the assumption that there were no changes from their last recorded values. Finally, the series of foreign penetration in domestic debt markets is measured as the ratio of domestically issued debt held by foreigners divided by the sum of total domestically issued debt from the Bank for International Settlements database (Tables 11 and 16A).³²

³²We thank Gian Maria Milesi-Ferretti for sharing the data on foreign penetration in domestic debt markets.

Appendix 4.2. Composition, Volatility, and Persistence of Net Private Capital Flows across Emerging Market Regions

We examine the composition, volatility, and persistence of net capital flows over time across the different emerging market regions, as defined in Appendix 4.1. These are measured as discussed in the main text.

Composition

The trend decline in net bank and other private flows that was observed for emerging market economies—EMEs (see Figure 4.7) is more prominent in emerging Asia and, to some extent, Latin America (Figure 4.20). In emerging Europe, the share of net bank and other private flows actually increased in the 2000s, whereas in other emerging economies, it increased in the 1990s but fell in the 2000s.

Volatility

Historically, there have been no systematic differences in the volatility of total net private capital flows across the various emerging market regions (Figure 4.21). Flows to emerging Asia appear to have had the lowest volatility over the past 30 years relative to those of the remaining regions, but the differences in volatility are not statistically significant. Only recently (starting in 1996) does there appear to be a relative rise in the volatility of total net flows to the other emerging economies, perhaps related to their relatively gradual shift away from debt-creating flows. The rise in the volatility of net flows to these economies, as well as the marginally higher volatility of net flows to emerging Europe, appears to underlie the small increase in volatility of net flows to EMEs discussed in the text and illustrated in Figure 4.9.

Persistence

The persistence of total net flows, measured as the AR(1) regression coefficient of total net private capital flows in percent of GDP, also does not appear to vary substantially across the four emerging market regions (Figure 4.22). Net flows to emerging Asian

economies appear to have been the most persistent, whereas net flows to the other emerging economies have been the least persistent, but these differences are not statistically significant. Most notably, the persistence of flows to the median economy in each region has become more similar over time.

Appendix 4.3. Global Factor Model

The following two models are estimated using cross-sectional ordinary least squares to identify the influence of (1) global factors and (2) global and regional factors on the variation in net capital flows to emerging market economies (EMEs) in any given year:³³

$$\text{Global factor model: } y_{i,t} = \alpha_t + \varepsilon_{i,t} \quad (4.2)$$

$$\text{Global and regional factor model: } y_{i,t} = \alpha_t + \sum_{j=1}^4 \beta_t^{(j)} D_j + \varepsilon_{i,t}, \quad (4.3)$$

where $y_{i,t}$ is the level of net capital flows (scaled by GDP) in economy i at time t ; α_t is a time dummy capturing the common global factor across all EMEs (i) at time t ; $\beta_t^{(j)}$ is the regional factor common to all economies within region (j) at time t ; D_j is a dummy for region j ; and $\varepsilon_{i,t}$ is a mean zero error term.

The models are estimated for a sample of 20 AEs in each year: the 23 economies listed in Table 4.1, excluding Belgium because of lack of data, and the financial centers, Luxembourg and Switzerland. For EMEs, the models are estimated for each year between 1980 and 1993 for 36 economies—the 59 economies listed in Table 4.2, excluding eastern Europe, the Commonwealth of Independent States (CIS), the financial centers, and other countries for which data are lacking.³⁴ For every year after 1994,

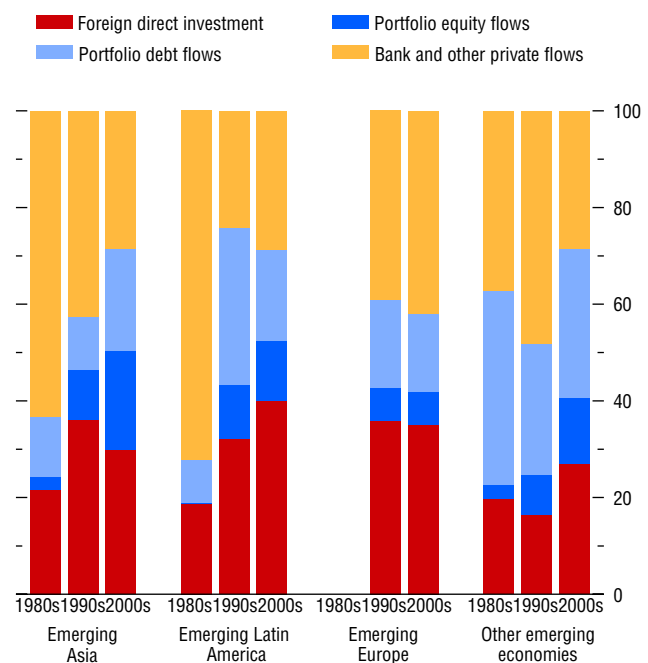
³³This section draws on Abiad (1996). EMEs are divided into four geographic regions—Asia, Latin America, Europe, and other (mainly CIS, Middle Eastern, and African economies) as listed in Table 4.2.

³⁴The excluded eastern European and CIS economies are Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia, and Ukraine. The excluded financial centers are Costa Rica, Cyprus, Hong Kong SAR, Lebanon, Malta, Panama, and Singapore. The economies excluded because of a lack of data are Angola, Azerbaijan, the Islamic Republic of Iran, Iraq, Kazakhstan, Qatar, Serbia, Trinidad, and Turkmenistan.

Figure 4.20. The Relative Importance of Various Types of Flow across Emerging Market Regions

(Percent of total)

The decline in the importance of bank and other private flows has been most pronounced in emerging Asian and Latin American economies. In emerging Europe, the share of bank and other private flows actually went up in the 2000s, while in other emerging market economies, it increased in the 1990s before falling in the 2000s.



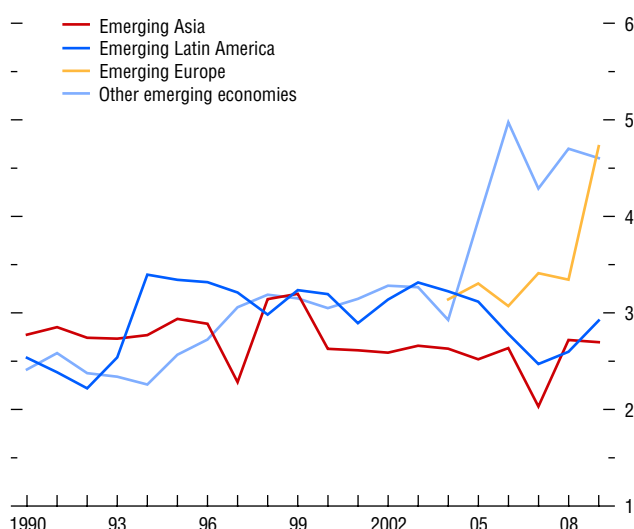
Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: The relative importance of a particular type of flow is calculated as the absolute value of the net flows of that type to the economies of the group divided by the sum of the absolute value of the net flows of all four types of instruments to the economies of the group. Ratios are calculated for each decade with annual data, computing both numerator and denominator over the years in each decade. Derivative flows, which comprise a very small share of the financial account, are excluded from the calculation. The group aggregates exclude offshore financial centers.

Figure 4.21. The Volatility of Net Private Capital Flows across Emerging Market Regions

(Standard deviation of net private capital flows in percent of GDP)

The volatility of total net private capital flows to different emerging market regions has been broadly similar. In recent periods, flows to other emerging market economies appear to have become relatively more volatile, which is perhaps related to the greater importance of debt-creating flows for these economies. However, the differences with respect to the remaining emerging market regions are generally not statistically significant.



Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Using annual data, the volatility of any particular flow is computed as its standard deviation over the prior 10-year window for each economy (for example, the 1990 value corresponds to the standard deviation during 1981–90). The median is plotted only if the standard deviation for the particular 10-year window and type of flow can be calculated for at least one-fifth of the economies in the group. The groups exclude offshore financial centers.

the sample includes eastern Europe and the CIS, and thus the models are estimated for the 50 EMEs listed in Table 4.1, excluding the financial centers and other countries for which data are lacking. The sum of the regional dummies is equal to the time dummy in the second model, and so instead of dropping one of the regional dummies, we restrict the coefficients to sum to zero, $\sum_{j=1}^4 \beta_t^{(j)} = 0$ at every t , so that the coefficients $\beta_t^{(j)}$ represent the over- or underperformance of the region relative to the global factor in all periods.

The residuals from the first model correspond to the portion of the cross-country dispersion in net capital flows that cannot be explained by global factors and are thus related to regional or economy-specific factors. Similarly, the residuals from the second model correspond to the portion of the cross-country dispersion in net capital flows that cannot be explained by global or regional factors and are thus related to economy-specific factors. To calculate the fraction of the dispersion in net capital flows across EMEs that is explained by global and regional factors, we compare the residuals from the two models above with those from a simple constant (α) model:

$$y_{i,t} = \alpha + \varepsilon_{i,t} \quad (4.4)$$

The share of the variation of net flows across countries explained by global and regional factors at each point in time corresponds to the following R^2 statistics:

$$\text{Global factor model: } R_t^{G2} = 1 - \frac{\sum_{i=1}^N (y_{it} - \hat{y}_{it}^G)^2}{\sum_{i=1}^N (y_{it} - \hat{y}_{it}^C)^2} \quad (4.5)$$

$$\text{Global and regional factors model: } R_t^{G\&R2} = 1 - \frac{\sum_{i=1}^N (y_{it} - \hat{y}_{it}^{G\&R})^2}{\sum_{i=1}^N (y_{it} - \hat{y}_{it}^C)^2} \quad (4.6)$$

R^{G2} is the variation in net capital flows that is explained by global factors only (relative to the simple constant model), \hat{y}_{it}^G is the fitted value from the global factor model, and \hat{y}_{it}^C is the fitted value from the simple constant model. $R^{G\&R2}$ is the variation in net capital flows that is jointly explained by global and regional factors (relative to the simple constant

model), and $\hat{y}_{it}^{G\&R}$ is the fitted value from the global and regional factors model.

Appendix 4.4. Regression Methodology and Robustness Checks

This appendix provides further details regarding the statistical methods used and the robustness of the regression results. It first describes the baseline regression model and estimation strategy. Next, it outlines the construction of the U.S. direct financial exposure weights. Third, it describes the approach used to isolate the component of changes in U.S. monetary policy rates that are unanticipated from the market’s perspective. Fourth, it discusses a variety of robustness checks that have been undertaken regarding the core results.

Model Specification and Estimation

The baseline specification is a cross section and time fixed-effects panel data model:

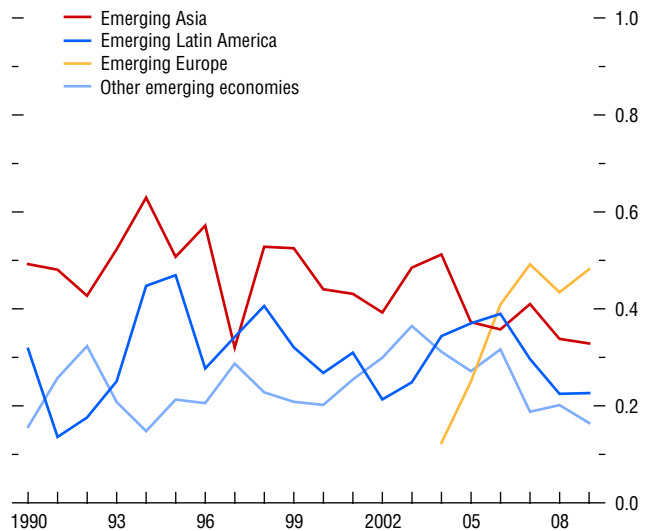
$$y_{i,t} = \alpha_i + \alpha_t + \sum_{s=0}^8 \beta_s (\omega_i \times \Delta r_{us,t-s}) + \sum_{s=0}^8 \lambda_s (\delta_i \times \Delta g_{us,t-s}) + X_{i,t-1} \gamma + \varepsilon_{i,t}, \quad (4.7)$$

where i indexes economies; t indexes time (quarterly date); $y_{i,t}$ is the ratio of net capital flows to GDP; α_i and α_t are economy and time fixed effects, respectively; ω_i denotes the U.S. direct financial exposure weights (described below); $\Delta r_{us,t}$ is the U.S. monetary policy change measure—here, based on either the realized or the unanticipated rate; δ_i denotes U.S. direct trade exposure weights; $\Delta g_{us,t}$ is the U.S. growth forecast error; $X_{i,t-1}$ is a vector of additional controls, including the lagged level in domestic short-term real rate, lagged level in domestic real GDP growth, lagged *International Country Risk Guide* composite risk level (whereby a higher value indicates lower risk), lagged log nominal GDP, a lagged binary exchange rate regime indicator (representing 1 for all pegged regimes and zero for nonpegged regimes), the fourth lag of the Chinn-Ito capital account openness measure, and the fourth lag of the liquid-liabilities-to-GDP ratio (Beck, Demirgüç-Kunt, and Levine, 2000 and 2009); and $\varepsilon_{i,t}$ is a mean zero error term.

Figure 4.22. The Persistence of Net Private Capital Flows across Emerging Market Regions

(AR(1) regression coefficients of net private capital flows in percent of GDP)

The persistence of total net private capital flows does not vary substantially across emerging market regions. Net flows to emerging Asian economies appear to have been the most persistent historically, while net flows to other emerging market economies have been the least, but these differences are not statistically significant and have declined over time.



Sources: IMF, *Balance of Payments Statistics*; national sources; and IMF staff calculations.

Note: Using annual data, the persistence of any particular flow is its AR(1) regression coefficient computed over the prior 10-year window for each economy (for example, the 1990 value corresponds to the AR(1) coefficient during 1981–90). The median is plotted only if the AR(1) coefficient for the particular 10-year window and type of flow can be calculated for at least one-fifth of the economies in the group. The groups exclude offshore financial centers.

The additional effect of U.S. monetary policy changes on net capital flows to directly financially exposed economies is disentangled from the time fixed effect (capturing all global factors) by interacting the U.S. monetary policy measure with the exposure weight, as seen in the term $(\omega_i \times \Delta r_{us,t-s})$. Because the interaction varies across both economy and time, its effects (denoted by the set of β s) are separately identifiable from the economy- and time-fixed effects.

Following the recommendations of Stock and Watson (2008) for fixed-effect panels, the underlying standard errors are clustered at the economy level. This allows for heteroscedasticity across economies and arbitrary autocorrelation of the error term within each economy. Figure 4.16 shows both the uncumulated and cumulated difference in the effect of a U.S. monetary policy change on economies with average direct financial exposure to the United States compared with those with no such exposure. The latter, for a given horizon S , is calculated as $\sum_{s=0}^S \beta_s$, multiplied by the mean exposure for the relevant sample and then multiplied by the size of the impulse. Conceptually, it is akin to the additional effect on net capital flows of a permanent change in the U.S. monetary policy stance for an economy with mean exposure. See Table 4.3 for the results from the baseline model, with their associated standard errors. As detailed below, the broad conclusions are unchanged if an explicitly dynamic panel model is used.

Construction of U.S. Direct Financial Exposure Weights

The economy-specific weight applied to the U.S. monetary policy measure for economy i in the baseline specification is defined as

$$\omega_i = \left(\frac{\sum_{k=1}^K (A_{US,i}^k + L_{US,i}^k)}{A_i + L_i} \right), \quad (4.8)$$

where i refers to economy i ; k indexes instruments or capital types (securities, bank loans, and so on); $A_{US,i}^k$ denotes economy i 's U.S. asset holdings of type k ; $L_{US,i}^k$ denotes economy i 's liabilities of type k to the United States; A_i denotes economy i 's international external asset position; and L_i denotes economy i 's international external liability position.

As indicated in Appendix 4.1, the components of the weights draw from three sources: (1) the U.S. Treasury International Capital System (TICS) database on bilateral assets and liabilities of the United States vis-à-vis other countries; (2) the U.S. Bureau of Economic Analysis Foreign Direct Investment Statistics; and (3) the IMF's International Investment Position (IIP) Statistics. The time coverage of the complete U.S. TICS data is irregular, with consistent coverage occurring only within the past decade. Accordingly, the average of the numerator terms is taken over the years 1994 and 2003–07 for each economy.³⁵ This is then divided by the sum of economy i 's average IIP asset and liability position over the same years to derive the weight. See Table 4.4 for the calculated weights for the economies in the full regression sample.

Identification of U.S. Monetary Policy Changes

This section describes the steps used to estimate the unanticipated component of U.S. monetary policy changes. We follow a modified version of the approach in Kuttner (2001). He argues that this can be measured using changes in the price of federal funds rate futures (derivatives based on the market's expectations of U.S. monetary policy) that occur around the time of policy decisions by the Federal Reserve Open Market Committee (FOMC). The federal funds futures market was established in October 1988 by the Chicago Board of Trade, with the set of contracts written on a monthly basis. They are settled based on the history of the effective federal funds rate within the contract month. As of the inception of these funds, Kuttner (2001) uses the daily change in the market price of the current-month futures contract around Federal Reserve monetary policy interventions to infer the size of the surprise component of U.S. monetary policy changes. Because the settlement price is a function of the monthly average federal funds rate, the

³⁵1994 is the first year that comprehensive benchmarking of the U.S. external, bilateral asset, and liability positions was undertaken. There is then a gap of several years before a similar degree of coverage is achieved, leading to the set of years detailed here. An economy is dropped if more than 75 percent of the data that underlie the numerator average used in the weight calculation are missing.

Table 4.3. Baseline Results

Explanatory Variable	Full Sample		Emerging Market Economies		Advanced Economies	
	(1)	(2)	(3)	(4)	(5)	(6)
	Unanticipated	Realized	Unanticipated	Realized	Unanticipated	Realized
USMP Rate Change	-0.457*** [0.158]	-0.058 [0.052]	-0.449* [0.235]	-0.073 [0.078]	-0.404* [0.213]	-0.079* [0.040]
USMP Rate Change Lag 1	-0.121 [0.149]	-0.065* [0.038]	-0.311* [0.176]	-0.032 [0.048]	-0.116 [0.227]	-0.076 [0.046]
USMP Rate Change Lag 2	0.158 [0.153]	0.009 [0.031]	0.124 [0.254]	-0.020 [0.035]	0.041 [0.102]	0.007 [0.053]
USMP Rate Change Lag 3	-0.040 [0.107]	-0.011 [0.024]	-0.131 [0.181]	-0.013 [0.041]	-0.047 [0.153]	0.003 [0.027]
USMP Rate Change Lag 4	-0.173 [0.109]	-0.024 [0.035]	-0.147 [0.147]	-0.040 [0.061]	-0.161 [0.133]	-0.012 [0.027]
USMP Rate Change Lag 5	-0.164 [0.119]	-0.037 [0.035]	-0.363** [0.169]	-0.098* [0.055]	-0.072 [0.164]	-0.016 [0.034]
USMP Rate Change Lag 6	-0.066 [0.189]	-0.067 [0.042]	-0.020 [0.213]	-0.064 [0.069]	-0.186 [0.210]	-0.072 [0.058]
USMP Rate Change Lag 7	-0.239* [0.141]	-0.102** [0.047]	-0.435 [0.275]	-0.117* [0.069]	-0.198* [0.096]	-0.096* [0.053]
USMP Rate Change Lag 8	-0.092 [0.113]	-0.056* [0.033]	-0.245 [0.222]	-0.092* [0.052]	-0.101 [0.125]	-0.044 [0.033]
US Growth Innovation	-0.054 [0.057]	-0.049 [0.057]	-0.049 [0.081]	-0.038 [0.073]	-0.030 [0.059]	-0.019 [0.060]
US Growth Inn. Lag 1	0.086 [0.056]	0.074 [0.056]	0.012 [0.045]	-0.003 [0.058]	0.117 [0.095]	0.114 [0.085]
US Growth Inn. Lag 2	0.025 [0.039]	0.068 [0.044]	-0.058 [0.053]	-0.010 [0.054]	0.045 [0.031]	0.074* [0.038]
US Growth Inn. Lag 3	0.025 [0.043]	0.033 [0.047]	0.073 [0.058]	0.080 [0.070]	-0.041 [0.051]	-0.028 [0.055]
US Growth Inn. Lag 4	0.027 [0.046]	0.042 [0.043]	-0.108** [0.048]	-0.034 [0.056]	0.061 [0.046]	0.046 [0.031]
US Growth Inn. Lag 5	-0.017 [0.047]	-0.018 [0.041]	0.058 [0.042]	0.059 [0.053]	-0.038 [0.048]	-0.022 [0.039]
US Growth Inn. Lag 6	0.001 [0.045]	0.039 [0.051]	0.049 [0.079]	0.074 [0.067]	-0.011 [0.045]	0.010 [0.049]
US Growth Inn. Lag 7	0.026 [0.049]	0.084 [0.054]	-0.041 [0.067]	0.061 [0.078]	0.071 [0.065]	0.111 [0.077]
US Growth Inn. Lag 8	-0.056 [0.047]	-0.027 [0.048]	0.047 [0.085]	0.052 [0.071]	-0.043 [0.057]	0.008 [0.077]
Domestic Real GDP Growth Lag 1	0.382*** [0.112]	0.374*** [0.112]	0.318*** [0.074]	0.316*** [0.073]	0.525 [0.342]	0.506 [0.337]
Domestic Real Short Rate Lag 1	-0.098** [0.037]	-0.102*** [0.038]	-0.121*** [0.029]	-0.124*** [0.029]	0.117 [0.436]	0.124 [0.425]
Domestic Risk Index Lag 1	0.078 [0.077]	0.091 [0.078]	0.047 [0.089]	0.053 [0.092]	0.150 [0.301]	0.169 [0.296]
Domestic Log NGDP Lag 1	4.576** [1.858]	4.430** [1.821]	4.667** [1.790]	4.157** [1.806]	7.762 [5.570]	7.601 [5.475]
Domestic Fin. Depth Lag 4	4.010 [3.250]	3.876 [3.107]	1.315 [3.973]	0.829 [3.835]	6.843 [6.724]	6.772 [6.544]
Domestic FX Regime Lag 1	-0.461 [0.852]	-0.542 [0.854]	-0.027 [1.122]	0.156 [1.139]	-2.316 [2.115]	-2.704 [1.939]
Domestic KA Openness Lag 4	-0.469 [0.327]	-0.519 [0.315]	-0.551 [0.386]	-0.562 [0.382]	0.619 [1.207]	0.438 [1.155]
R ²	0.2295	0.2320	0.4007	0.4063	0.1851	0.1869
N	3,008	3,008	1,581	1,581	1,427	1,427
N Economies	50	50	30	30	20	20

Source: IMF staff calculations.

Note: The dependent variable is total net private capital flows in percent of GDP. Standard errors are in brackets underneath each estimate. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively. Offshore financial centers are excluded from the analysis. The estimates for the effects of U.S. monetary policy (USMP) and U.S. growth innovation are evaluated at the average values of U.S. direct financial exposure and U.S. bilateral trade weights for each sample. The monetary effects are also normalized to a 1 standard deviation unanticipated rate rise. The average financial exposures by sample are 0.159 for all economies, 0.173 for emerging market economies, and 0.138 for advanced economies. The bilateral trade weights by sample are 0.154 for all economies, 0.179 for emerging market economies, and 0.116 for advanced economies. NGDP = national gross domestic product. FX = foreign exchange. KA openness measures financial openness.

Table 4.4. U.S. Direct Financial Exposure Weight*(Proportion of total external assets and liabilities that are U.S. assets and/or liabilities)*

Economy and IFS Code	U.S. Direct Financial Exposure	Economy and IFS Code	U.S. Direct Financial Exposure
Canada (156)	0.470	Sweden (144)	0.138
Mexico (273)	0.451	Indonesia (536)	0.135
Uruguay (298)	0.328	Belgium (124)	0.133
China (924)	0.302	South Africa (199)	0.130
Korea (542)	0.289	Russia (922)	0.130
Israel (436)	0.289	Hungary (944)	0.127
Brazil (223)	0.276	Ireland (178)	0.126
Guatemala (258)	0.274	Poland (964)	0.108
Japan (158)	0.273	Finland (172)	0.104
Colombia (233)	0.246	Turkey (186)	0.102
Chile (228)	0.234	Germany (134)	0.100
United Kingdom (112)	0.234	France (132)	0.094
Australia (193)	0.233	Denmark (128)	0.085
Philippines (566)	0.218	Iceland (176)	0.076
El Salvador (253)	0.206	Czech Republic (935)	0.066
Peru (293)	0.182	Spain (184)	0.059
Thailand (578)	0.182	Italy (136)	0.051
Netherlands (138)	0.178	Austria (122)	0.043
India (534)	0.168	Romania (968)	0.041
Norway (142)	0.160	Jordan (439)	0.039
Egypt (469)	0.156	Ukraine (926)	0.038
Malaysia (548)	0.152	Greece (174)	0.036
Argentina (213)	0.141	Bulgaria (918)	0.028
Ecuador (248)	0.139	Morocco (686)	0.025
New Zealand (196)	0.139	Portugal (182)	0.023

Sources: U.S. Treasury International Capital System Database; U.S. Bureau of Economic Analysis Foreign Direct Investment Statistics; IMF International Investment Position Statistics; and IMF staff calculations.

Note: The economies listed here coincide with those included in the full regression sample. In a robustness check, we also include offshore financial centers for which data are available. They and their U.S. exposures are Costa Rica (238) at 0.241, Hong Kong SAR (532) at 0.082, Singapore (576) at 0.216, and Switzerland (146) at 0.224. The underlying data and construction of the weights are described in Appendix 4.4.

procedure requires scaling the day-to-day difference in closing prices for the current-month futures contract on the day of a Federal Reserve intervention. Specifically, the unanticipated (surprise) component is calculated as

$$u_{t,s} = -\left(\frac{D_s}{D_s - t + 1}\right)(f_{t,s} - f_{t-1,s}), \quad (4.9)$$

where the intervention occurs on day t in month/year s ; D_s is the number of days in month/year s ; $f_{t,s}$ is the closing price of the federal funds futures contract for month/year s ; and $u_{t,s}$ is the unanticipated component of the intervention.

Near the end of the month, the scaling factor grows extremely large, potentially magnifying the influence of any noise in price movements. Based on the findings of Hamilton (2008) regarding the influence of noise on federal funds futures prices, the chapter takes the unscaled change in the next-month contract price whenever the date of an intervention occurs during the last fifth of a month.³⁶

³⁶In the original 2001 article, Kuttner addresses this issue by using the unscaled change in the next month's federal funds futures contract whenever the date of an intervention occurs on the last three days of the month.

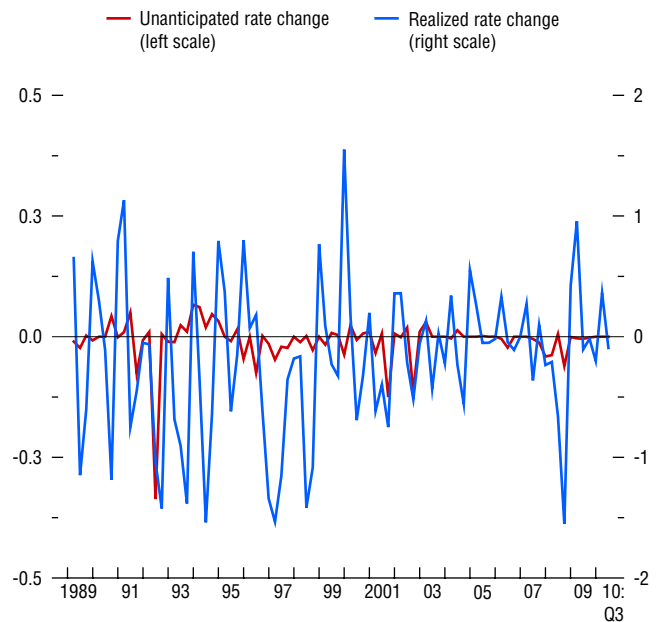
This analysis makes two modifications to Kuttner's approach. First, it considers only U.S. monetary policy actions (or inactions) that are associated with scheduled FOMC meetings. Second, the dates when monetary policy actions are revealed to the market are determined according to the method described in Bernanke and Kuttner (2005). Roughly speaking, during the period October 1988–January 1994, this means that the analysis uses the scaled difference between the closing price from the day after the concluding date of an FOMC meeting and the price from the FOMC meeting's concluding date. After February 1994, the analysis uses the scaled difference between the closing price from the day of the concluding date of an FOMC meeting and the price from the day before the FOMC meeting's concluding date.³⁷

Because the net capital flows data are quarterly, the unanticipated U.S. monetary policy change series at the FOMC meeting frequency (which is daily) must be mapped to a quarterly frequency. To ensure that the contemporaneous and lagged effects of such identified U.S. monetary policy changes are correctly estimated, the analysis follows a version of the aggregation method in Bluedorn and Bowdler (2011). For the contemporaneous effect, the analysis takes the sum of the daily weighted U.S. monetary policy changes within the quarter. In each case, the daily weight is the number of days remaining in the quarter at the time of a U.S. monetary policy change divided by the total number of days in the quarter. For the lagged effect, the unweighted sum of the policy changes within the quarter is used. The same aggregation method is also applied to calculate the quarterly realized rate change, using daily data on the effective federal funds rate. The realized nominal rate changes are transformed into real rate changes by subtracting the corresponding change in the Survey of Professional Forecasters one-quarter-ahead forecast of inflation.

Figure 4.23 compares the contemporaneous realized and unanticipated real rate change series over time. From the figure, it is clear that the realized rate change contains a host of components other than

Figure 4.23. Realized and Unanticipated Changes in U.S. Monetary Policy over Time
(Percentage points)

Realized changes in U.S. monetary policy rates contain a host of components other than the unanticipated component. The unanticipated component accounts for only a small part of the variation of realized rate changes.



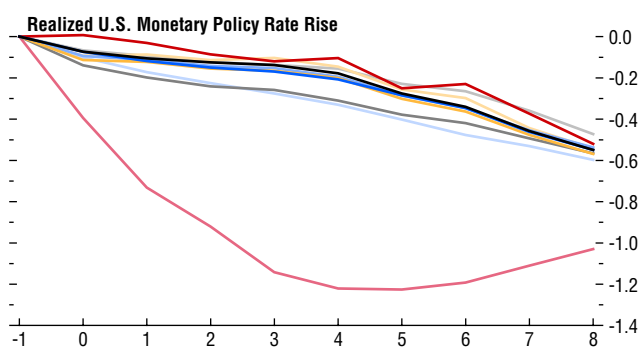
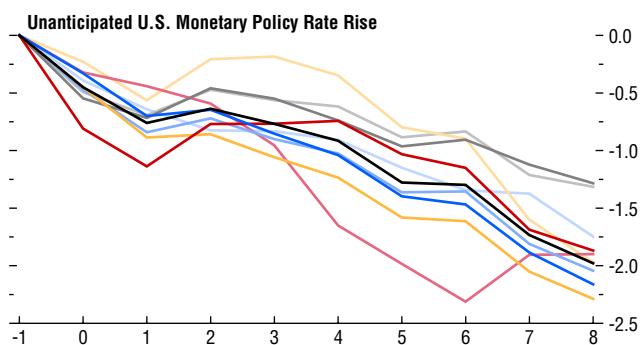
Sources: Datastream; Federal Reserve; and IMF staff calculations.
Note: The underlying data and construction of the realized and unanticipated, time-weighted changes in the U.S. policy rate are described in Appendix 4.4.

³⁷FOMC policy decisions at a meeting have been publicly announced since February 1994.

Figure 4.24. Robustness Checks for the Difference in Response of Net Private Capital Flows to Directly Financially Exposed Emerging Market Economies

(Percent of GDP)

The main result of a negative additional effect of U.S. monetary tightening on net flows to emerging market economies that are directly financially exposed to the United States (relative to those that are not) continues to hold under alternative robustness checks.



Source: IMF staff calculations.

Note: The dependent variable is total net private capital flows in percent of GDP. The x-axis shows the number of quarters after an impulse. The impulse at quarter zero is a permanent U.S. monetary policy rate rise, normalized to a 1 standard deviation unanticipated rate rise for the economy at the group's average financial exposure. Discussion of the various robustness checks is in Appendix 4.4.

the unanticipated rate change. Possible confounders include changes in inflation expectations unrelated to monetary policy, the endogenous response of real rates to a productivity boom, the endogenous response of real rates to a rise in aggregate demand, and so on.

Finally, as noted in the main text, the impulse responses are presented for a 1 standard deviation unanticipated rate rise (calculated during 1989:Q1–2010:Q3). In the case of the unanticipated rate change, this is approximately a 4.8 basis point impulse. For the realized U.S. rate change, the corresponding impulse is approximately 11.8 basis points, as revealed by a simple univariate regression of the realized rate change on the unanticipated rate change. Thus, a within-quarter realized rate change of 12 basis points corresponds to about a 5 basis point unanticipated rate change. The effect of unanticipated changes on realized changes is greater than one for one, which arises from the fact that each unanticipated rate change also changes the anticipated path of rates later in the quarter.

Robustness Checks

A variety of robustness checks were undertaken for the baseline results of the additional impact of U.S. monetary policy rate changes on net flows to directly financially exposed EMEs (Figure 4.24). These include:

- A dynamic fixed-effects (economy and time) panel model: A single one-quarter lag of the dependent variable was added to the baseline specification (standard autocorrelation tests indicated this lagged specification as sufficient). The impulse responses generated from this model then take into account the additional dynamics introduced by the lagged dependent variable.
- A broader set of global growth indicators: We augmented the baseline specification with European Economic and Monetary Union (post-1998) and German (pre-1999) growth innovations at a quarterly frequency (contemporaneous and eight lags). To disentangle the additional effect of direct trade exposure to Europe from the general global factor, we weighted the growth innovations with their

respective economy-specific bilateral trade shares (similar to the U.S. growth innovations). The EMU/German growth innovations are the one-year-ahead growth forecasts errors for each quarter. (One-quarter-ahead errors were not available.)

- A measure of global risk aversion: We augmented the baseline specification with the Chicago Board Options Exchange Volatility Index (VIX) changes at a quarterly frequency (contemporaneous and eight lags). Again, to disentangle its additional effect on internationally financially exposed economies from the global factor, we weighted the VIX changes with each economy's international financial exposure, as measured by the sum of an economy's external assets plus liabilities divided by domestic GDP.
- Euro area real interest rate: We augmented the baseline specification with the euro area real interest rate (constructed as described in the main text) changes at a quarterly frequency (contemporaneous and eight lags). Similar to the global risk-aversion measure robustness check, we weighted these real interest rate changes with each economy's international financial exposure, as measured by the sum of an economy's external assets plus liabilities divided by domestic GDP.
- Estimation using only pre-2008 observations, prior to the global financial crisis.
- Estimation using only observations from before 1998, prior to the Asian crisis.
- Estimation using only observations from 1998 onward, a period that witnessed major changes in global capital markets.
- Estimation including offshore financial centers (OFCs).³⁸
- Estimation using only the 10 largest emerging market economies in the baseline regression sample.³⁹

As shown in Figure 4.24, the overall qualitative pattern of the additional response of net flows for directly financially exposed economies to a 1 standard deviation unanticipated U.S. policy rate rise is roughly the same across the robustness checks. There

³⁸See Appendix 4.1 for a listing of the OFCs.

³⁹The 10 largest EMEs in the baseline regression sample are Argentina, Brazil, China, India, Indonesia, Korea, Mexico, Poland, Russia, and Turkey.

is typically a downward trend over time, starting from a negative additional impact effect. All responses are negative across the robustness checks at quarter 8, with a long-term effect lying between 1.25 and 2.5 percent of GDP. The additional response of net flows for directly financially exposed economies to a realized rate change of comparable size is similarly robust, exhibiting a downward trend toward a long-term effect of about 0.5 percent of GDP. The only marked outlier here is the response estimated only over the pre-1998 sample for EMEs. It shows a much stronger initial additional effect before settling on a long-term additional effect that is about 1 percent of GDP.

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