

# MANAGING SUDDEN STOPS

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Sudden stops are when capital inflows dry up abruptly. The banker’s aphorism—“It’s not speed that kills, but the sudden stop”—has been popularly invoked since at least the Mexican crisis in 1994. Awareness then rose with impetus from the Argentine crisis (1995), the Asian crisis (1997), the Russian crisis (1998), and the Brazilian crisis (1999). Google’s Ngram Viewer shows a sharp increase after 2000 in references to the phrase.<sup>1</sup>

The question is whether this increase reflects the growing incidence of the problem or simply the growing currency of the term. The gradual diffusion of scholarly terminology suggests that the observed trend may simply reflect the latter. At the same time, however, there is heightened awareness in the policy community of capital-flow volatility and reversals as reflected in the decision of the International Monetary Fund to adopt a new, more sympathetic view of capital controls and international capital market interventions generally (IMF 2012), indicative perhaps of a growing problem. Episodes like the “taper tantrum” in 2013, when talk that the Federal Reserve might taper its purchases of securities, leading emerging-market currencies to crash, and the “normalization” episode in 2015, when expectations that the Fed would soon start raising U.S. interest rates leading to an outflow of funds from emerging markets, suggest that sudden stops may in fact be growing more frequent or, perhaps, more disruptive.

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1. See [https://books.google.com/ngrams/graph?content=sudden+stop&year\\_start=1970&year\\_end=2008&corpus=15&smoothing=0&share=&direct\\_url=t1%3B%2Csudden%20stop%3B%2Cc0](https://books.google.com/ngrams/graph?content=sudden+stop&year_start=1970&year_end=2008&corpus=15&smoothing=0&share=&direct_url=t1%3B%2Csudden%20stop%3B%2Cc0).

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In this paper we extend previous analyses of sudden stops, contrasting their incidence and severity before and after 2002, the end of the period covered by most of the classic contributions to the literature.<sup>2</sup> Our central contributions are two. First, we update those earlier classic contributions, highlighting what if anything has changed in the decade or so since their initial publication. Second, we analyze the policy response, asking whether that response has evolved over time and, specifically, whether there is evidence of central banks and governments in emerging markets responding in ways that promise to better stabilize output, employment and, not least, domestic financial markets.

We show that the frequency and duration of sudden stops in emerging markets have remained largely unchanged since 2002. Casual impression gleaned from the tapering episode in 2013 might suggest otherwise. But excitable press coverage notwithstanding, we find that interruptions to capital flows during the Fed's discussion and implementation of its policy of "tapering" security purchases were milder than the sudden stops of prior years. These episodes were shorter, entailed smaller reversals, and had a milder impact on financial and real variables.<sup>3</sup> One might call them "sudden pauses" rather than "sudden stops".

At the same time, global factors appear to have become more important for the incidence of sudden stops. Similarly, when we consider a measure of contagion or concurrence such as the number of sudden stops occurring simultaneously in other countries, we find that it is sudden stops globally that matter after 2002, whereas in the preceding period it had been sudden stops in the same region. Again, we are inclined to interpret this in terms of the growing importance of global factors.

Sudden stops, as is well known, have both financial and real effects. We confirm that the financial effects materialize first: the exchange rate depreciates, reserves decline, and equity prices fall. GDP growth then decelerates, investment slows, and the current account strengthens. The growth of GDP falls by roughly 4 percent year on

2. The five most widely cited empirical papers on sudden stops, according to Google Scholar, are Calvo, Izquierdo, and Mejia (2004), Calvo, Izquierdo, and Talvi (2003), Cavallo and Frankel (2008), Edwards (2004a), and Edwards (2004b). None uses data for the period after 2002.

3. The picture may look different once we have enough data to analyze the 2015 normalization episode. But the partial data available at the time of writing suggest that for only a few countries did capital flow shifts in 2015 qualify as sudden stops.

year in the first four quarters of a sudden stop. The decline in GDP is somewhat larger in the second sub-period, reflecting a larger global shock (larger increase in the VIX, in particular), something whose effects were offset only partially by stronger macroeconomic positions.

Countries responded in the 1990s by stepping down the exchange rate, sometimes floating the currency, and then supporting that new exchange rate or float with a tighter monetary policy. In the worst-hit cases there was resort to an IMF program, extension of which was typically conditional on trade reforms, fiscal tightening, and privatization of public enterprises. In the second sub-period, there was less of a tendency to tighten both monetary and fiscal policies. Indeed some countries were able to reduce policy interest rates as a way of supporting economic activity and financial markets. Less monetary stringency and some currency depreciation were feasible because countries had reduced foreign currency mismatches in the interim, limiting balance-sheet damage from depreciation. Budgets already being closer to balance (fiscal positions being stronger), governments were able to respond with less fiscal consolidation. Recourse to IMF programs was less frequent in the 2000s, partly because countries had accumulated larger international reserves and moved to more flexible exchange rates in the interim.

This is progress, after a fashion. At the same time, it is clear that the recipe of stronger fiscal positions, more flexible exchange rates, deeper financial markets and less foreign currency mismatch has not insulated emerging markets from sudden stops; the frequency of the event has not declined. Any benefit from stronger country fundamentals has been offset by larger external shocks. Nor has progress on the policy front limited the negative output effects. As we show below, the drop in output in the first four quarters is no smaller in the second sub-period than the first; if anything it is slightly larger.<sup>4</sup> It would appear, with the continued growth of international financial markets and transactions, countries are now exposed to larger capital flow reversals, and those larger reversals have more disruptive output effects. It is troubling that neither national officials, with their increased policy space, nor the international financial institutions, with their proliferation of financing facilities, have succeeded in cushioning emerging markets from these effects.

4. Although the difference is not statistically significant at standard confidence levels.

## 1. BASICS

Our country sample is all emerging markets with their own currencies for which capital flow data are available for at least 24 consecutive quarters between 1991 and 2014. Our primary source of quarterly gross capital flow data is the International Monetary Fund's International Financial Statistics (accessed through Haver Analytics). We have data for 20 emerging markets in 1991, 28 in 1995, and 34 from 2000 onwards, resulting in an unbalanced panel. In robustness checks, we work with a smaller, balanced sample for which data are available for the entire period.<sup>5</sup>

Sudden stops are when inflows are a certain number of standard deviations below their average in a specified number of prior years. Most studies only classify episodes as such when they last more than one quarter. While some papers focus on net capital inflows by nonresidents, others add net capital outflows by residents.<sup>6</sup> Some papers use data for all capital flows, while others use data for only items other than FDI, on the grounds that FDI flows are relatively stable.<sup>7</sup>

We focus on portfolio flows and other flows (consisting in practice primarily of loans and trade credits) by nonresidents on the grounds

5. The full list of countries and the periods for which their data are available is in appendix A.

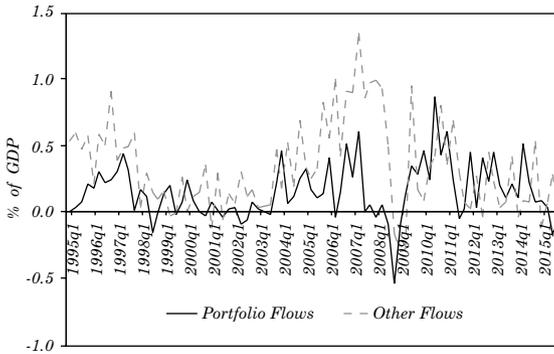
6. See for example Forbes and Warnock (2014). Cavallo and others (2013) show that the sudden stops in flows from nonresidents tend to be larger and have stronger impacts on economies than those which are driven by outflows by residents.

7. This, of course, is not the only country sample, periodicity and algorithm for identifying sudden stops. Calvo and others (2004), in an early influential study, use monthly data for 20 advanced and emerging markets over the period 1990-2001. Since capital flow data are unavailable monthly, they instead use the change in reserves and the trade balance. According to their definition, a sudden stop begins when capital flows so measured fall one standard deviation below the mean for the past 24 months; the episode continues until flows recover to above the earlier mean. In addition they require that in at least one month during the duration of the episode capital flows fall two standard deviations below their earlier mean. They also construct an alternative indicator that adds to the above an additional criterion of costly disruption to economic activity, defined as a fall in output of at least two standard deviations below the mean change in the log of output (more on this below). Forbes and Warnock (2012) define sudden stops similarly but use data on actual capital flows available at a quarterly frequency. A sudden stop is said to occur when the year-on-year change in capital flows over four quarters is at least one standard deviation below the average in the previous five years and when, in at least one quarter, flows are two standard deviations below that prior average. They discard episodes lasting only one quarter.

that these are the most volatile component (figure 1).<sup>8</sup> We classify an episode as a sudden stop when portfolio and other inflows by nonresidents decline below the average in the previous 20 quarters by at least one standard deviation, when the decline lasts for more than one quarter, and when flows are two standard deviations below their prior average in at least one quarter. Episodes end when capital flows recover to the prior mean minus one standard deviation. When two sudden stops occur in close proximity (which is the case in only a few instances), we treat them as a single episode.<sup>9</sup>

The resulting dates are listed in appendix A. We double-checked the list for consistency against country details provided in IMF Article IV reports.<sup>10</sup> Episodes identified by an alternative criterion where the sudden stop ends when capital flows recover to the average of the past 20 quarters are listed in appendix A as well.

**Figure 1. Portfolio and Other Capital Flows**  
(median flows for all emerging markets in percent of GDP)



8. One might cut the data other ways. For example, Forbes and Warnock (2014) suggest focusing on debt and other flows while excluding equity flows on the grounds that these are fundamentally different. Blanchard and Acalin (2016) suggest that it may be desirable to include also foreign direct investment on the grounds that this behaves in broadly similar fashion to portfolio capital flows. In what follows, we provide some limited comparisons with other categories of capital movements (FDI flows and portfolio flows by residents).

9. In some cases where the criterion of capital flows declining by two standard deviations below mean was missed by a whisker, we still identified that episode as a sudden stop. One could, of course, measure capital flows and their volatility in a number of different ways. In focusing on gross inflows by nonresidents, we follow Efremidze and others (2015), who show that sharp reductions in gross flows from abroad tend to be most strongly associated with sudden stops as defined here (and are more informative for understanding the latter than, *inter alia*, net flows).

10. In a very few cases where we noted discrepancies, we took the qualitative discussion in the Article IV reports as definitive.

As measures of the stance of monetary and fiscal policies, we consider changes in policy interest rates and announcements of tax increases and expenditure changes. Information on these monetary and fiscal policies, participation in IMF programs, and the implementation of structural reforms is gathered from a detailed reading of the relevant IMF Article IV reports, program reports and other documents, both from Haver Research and from other market-oriented websites. We rely on IMF's AREAER to code changes in exchange rate arrangements, changes in capital-account liberalization and restriction measures, and macroprudential policy measures.<sup>11</sup> We scan these documents for policy changes over the same window (the same quarters) for which we code a country as experiencing a sudden stop.

The sources of these data as their correlation matrix are in appendix B.

## **2. UPDATING THE STYLIZED FACTS**

We identify 46 sudden stops since 1991. These are listed in appendix A. These episodes last on average for four quarters. Capital outflows during sudden stops average about 1.5 percent of GDP per quarter (cumulatively 6 percent of GDP for the duration of the stop), as compared to inflows of about 1.7 percent of GDP a quarter over the preceding year. This implies a swing in capital flows of some 3 percent of GDP in a quarter—(a large amount).

The frequency of sudden stops in any one quarter is about 2 percent, or 8 percent in a year. The frequency and duration of these episodes and the magnitude of the associated capital outflows are all similar across sub-periods. While the duration of sudden stops is slightly less in the second sub-period, the difference is not statistically significant. In other words, none of the statistics in the first five rows of table 1 differs significantly across columns at standard confidence levels. The significant difference between the two sub-periods is the magnitude of the capital flow turnaround, defined as average capital flows during the sudden stop (either the first four quarters of the event or all quarters of the event) minus average capital flows in the four preceding quarters, all scaled by GDP. The turnaround is significantly larger in the second sub-period than in the first.

11. For macroprudential policy initiatives, we utilized AREAER information under Heading XII: Provisions Specific to the Financial Sector, supplemented with information from IMF Article IV reports.

**Table 1. Sudden Stops, 1991-2002 vs. 2003-2015**

|   | 1991-2002         | 2003-2015            |
|---|-------------------|----------------------|
| No. of sudden stops   | 16                | 30                   |
| As percent of available observations  | 1.8 %<br>(16/903) | 2.1%<br>(30/1446)    |
| No. of quarters for which the sudden stops last   | 4.5               | 3.6                  |
| Capital flows during sudden stops<br>(% of GDP), first quarter  | -1.61             | -1.25                |
| Capital flows during sudden stops (% of GDP),<br>average for first four quarters  | -1.79             | -1.36                |
| Capital flows in the four quarters preceding<br>sudden stops (% of GDP)   | 1.28              | 2.00 <sup>^</sup>    |
| Portfolio flows in the four quarters preceding<br>sudden stops (% of GDP)   | 0.68              | 0.42 <sup>*</sup>    |
| Other flows in the four quarters preceding sudden<br>stops (% of GDP)   | 0.60              | 1.57 <sup>^^</sup>   |
| Capital flow turnaround: Avg. capital flows during<br>four quarters of sudden stops- Avg. capital flows in<br>the four preceding quarters | -3.06             | -3.54 <sup>*</sup>   |
| Capital flow turnaround: Avg. capital flows during<br>all quarters of sudden stops- Avg. capital flows in<br>the four preceding quarters  | -2.28             | -3.16 <sup>***</sup> |

<sup>\*</sup>, <sup>\*\*</sup>, <sup>\*\*\*</sup> indicate that the value is significantly lower in the second column, compared to its value in the first column at 10, 5 or 1% level of significance (in a one tailed test). <sup>^</sup>, <sup>^^</sup>, <sup>^^^</sup> indicate that the value is significantly higher in the second column, compared to its value in the first column, at 10, 5 or 1% level of significance (in a one tailed test).

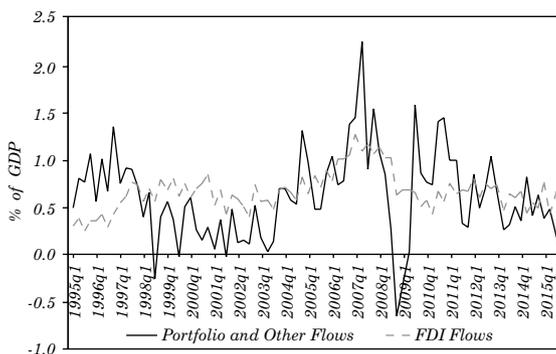
**Figure 2. Magnitude of FDI and Non-FDI Flows**  
(median flows for all emerging markets in percent of GDP)

Table 1 also shows that capital inflows in the four quarters preceding sudden stops were larger as a share of recipient-country GDP in the second period. (What is true of four quarters is similarly true of the preceding eight and 12 quarters, here and in the remainder of this paragraph.) That increase in the volume of inflows in the preceding period does not reflect an increase in portfolio capital (equity and bond-market related) flows. Rather, it is more than fully accounted for by an increase in other inflows (interbank borrowing, suppliers' credits, trade credit and other more difficult to classify items). Figure 1 confirms that these other flows have grown larger and more volatile. One suspects that as the authorities have tightened oversight and regulation of short-term portfolio debt and equity flows in response to earlier problems, other flows have become a more important conduit for short-term capital movements.<sup>12</sup> Figure 2 shows that it is still the case, as before 2003, that FDI flows are less volatile than portfolio and other flows.

As before, sudden stops continue to bunch in certain years. While in the 1990s they were concentrated around the Asian and Russian crises, in the last decade the most prominent cluster was in 2008-2009 at the time of the turmoil triggered by the collapse of the Lehman Brothers. This suggests that, in accounting for incidence, it will be important to consider global factors.

No sudden stops so defined occurred during the "taper tantrum" of mid-2013, when Federal Reserve officials mooted the possibility of curtailing the institution's security purchases, provoking volatility in emerging financial markets (see the first column of appendix A). A decline in capital inflows into emerging markets and, in some cases, capital-flow reversals occurred in this period, but these lasted only one quarter, as opposed to more than four quarters on average in our sudden stops cases. The decline, thus, was not of the duration required to qualify as a sudden stop according to our algorithm.

In addition, the magnitude of the capital flow reversal was not comparable. Capital inflows in the prior four quarters averaged less than one percent of GDP in the tapering episode, as opposed to more than 1.5 percent in sudden stops. The swing from inflow to outflow was one and a half percent of GDP a quarter as opposed to more than three

12. This pattern is especially striking in light of official efforts in the second half of the period, in Asia and elsewhere, to develop bond markets as a "spare tire" for intermediation. The data show that, such initiatives notwithstanding, it is bank lending and related flows that have grown most rapidly on average between the two sub-periods.

percent of GDP in our sudden stop episodes. Currency depreciation was more than three times as large in sudden stop episodes. The decline in equity prices was five times as large.<sup>13</sup> We do pick up two sudden stops in early 2014, in the Russian Federation and Ukraine, but these are plausibly attributable to factors other than the Fed's tapering talk, given the time lag and concurrent geopolitical developments.<sup>14</sup>

It is similarly interesting to observe that only two countries, Chile and South Korea, register on our criteria as experiencing sudden stops in 2015. The decline in net capital flows to emerging markets in 2015 has been much commented upon. But this decline was "an intensification of trends that have been underway since 2012, making the current episode feel more like a lengthening drought rather than a crisis event," according to the Institute of International Finance (quoted in Strohecker 2016). It can be argued that this is a different kind of episode: a gradual stop rather than a sudden stop, although as data for 2016 become available, more countries may still register as experiencing sudden stops starting in the final quarters of 2015.

In table 2 we regress different types of capital flows on a dummy variable for the first four quarters of a sudden stop.<sup>15</sup> The results indicate that while both portfolio and other inflows by nonresidents decline significantly during sudden stops, the shift is larger for other flows than for portfolio flows. Consistent with previous studies, we see that residents respond in stabilizing ways, reducing capital outflows during sudden stops (more so in the 2000s than previously), although the decline in outflows by residents is not sufficient to offset the impact of flight by nonresidents.<sup>16</sup>

13. It might be objected that our criteria for defining sudden stops include that the capital flow interruption lasts at least two quarters, whereas these tapering events typically lasted only one, meaning that we are comparing apples and oranges. If we relax the requirement that sudden stops last at least two quarters and include also one quarter interruptions, the reversal in capital flows is still 50 percent larger in this expanded sample of sudden stops. Depreciation of the exchange rate in the quarter in question is still more than twice as large. The decline in equity prices is still three times as large.

14. Specifically, there was a role for low oil prices, Russian intervention in Ukraine, and the threat of Western sanctions.

15. We drop subsequent quarters of sudden stop episodes, if any, from the regressions. Regressions are estimated using country fixed effects, with robust standard errors.

16. This contrast between outflows by nonresidents and inflows by residents during the same sudden stop episodes is consistent with the focus on gross as opposed to net capital inflows in recent analyses of capital-flow volatility (e.g. Forbes and Warnock, 2014).

**Table 2. FDI, Portfolio and other Capital Flows by Nonresidents and Residents during Sudden Stops**

| <i>Variable</i>                        | (1)<br><i>Portfolio flows<br/>(% of GDP)</i> | (2)<br><i>Other flows<br/>(% of GDP)</i> | (3)<br><i>Total flows<br/>(portfolio +<br/>other, % of<br/>GDP)</i> | (4)<br><i>Net capital<br/>flows by<br/>residents and<br/>nonresidents<br/>(% of GDP)</i> |
|--|--|--|---|--|
| Sudden stop                            | -0.587***<br>[3.40]                          | -1.823***<br>[4.18]                      | -2.410***<br>[6.73]   | -2.289***<br>[6.85]  |
| Dummy for<br>2003-2015                 | 0.118**<br>[2.24]                            | 0.095<br>[0.90]                          | 0.211*<br>[1.82]  | -0.082<br>[0.72]   |
| Sudden stop*<br>dummy for<br>2003-2015 | -0.376<br>[1.63]                             | 0.117<br>[0.28]                          | -0.243<br>[0.61]  | 0.338<br>[0.82]  |
| Constant                               | 0.273***<br>[8.51]                           | 0.533***<br>[8.19]                       | 0.798***<br>[11.81]   | 0.419***<br>[6.46]   |
| No. observations                       | 2,626  | 2,610                                    | 2,610   | 2,610  |
| R-squared                              | 0.052  | 0.079                                    | 0.130   | 0.085  |
| No. of countries                       | 34   | 34                                       | 34  | 34   |
| Adj. R-squared                         | 0.0513                                       | 0.0775                                   | 0.129   | 0.0835   |

Data are quarterly over the period 1991-2015. Dependent variable is portfolio, other flows, or their sum by nonresidents; or net flows by residents and nonresidents, in percent of GDP. Regressions include country fixed effects. First four quarters of the sudden stop are included in the regressions. Robust t statistics are in parentheses. \*, \*\*, or \*\*\* indicate the coefficients are significant at 10, 5 or 1% level of significance. Regressions with year fixed effects instead of a different intercept for post 2003 period yield similar coefficients.

Overall, then, the frequency and duration of sudden stops has remained largely unchanged since the period covered by earlier studies. Although the countries concerned have changed over time, the reversal in portfolio flows is larger, and “other flows” have become more important.

Turning to effects, tables 3 and 4 show that when a sudden stop occurs, the exchange rate depreciates and reserves decline (not unexpectedly). The fall in investment being proportionally larger than the fall in GDP and, by implication, than the fall in saving, the current account strengthens. While the impact on financial variables peaks in the first two quarters, the impact on real variables, like the current

account, GDP growth and investment, peaks later.<sup>17</sup> The fall in GDP growth is significant: growth is roughly 4 percentage points slower year over year in the first four quarters of the sudden stop.<sup>18</sup> There is no significant difference between the first and second sub-periods in magnitude of that growth slowdown—the drop in output is larger in the second sub-period, but the difference is not significant at conventional confidence levels. Interestingly, the one variable for which the impact is significantly greater in the second sub-period is equity prices, presumably reflecting the greater attention paid to emerging equity markets in the second period by international investors. Another variable for which the impact differs across sub-periods is the real effective exchange rate (and to a lesser extent the nominal effective exchange rate), which shows a smaller depreciation in the second sub-period, perhaps reflecting greater bunching of sudden stops in the second period.

We analyze the probability of a country experiencing a sudden stop by estimating:

$$\text{Prob}(SS_{it} = 1) = F(X_t^{\text{Global}} \alpha + Z_{i \text{ avg}(t-1, t-8)}^{\text{Domestic}} \gamma) \quad (1)$$

where  $SS_{it}$  is a dummy variable that takes the value of 1 if country  $i$  is experiencing an episode of sudden stop in quarter  $t$ .<sup>19</sup>

As global or external factors, we consider the log of the VIX as a proxy for global risk aversion; G4 money supplies (calculated as the percent change in the sum of M2 in the US, Eurozone, Japan, and UK, or in percent of their combined GDP) as a proxy for global liquidity; world GDP growth (to account for the strength of the global economy, perhaps another reflection of the investment appetite of the investors), and the Federal Reserve's policy interest rate (to account for the special role of the dollar as a source of liquidity to the global

17. In the spirit of Eichengreen, Rose and Wyplosz (1995), we also construct a composite index of the impact of sudden stops on the foreign exchange market, consisting of the rate of exchange rate depreciation and decline in reserves, as well as in some cases the decline in equity prices. We normalize the series by subtracting the average values of the respective variables in the previous 20 quarters and dividing by the standard deviation over that period. These indices, without and with equity prices, show similar patterns (results not reported for brevity).

18. Here it is important to note that our indicator of sudden stops is not based on the falls in output around the indicated dates, in contrast to the alternative measure in Calvo and others (2004) (see footnote 8 above).

19. We estimate the equation by a probit, as well as other limited dependent variable models such as logit and complementary logarithmic framework, cloglog (following Forbes and Warnock, 2012), since the distribution of  $F$  is likely to be asymmetric, owing to the fact that episodes occur irregularly).

financial system).<sup>20</sup> In addition, we count the number of sudden stops starting elsewhere in the region or world in the same quarter.

**Table 3. Comparing the Impact over Time**

|                                  | (1)                               | (2)                    | (3)                           | (4)                                     | (5)                               | (6)                                      | (7)                                  |
|----------------------------------|-----------------------------------|------------------------|-------------------------------|---|-----------------------------------|--|--------------------------------------|
| <i>Dependent variable</i>        | <i>Exchange rate depreciation</i> | <i>REER change (%)</i> | <i>Change in reserves (%)</i> | <i>Real change in equity prices (%)</i> | <i>GDP growth (quarterly yoy)</i> | <i>Investment growth (quarterly yoy)</i> | <i>Current account balance % GDP</i> |
| Sudden stop                      | 11.11**<br>[2.58]                 | 8.80***<br>[3.54]      | -12.51**<br>[2.70]            | -3.16<br>[0.95]                         | -3.74***<br>[3.35]                | -11.62***<br>[2.88]                      | 1.68<br>[1.55]                       |
| Dummy 2003-2015                  | -4.38***<br>[2.86]                | -0.15<br>[0.53]        | -1.05<br>[1.48]               | 2.63***<br>[4.10]                       | 0.68<br>[1.58]                    | 0.24<br>[0.14]                           | -0.10<br>[0.12]                      |
| Sudden stop* dummy for 2003-2015 | -3.37<br>[0.76]                   | -5.66**<br>[2.20]      | 5.43<br>[1.06]                | -7.30*<br>[1.88]                        | -1.17<br>[0.83]                   | 1.60<br>[0.26]                           | -0.78<br>[0.57]                      |
| Constant                         | 4.47***<br>[4.71]                 | -0.31<br>[1.54]        | 2.82***<br>[5.99]             | 0.89**<br>[2.05]                        | 3.76***<br>[12.56]                | 7.74***<br>[7.05]                        | -1.55***<br>[2.77]                   |
| No. observations                 | 2,616                             | 2,234                  | 2,669                         | 2,355                                   | 2,236                             | 2,031                                    | 2,076                                |
| R-squared                        | 0.053                             | 0.072                  | 0.007                         | 0.024                                   | 0.071                             | 0.029                                    | 0.004                                |
| No. of countries                 | 34                                | 28                     | 34                            | 31                                      | 33                                | 29                                       | 31                                   |
| Adj. R-squared                   | 0.0516                            | 0.0705                 | 0.00628                       | 0.0229                                  | 0.0700                            | 0.0275                                   | 0.00288                              |

Data are quarterly over the period 1991-2015. Dependent variables are as indicated in the first row. All variables are in percentage. GDP growth and investment growth are year-over-year. Regressions include country fixed effects. Robust t statistics are in parentheses. \*, \*\*, or \*\*\* indicate the coefficients are significant at 10, 5 or 1% level of significance. Regressions with year fixed effects instead of a different intercept for post 2003 period yield similar coefficients.

20. Variables within each category are correlated with one another; hence we include them parsimoniously in the regressions. When using quarterly data for World GDP, we aggregate data for the largest countries for which it is available. These account for approximately two-thirds of global GDP.

**Table 4. Impact on Economic and Financial Variables**

| <i>Dependent variable</i> | <i>Exchange rate depreciation</i> | <i>Change in reserves (%)</i> | <i>Real change in equity prices (%)</i> | <i>GDP growth (yoy)</i> | <i>Investment growth (yoy)</i> | <i>Current account balance / GDP</i> |
|---------------------------|-----------------------------------|-------------------------------|---|-------------------------|--------------------------------|--------------------------------------|
| Quarter 1                 | 10.126***<br>[4.37]               | -14.538***<br>[4.75]          | -15.826***<br>[5.45]                    | -2.270***<br>[3.09]     | -6.019**<br>[2.75]             | -0.662<br>[1.12]                     |
| Quarter 2                 | 12.853***<br>[3.40]               | -6.494***<br>[2.85]           | -10.442***<br>[3.20]                    | -5.521***<br>[4.97]     | -9.038**<br>[2.17]             | 1.045<br>[1.14]                      |
| Quarter 3                 | 3.514**<br>[2.39]                 | -7.844<br>[1.50]              | 2.883<br>[0.79]                         | -5.845***<br>[4.51]     | -16.643***<br>[3.83]           | 2.506**<br>[2.32]                    |
| Quarter 4                 | 5.621<br>[1.67]                   | -4.861<br>[0.64]              | -0.304<br>[0.07]                        | -5.193***<br>[2.95]     | -14.447**<br>[2.46]            | 3.272***<br>[2.84]                   |
| Constant                  | 1.823***<br>[17.68]               | 2.173***<br>[15.93]           | 2.549***<br>[22.86]                     | 4.204***<br>[70.94]     | 7.904***<br>[41.00]            | -1.622***<br>[38.16]                 |
| No. observations          | 2,658                             | 2,669                         | 2,355                                   | 2,236                   | 2,031                          | 2,076                                |
| R-squared                 | 0.029                             | 0.008                         | 0.032                                   | 0.074                   | 0.034                          | 0.010                                |
| No. of countries          | 34                                | 34                            | 31                                      | 33                      | 29                             | 31                                   |
| Adj. R-squared            | 0.027                             | 0.01                          | 0.03                                    | 0.07                    | 0.03                           | 0.01                                 |

Data are quarterly over the period 1991-2015. Dependent variables are as indicated in the first row. All variables are in percentage. GDP growth and investment growth are year-over-year. Regressions include country fixed effects. Robust t statistics are in parentheses. \*, \*\*, or \*\*\* indicate the coefficients are significant at 10, 5 or 1% level of significance. Regressions with year fixed effects instead of a different intercept for post 2003 period yield similar coefficients.

As country-specific factors, we consider GDP growth, public debt, the budget deficit, and the increase in capital flows in previous period (portfolio and other inflows by nonresidents in percent of GDP to account for the possibility that sudden stops are preceded by large capital inflows). We include variables intended to capture overheating and increased leverage during episodes of large capital inflows, such as the current account balance, bank credit, and real exchange rate appreciation. We also consider reserves (as percent of GDP) as a measure of the ability to withstand the impact of sudden stop and thus lowering the probability of sudden stop itself. To account for the possibility that more financially open economies are more susceptible to a sudden stop in response to external shocks or domestic vulnerabilities, we include the *de facto* financial openness

of the economy, calculated as the international investment position for portfolio and other flows in percent of GDP. For these domestic variables, endogeneity is a concern, so we enter their average over eight prior quarters.<sup>21</sup> Variables are normalized around a zero mean and standard deviation equal to one.

In table 5 we report marginal effects from probit regressions. The results indicate that an increase in the VIX significantly raises the probability of a sudden stop. The effect is not just statistically significant, but numerically large. A one standard deviation increase in the VIX raises the probability of a sudden stop in the same quarter by 1.2%. This is a 60 percent increase over the unconditional probability of two percent. In terms of magnitudes, the impact of the VIX dominates that of other variables, as is evident from the size of the marginal effects.

The significance and magnitude of the two “sudden stops in other countries” variables similarly point to the importance of the external environment and global factors.

Domestic factors associated with the increase in the probability of a sudden stop are capital flows in prior years and domestic credit as a share of GDP; both are positively associated with the probability of a country experiencing a sudden stop. International reserves and the real exchange rate do not show up as significant, perhaps because of their correlation with the capital-flow and credit variables.

The two sub-periods are compared in tables 6 and 7 and further in appendix C. There appears to have been some change in the relative importance of different external factors over time. U.S. monetary policy was evidently more important in the 1990s, while global risk aversion as captured by the VIX mattered more subsequently. This may seem surprising in light of the attention paid to Federal Reserve policy in the second sub-period, first when quantitative easing by the U.S. central bank propelled capital flows to emerging markets (the currency war problem), and then when its tapering talk precipitated a reversal, but the pattern in question comes through in the data.

21. This should also help to attenuate problems of noise in the quarterly data. Results do not change when we average the domestic variables over somewhat shorter or longer periods. In addition, we drop crisis observations after the first quarter. If capital flows reverse, the real exchange rate depreciates, or credit growth slows when the sudden stop hits an economy, including all subsequent quarters might lead one to erroneously conclude that lower capital flows real exchange rate depreciation, or slower credit growth increase the probability of a sudden stop (see e.g. Demirgüç-Kunt and Detragiache, 2000; Gourinchas and Obstfeld, 2012).

**Table 5. Correlates of Sudden Stops**  
(Probit model, marginal effects in percent, 1991-2014)

|   | (1)               | (2)               | (3)               | (4)               | (5)               | (6)               | (7)               | (8)               |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| VIX, log                                    | 1.00***<br>[7.02] | 1.21***<br>[6.92] | 1.20***<br>[6.66] | 1.20***<br>[6.87] | 1.21***<br>[6.90] | 0.69***<br>[3.62] | 0.94***<br>[4.36] | 0.66***<br>[3.28] |
| US policy rates (%)                         | 0.30*<br>[1.81]   | 0.30**<br>[2.04]  | 0.30*<br>[1.81]   | 0.34**<br>[2.34]  | 0.31**<br>[2.15]  | 0.42***<br>[2.61] | 0.42***<br>[2.75] | 0.45***<br>[2.77] |
| Capital flows/GDP                           | 0.50***<br>[4.03] | 0.52***<br>[3.62] | 0.50***<br>[3.50] | 0.50***<br>[3.65] | 0.51***<br>[3.60] | 0.40***<br>[2.58] | 0.43***<br>[2.59] | 0.38**<br>[2.32]  |
| Domestic credit/GDP                         |                   | 0.29**<br>[2.49]  | 0.33***<br>[2.96] | 0.22*<br>[1.71]   | 0.28**<br>[2.48]  | 0.28**<br>[2.48]  | 0.34***<br>[2.98] | 0.30***<br>[2.68] |
| RER (% change)                              |                   |                   | -0.13<br>[1.04]   |                   |                   |                   |                   |                   |
| Reserves/GDP                                |                   |                   |                   | 0.19<br>[1.21]    |                   |                   |                   |                   |
| External liabilities/GDP                    |                   |                   |                   |                   | 0.10<br>[0.35]    |                   |                   |                   |
| No. of sudden stops elsewhere in the world  |                   |                   |                   |                   |                   | 0.53***<br>[4.41] |                   | 0.45***<br>[2.86] |
| No. of sudden stops elsewhere in the Region |                   |                   |                   |                   |                   |                   | 0.36***<br>[3.16] | 0.14<br>[1.01]    |
| No. observations                            | 2,208             | 2,178             | 2,150             | 2,178             | 2,177             | 2,178             | 2,178             | 2,178             |
| Pseudo R-squared                            | 0.180             | 0.185             | 0.185             | 0.188             | 0.186             | 0.229             | 0.213             | 0.232             |

Dependent variable is a binary variable which is equal to 1 if a sudden stop occurs and 0 otherwise. The first quarter of sudden stop is included in the regressions, and all subsequent quarters dropped. Domestic variables are averages of previous eight quarters. All variables have been standardized around zero mean and standard deviation equal to 1. Capital flows, domestic credit and reserves, and international investment are in percent of GDP. Real exchange rate is in percent change; an increase denotes a depreciation. VIX is in log; sudden stop episodes elsewhere in the world or region are the number of sudden stops elsewhere in the same quarter. Regressions are estimated with robust standard errors, and observations clustered by countries. Z statistics reported in parentheses. \*\*\*, \*\* and \* indicate significance at 1, 5, and 10% levels, respectively.

**Table 6. Correlates of Sudden Stops**  
(Probit model, marginal effects in percent, 1991-2002)

|   | (1)               | (2)               | (3)               | (4)               | (5)               | (6)               | (7)               | (8)               |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| VIX, log                                    | 0.91*<br>[1.93]   | 0.86*<br>[1.92]   | 0.79*<br>[1.92]   | 0.87**<br>[2.18]  | 0.83**<br>[2.10]  | 0.79*<br>[1.65]   | 0.67<br>[1.61]    | 0.74<br>[1.61]    |
| US policy rates (%)                         | 1.00***<br>[4.27] | 0.97***<br>[4.79] | 0.92***<br>[4.32] | 0.83***<br>[4.25] | 0.84***<br>[4.15] | 0.92***<br>[3.46] | 0.85***<br>[4.22] | 0.90***<br>[3.61] |
| Capital flows/GDP                           | 1.00***<br>[6.46] | 1.28***<br>[6.02] | 1.17***<br>[6.09] | 1.30***<br>[6.27] | 1.39***<br>[5.12] | 1.28***<br>[5.99] | 1.21***<br>[6.13] | 1.21***<br>[6.17] |
| Domestic credit/GDP                         |                   | -0.23<br>[1.07]   | -0.12<br>[0.72]   | -0.12<br>[0.48]   | -0.21<br>[1.08]   | -0.22<br>[1.05]   | -0.17<br>[0.76]   | -0.17<br>[0.80]   |
| RER change (%)                              |                   |                   | -0.45*<br>[1.93]  |                   |                   |                   |                   |                   |
| Reserves/GDP                                |                   |                   |                   | -0.68*<br>[1.93]  |                   |                   |                   |                   |
| External liabilities/GDP                    |                   |                   |                   |                   | -0.44*<br>[1.70]  |                   |                   |                   |
| No. of sudden stops elsewhere in the world  |                   |                   |                   |                   |                   | 0.21<br>[0.47]    |                   | -0.32<br>[0.50]   |
| No. of sudden stops elsewhere in the region |                   |                   |                   |                   |                   |                   | 0.65*<br>[1.96]   | 0.79*<br>[1.66]   |
| No. observations                            | 882               | 862               | 840               | 862               | 861               | 862               | 862               | 862               |
| Pseudo R-squared                            | 0.120             | 0.121             | 0.130             | 0.137             | 0.129             | 0.122             | 0.135             | 0.137             |

Dependent variable is a binary variable which is equal to 1 if a sudden stop occurs and 0 otherwise. The first quarter of sudden stops are included in the regressions, all subsequent quarters dropped. Domestic variables are averages of previous eight quarters. All variables have been standardized around zero mean and standard deviation equal to 1. Capital flows, domestic credit and reserves, and international investment are in percent of GDP. Real exchange rate is in percent change; an increase denotes a depreciation. VIX is in log; sudden stop episodes elsewhere in the world or region are the number of sudden stops elsewhere in the same quarter. Regressions are estimated with robust standard errors, and observations clustered by countries. Z statistics reported in parentheses. \*\*\*, \*\* and \* indicate significance at 1, 5, and 10% levels, respectively.

**Table 7. Correlates of Sudden Stops**  
(Probit model, marginal effects in percent, 2003-2014)

|   | (1)              | (2)               | (3)               | (4)               | (5)               | (6)               | (7)               | (8)               |
|---|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| VIX, log                                    | 1.0***<br>[6.63] | 1.14***<br>[6.56] | 1.14***<br>[6.74] | 1.06***<br>[6.29] | 1.13***<br>[6.42] | 0.64**<br>[2.25]  | 0.99***<br>[3.75] | 0.62**<br>[2.04]  |
| US policy rates (%)                         | 0.51<br>[1.60]   | 0.51*<br>[1.76]   | 0.54*<br>[1.88]   | 0.48*<br>[1.75]   | 0.53*<br>[1.79]   | 0.35<br>[1.05]    | 0.57*<br>[1.87]   | 0.39<br>[1.21]    |
| Capital flows/GDP                           | 0.14*<br>[1.72]  | 0.14<br>[1.22]    | 0.17<br>[1.58]    | 0.13<br>[1.17]    | 0.09<br>[0.75]    | 0.11<br>[0.80]    | 0.05<br>[0.37]    | 0.07<br>[0.52]    |
| Domestic credit/GDP                         |                  | 0.34***<br>[3.06] | 0.32***<br>[2.91] | 0.17<br>[1.43]    | 0.30***<br>[2.95] | 0.36***<br>[2.92] | 0.40***<br>[3.36] | 0.37***<br>[3.05] |
| RER change (%)                              |                  |                   | 0.20*<br>[1.76]   |                   |                   |                   |                   |                   |
| Reserves/GDP                                |                  |                   |                   | 0.31**<br>[2.42]  |                   |                   |                   |                   |
| External liabilities/GDP                    |                  |                   |                   |                   | 0.12<br>[1.13]    |                   |                   |                   |
| No. of sudden stops elsewhere in the world  |                  |                   |                   |                   |                   | 0.41***<br>[3.06] |                   | 0.37**<br>[2.39]  |
| No. of sudden stops elsewhere in the region |                  |                   |                   |                   |                   |                   | 0.24**<br>[2.22]  | 0.09<br>[0.80]    |
| No. observations                            | 1,326            | 1,316             | 1,310             | 1,316             | 1,316             | 1,316             | 1,316             | 1,316             |
| Pseudo R-squared                            | 0.263            | 0.278             | 0.281             | 0.291             | 0.281             | 0.327             | 0.305             | 0.330             |

Dependent variable is a binary variable which is equal to 1 if a sudden stop occurs and 0 otherwise. The first quarter of sudden stops are included in the regressions, all subsequent quarters dropped. Domestic variables are averages of previous eight quarters. All variables have been standardized around zero mean and standard deviation equal to 1. Capital flows, domestic credit and reserves, and international investment are in percent of GDP. Real exchange rate is in percent change; an increase denotes a depreciation. VIX is in log; sudden stop episodes elsewhere in the world or region are the number of sudden stops elsewhere in the same quarter. Regressions are estimated with robust standard errors, and observations clustered by countries. Z statistics reported in parentheses. \*\*\*, \*\* and \* indicate significance at 1, 5, and 10% levels, respectively.

The level of the VIX, the percentage change in the VIX, the standard deviation of the VIX and the coefficient of variation of the VIX, all in the quarter of sudden stops, are significantly larger in the second sub-period than the first; this is not true, in contrast of the change in the U.S. policy rate. The influence of country characteristics like the reserve-to-GDP ratio, real exchange rate appreciation, and a negative international investment position (as defined and calculated by Lane and Milesi-Feretti, 2007) seem to matter less consistently in the more recent period. This suggests that global (push) factors have been playing a larger role in sudden stops in the more recent decade. The changing nature of contagion effects (regional in the 1990s, global in the 2000s) similarly points to the growing influence of global factors.<sup>22</sup>

Finally, we can return to the determinants of the output drop following the sudden stop and ask how this is shaped by the magnitude and composition of the capital inflow in the immediately preceding period. Table 8 is consistent with the idea that the decline in GDP in the first four quarters of the sudden-stop episode is an increasing function of the total capital inflow (portfolio plus other, as a share of GDP) in the preceding eight quarters (the coefficient on capital flows in the preceding period is significant at the 5 percent confidence level). Subsequent columns show that the explanatory power in this relationship is concentrated in the second sub-period. There is no evidence that the breakdown of those prior inflows into portfolio and other (bank-related) flows makes a difference for the magnitude of the output drop.

22. A battery of sensitivity tests supports the robustness of these results. We used the alternative sudden stop dates presented in the last column in appendix A. We eliminated outliers by winsorizing observations at 1 percent on each end. We worked with a balanced panel. We re-estimated eq. (1) using fixed-effects probit to control for time invariant characteristics of countries. We re-estimated eq. (1) using logit. We added back in the fifth and subsequent quarters of sudden stops, where the baseline regressions included only the first four quarters. We shifted the partition between periods two years in each direction. We included additional measures of external conditions (G4 money supply growth, global economic growth) and country characteristics (presence of capital controls, per capita income, political stability, the exchange rate regime, trade openness, and incidence of sudden stops elsewhere in the preceding as opposed to the current quarter). Results are available on request.

**Table 8. Average (Year on Year) GDP Growth in the First Four Quarters of Sudden Stops**

|   | (1)                | (2)               | (3)                |
|---|--------------------|-------------------|--------------------|
| Capital flows (% of GDP, average of past 8 quarters)                  | -1.800**<br>[2.14] | 1.080<br>[0.68]   | 1.727<br>[1.11]    |
| Capital flows (% of GDP, average of past 8 quarters)* dummy 2003-2014 |                    | -3.305*<br>[1.80] | -3.861**<br>[2.12] |
| Other flows/Total flows   | -0.677<br>[1.09]   |                   | -3.819<br>[1.40]   |
| (Other flows/Total flows)* dummy 2003-2014                            |                    |                   | 3.235<br>[1.16]    |
| Dummy for 2003-2014   |                    | 5.145*<br>[1.99]  | 4.790*<br>[1.85]   |
| Constant  | 2.018*<br>[1.71]   | -2.494<br>[1.12]  | -2.045<br>[0.92]   |
| No. observations  | 41                 | 41                | 41                 |
| R-squared   | 0.241              | 0.281             | 0.309              |
| Adj. R-squared  | 0.201              | 0.223             | 0.211              |

Robust t statistics in parentheses. \*\*, \*\* and \* indicate significance at 1, 5, and 10% levels, respectively.

### 3. THE POLICY RESPONSE

We next consider how countries adjust policy in response to sudden stops. If there is a conventional wisdom, it is that they tighten monetary and fiscal policies to counter the drop in the exchange rate and in an effort to restore confidence. In extreme cases, they tighten controls on capital outflows and appeal to the International Monetary Fund for emergency assistance.

In fact, this conventional response is evident in only a minority of cases. In only eight of the 43 cases considered here did countries in fact tighten both monetary and fiscal policies in response to sudden stops. Over the entire period, monetary policy was eased in response to sudden stops more often than it was tightened. Instead (or in addition), governments respond to sudden stops with a variety of other measures targeted at buttressing the stability of their domestic financial system and signaling to investors their commitment to sound and stable policies.

Moreover, there are differences in the nature of the typical response between the first and second sub-periods. There was less of a tendency to tighten both monetary and fiscal policies in the second sub-period. In both sub-periods countries experiencing sudden stops moved in the direction of a more flexible exchange rate, but that tendency was more pronounced in the first sub-period than the second. And, there is more recourse to the IMF and program finance in the first sub-period.

As noted in section 2, we rely on a detailed reading of IMF reports and relevant market commentary to code changes in monetary and fiscal policies, as well as participation in IMF programs and implementation of structural reforms. In relying on reports of fiscal initiatives for coding the timing and direction of fiscal policy changes, we are following the narrative approach—see e.g. Romer and Romer (1989) and Alesina and others (2016)—which attempts to pinpoint exogenous changes in policy, rather than relying on heavily changes in fiscal and financial accounts.

A first pattern in table 9 is that a majority of countries experiencing sudden stops between 1991 and 2014 in fact eased monetary policy in response, whereas a majority tightened fiscal policy. Countries experiencing sudden stops need to simultaneously do something to reduce the level of spending relative to income when foreign finance becomes more difficult to tap, while at the same time taking other steps to support economic activity and aid the financial system.<sup>23</sup> Fiscal tightening evidently is the preferred policy for pursuing the former, while monetary easing is the preferred instrument for achieving the latter. Governments could conceivably adopt the opposite policy mix, but in only 1 of 44 episodes do we observe this response. Budget deficits become more difficult to finance in the wake of sudden stops, especially if monetary policy is tightened, making some degree of fiscal consolidation inevitable for countries with preexisting fiscal deficits. Monetary tightening could reinforce the expenditure-reducing effects of fiscal consolidation, but monetary easing has the advantage of potentially relieving the strain on commercial-bank balance sheets.

23. One is reminded, for example, of Brazil's response to its sudden stop in 2015, which entailed fiscal consolidation and a reluctance to tighten monetary policy (keeping central bank interest rates on hold in a period when inflation was rising).

**Table 9. Policies during Sudden Stops 1991-2014**

|                                     | 1991-2014          |                          |
|-------------------------------------|--------------------|--------------------------|
|                                     | Number<br>of cases | Fraction of cases<br>(%) |
| <i>Monetary policy</i>              |                    |                          |
| Eased                               | 27                 | 63                       |
| Tightened                           | 9                  | 21                       |
| No change, or no clear stance       | 7                  | 16                       |
| <i>Fiscal policy</i>                |                    |                          |
| Eased                               | 14                 | 33                       |
| Tightened                           | 23                 | 53                       |
| No change, or no clear stance       | 6                  | 14                       |
| <i>Capital account transactions</i> |                    |                          |
| Eased                               | 9                  | 23                       |
| Tightened                           | 7                  | 17                       |
| No change, or no clear stance       | 24                 | 60                       |
| <i>Macroprudential measures</i>     |                    |                          |
| Strengthened                        | 13                 | 33                       |
| Eased                               | 4                  | 10                       |
| No change, or no clear stance       | 22                 | 56                       |
| <i>Exchange rate regime</i>         |                    |                          |
| Changed                             | 14                 | 33                       |
| No change                           | 29                 | 67                       |
| <i>IMF program</i>                  |                    |                          |
| New or ongoing                      | 22                 | 49                       |
| No program                          | 21                 | 51                       |
| New program                         | 12                 | 29                       |
| No new program                      | 29                 | 71                       |

Table 10 shows that this tendency to ease monetary policy in response to sudden stops was more prevalent in the second sub-period. The constraint on easing monetary policy and allowing the currency to depreciate is the existence of currency mismatches on the national balance sheet, insofar as depreciation raises the burden of foreign-currency-denominated liabilities. A number of emerging markets took steps to limit such mismatches following the Asian financial crisis and more generally; this may help to account for their greater willingness to ease monetary policy in the second sub-period. We provide more evidence of this in table 12 below.

**Table 10. Policies during Sudden Stops – Sub-periods**

|                                     | <i>1991-2002</i>       |                          | <i>2003-2014</i>       |                              |
|-------------------------------------|------------------------|--------------------------|------------------------|------------------------------|
|                                     | <i>Number of cases</i> | <i>Fraction of cases</i> | <i>Number of cases</i> | <i>Fraction of cases (%)</i> |
| <i>Monetary policy</i>              |                        |                          |                        |                              |
| Eased                               | 7                      | 44                       | 20                     | 74                           |
| Tightened                           | 6                      | 38                       | 3                      | 11                           |
| No change, or no clear stance       | 3                      | 19                       | 4                      | 15                           |
| <i>Fiscal policy</i>                |                        |                          |                        |                              |
| Eased                               | 1                      | 6                        | 13                     | 48                           |
| Tightened                           | 13                     | 81                       | 10                     | 37                           |
| No change, or no clear stance       | 2                      | 13                       | 4                      | 15                           |
| <i>Capital account transactions</i> |                        |                          |                        |                              |
| Eased                               | 5                      | 39                       | 4                      | 15                           |
| Tightened                           | 3                      | 23                       | 4                      | 15                           |
| No change, or no clear stance       | 5                      | 39                       | 19                     | 70                           |
| <i>Macroprudential measures</i>     |                        |                          |                        |                              |
| Strengthened                        | 3                      | 25                       | 10                     | 37                           |
| Eased                               | 0                      |                          | 4                      | 15                           |
| No change, or no clear stance       | 9                      | 75                       | 13                     | 48                           |
| <i>Exchange rate regime</i>         |                        |                          |                        |                              |
| Changed                             | 10                     | 63                       | 4                      | 15                           |
| No change                           | 6                      | 37                       | 23                     | 85                           |
| <i>IMF program</i>                  |                        |                          |                        |                              |
| New or ongoing                      | 15                     | 94                       | 7                      | 26                           |
| No program                          | 1                      | 6                        | 20                     | 74                           |
| New program                         | 7                      | 50                       | 5                      | 19                           |
| No new program                      | 7                      | 50                       | 22                     | 81                           |
| <i>Structural reforms</i>           |                        |                          |                        |                              |
| Reforms                             | 14                     | 7                        | 14                     | 52                           |
| No reforms                          | 1                      | 93                       | 13                     | 48                           |

The tendency to tighten fiscal policy is similarly more evident in the first sub-period. On average, budget deficits as a share of GDP in the years preceding sudden stops were larger in the first sub-period. This plausibly explains why fiscal tightening was more widely resorted to in the first sub-period, reflecting both the greater difficulty of financing those deficits following sudden stops and the importance of fiscal consolidation in sending a confidence-enhancing signal to financial markets.<sup>24</sup>

In terms of financial policies, only a small handful of countries altered capital controls in response to sudden stops. Strikingly, that minority of cases was divided roughly equally between instances where controls were tightened (to limit capital outflows) and eased (presumably to enhance confidence in the effort to attract inflows). It is fair to say that there is no consensus on or general answer to the question of how capital-control measures are best utilized in the event of a sudden stop.

Macroprudential policies were strengthened in roughly a third of cases. Almost all of these were concentrated in the second sub-period, when greater attention was paid to macroprudential regulation. We also observe a few cases where macroprudential policies were loosened for reasons of forbearance, not unlike how capital controls were loosened in a minority of cases. But these are exceptions to the rule. The exchange rate regime was changed in almost half of all cases in the 1991-2002 decade, uniformly in the direction of greater flexibility. In contrast, it was rarely changed in the second sub-period, a larger number of countries already having moved to more flexible rates.

We see more recourse to IMF support in the first sub-period than in the second. Implementation or at least mention of structural reforms goes along with IMF programs, as shown in table 11. Nearly three-fourths of structural reforms were implemented in conjunction with IMF programs, while almost all IMF programs entailed structural reforms. Mention of structural reforms is much more common in the first sub-period than in the second. In the second sub-period, in almost half of all instances where countries experiencing sudden stops responded with self-advertised structural reform measures, they did so without resorting to an IMF program. There is also a greater tendency for countries in IMF programs to tighten monetary policy and loosen

24. Vegh and Vuletin (2014) note that the response of fiscal and monetary policies to growth crises has, on average, become more countercyclical in Latin American countries since 1998.

the exchange rate regime. Whether this difference is a function of IMF conditionality or of the fact that most program cases are in the first sub-period when the monetary and fiscal condition of the countries considered was weaker on average is difficult to say; the observed effect most likely reflects both influences.

**Table 11. IMF Programs and Structural Reform**

*Full period, 1991-2014*

| <i>Structural reform</i> | <i>IMF program</i> ▶ | <i>No</i> | <i>Yes</i> | <i>Total</i> |
|--------------------------|----------------------|-----------|------------|--------------|
| ▼<br>No                  |                      | 13        | 8          | 21           |
| Yes                      |                      | 1         | 20         | 21           |
| Total                    |                      | 14        | 28         | 42           |

*First Sub-period, 1991-2002*

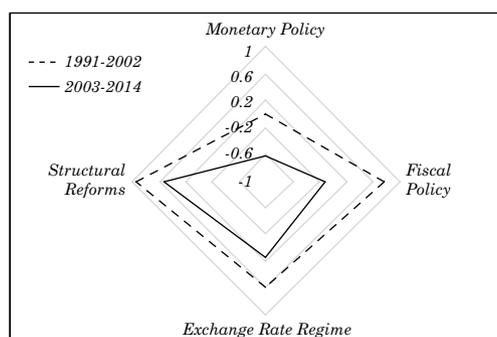
| <i>Structural reform</i> | <i>IMF program</i> ▶ | <i>No</i> | <i>Yes</i> | <i>Total</i> |
|--------------------------|----------------------|-----------|------------|--------------|
| ▼<br>No                  |                      | 1         | 0          | 1            |
| Yes                      |                      | 0         | 14         | 14           |
| Total                    |                      | 1         | 14         | 15           |

*Second Sub-period, 2003-2014*

| <i>Structural reform</i> | <i>IMF program</i> ▶ | <i>No</i> | <i>Yes</i> | <i>Total</i> |
|--------------------------|----------------------|-----------|------------|--------------|
| ▼<br>No                  |                      | 12        | 8          | 20           |
| Yes                      |                      | 1         | 6          | 7            |
| Total                    |                      | 13        | 14         | 27           |

Source: See text.

**Figure 3. Policy Tradeoffs in Sudden Stop Episodes**



We assign either a zero, one, or negative one to a country in each episode, with a one when a country tightened monetary policy, tightened fiscal policy, made its exchange rate regime more flexible, or committed to structural reforms common followed by low case "z". Zero when there is no change, and minus one when a country eased monetary policy or fiscal policy. Countries with all minus one are at the center of the figure, whereas countries with all ones are at the four vertices (they trace out the diamond).

Figure 3 summarizes the pattern of responses in the two sub-periods. We assign either a zero, one, or negative one to a country in each episode: a one when a country tightened monetary policy, tightened fiscal policy, made its exchange rate regime more flexible, or committed to structural reforms; a zero when there is no change; and minus one when a country eased monetary policy or fiscal policy, or reversed the structural reforms, or made its exchange rate regime less flexible. Countries with all minus one are at the center of the figure, whereas countries with all ones are at the four vertexes (they trace out the diamond). We see a less sharp response along all four dimensions in the second sub-period, most noticeably in the cases of fiscal and monetary policies.

These choices seem consistent with the changing nature of the sudden stops and of the position of countries experiencing them. Table 12 shows the average values of a variety of policy variables in the eight quarters prior to sudden stops, again distinguishing the two sub-periods. In the 1990s, sudden stops were heavily associated with weak macroeconomic fundamentals, whereas episodes in the subsequent decade were associated more with external factors and occurred despite stronger domestic economic and financial fundamentals.

**Table 12. Macroeconomic Frameworks and Structural Factors in the Eight Quarters Before Sudden Stops**

|                           | (1)                        | (2)                     | (3)                | (4)                         | (5)                  | (6)                              | (7)                     | (8)                        | (9)                    |
|---------------------------|----------------------------|-------------------------|--------------------|-----------------------------|----------------------|----------------------------------|-------------------------|----------------------------|------------------------|
| <i>Dependent Variable</i> | <i>Fiscal balance/ GDP</i> | <i>Public debt/ GDP</i> | <i>Inflation</i>   | <i>Exchange rate regime</i> | <i>Reserves/ GDP</i> | <i>Foreign currency position</i> | <i>Capital controls</i> | <i>Inflation targeting</i> | <i>Domestic credit</i> |
| Dummy for 2003-2014       | 1.4*<br>[1.14]             | -11.03*<br>[1.09]       | -3.27**<br>[1.31]  | 0.44**<br>[1.70]            | 11.39***<br>[4.01]   | 0.32***<br>[5.25]                | -0.14*<br>[0.97]        | 0.46***<br>[3.34]          | 14.78**<br>[1.34]      |
| Constant                  | -2.45**<br>[2.31]          | 51.20***<br>[6.33]      | 10.69***<br>[5.19] | 1.75***<br>[8.61]           | 8.95***<br>[3.98]    | -0.31***<br>[6.52]               | 0.55***<br>[4.55]       | 0.06<br>[0.58]             | 43.33***<br>[4.95]     |
| No. Observations          | 36                         | 42                      | 38                 | 43                          | 43                   | 32                               | 30                      | 43                         | 43                     |
| R-squared                 | 0.037                      | 0.029                   | 0.046              | 0.066                       | 0.282                | 0.479                            | 0.033                   | 0.214                      | 0.042                  |

For inflation, we dropped two episodes where inflation was more than 40%. Exchange rate regime is an index; a higher value implies a more flexible exchange rate regime. Foreign currency position is an index; a higher value means a less negative foreign currency position. For capital controls, a higher value means more controls. Inflation targeting is a dummy for inflation targeting countries. Domestic credit is the ratio of private sector bank credit to GDP. Results are for linear regressions of dependent variables in first row. Coefficients indicate averages for the sudden stops across two sub-periods. \*, \*\*, \*\*\* indicate if the coefficients across sub-periods are significant at 20, 10 or 1% level of significance in a one-tailed test. Data are from the sources noted in appendix A, and from the IMF reports.

In the first sub-period, sudden stops required countries with large budget deficits and rapid inflation to tighten monetary and fiscal policies and request IMF assistance, both in order to adjust to tighter financing conditions and to send the necessary signal to the markets. In the second sub-period, compared to the first, countries experiencing sudden stops had smaller budget deficits and public debts (as shares of GDP) and significantly lower rates of inflation. Their international reserves as a share of GDP were more than twice as high as in the first sub-period. These stronger fundamentals made IMF support less imperative and gave them some additional leeway to adjust in ways that provided more support to domestic economic activity and the financial system, in some cases loosening monetary policy and limiting the extent of fiscal consolidation.

In the more recent decade, countries experiencing sudden stops were significantly more likely to have flexible exchange rates; they were more likely to be operating inflation targeting regimes. They had significantly deeper financial sectors (as measured by bank credit to the private sector as a share of GDP). They had significantly smaller foreign currency mismatches, as measured by net foreign currency position, enabling them to rely more on exchange rate changes to facilitate adjustment.

All this points to the possibility that countries have more leeway to apply policies designed to buffer the real economic impact of sudden stops. It is worth emphasizing, therefore, that the year-on-year drop in growth rates in the first four quarters of sudden stops is no different in the second period than in the first. The drop in the second period is actually larger, as noted above, although the difference is not statistically significant. This suggests that something else was also changing in a direction with less favorable consequences, where that something else could be the magnitude of capital inflows and the size of the capital-flow reversal, which were larger in the second sub-period.<sup>25</sup>

25. Some readers will wonder how our results relate to those of Rey (2013), who concludes that exchange rate flexibility is largely ineffective in insulating economies from capital flow volatility. Technically, we are not able to distinguish between the views that (a) exchange rate flexibility is ineffective, and (b) that exchange rate flexibility is partially effective in offsetting the impact of international financial shocks, but only partially, while those shocks have grown larger the second period.

#### **4. CONCLUSION**

We have updated earlier analyses of sudden stops in order to shed light on what is known, what is not known, and what is changing. We compare the 1991-2002 period that was the focus of early analyses and on whose basis generalizations and conclusions were drawn with the subsequent period 2003-2015.

We confirm, perhaps obviously, that sudden stops remain a problem. We count more of them in the second sub-period, but there are also more emerging economies actively involved in global financial markets. On balance, the frequency, duration, and severity of sudden stops remains roughly unchanged across sub-periods. However, the associated decline in GDP is larger in the second sub-period, plausibly reflecting larger capital inflows in the preceding quarters and a larger turnaround in capital flows.

In addition, there are indications of changes over time in the relative importance of global economic conditions versus country characteristics and policies in the incidence of sudden stops. We present some evidence that global factors, though always important, have grown more important recently. Our evidence suggests also that the global factors that matter most have been changing. Increases in U.S. policy interest rates, which matter for the supply of global liquidity, were relatively important in the 1990s. In contrast, the VIX, which contains information about global risk aversion and the demand for liquidity, was more important in the subsequent decade. In a number of respects, the policies of countries experiencing sudden stops were stronger in the second sub-period, but this was still no guarantee of insulation from sudden stops.

What stronger policies did permit, however, was a different response at the national level. In the first sub-period, countries with large budget deficits and high inflation had no choice but to tighten monetary and fiscal policies. In the second sub-period, the deficits and inflation rates of the affected countries were lower. Sudden stops still made financing deficits more difficult and required policy makers to take painful steps in order to send reassuring signals to financial markets. But, in a number of cases, they were able to do so by tightening fiscal policy, while at the same time loosening monetary policy so as to support domestic economic activity and the financial system. That foreign currency mismatches were less and a significant number of central banks had installed inflation targeting permitted them to adopt a more permissive attitude toward currency depreciation

than in the first sub-period. Larger foreign reserves similarly provided reassurance that the authorities had the wherewithal to intervene were those currency movements to get out of hand.

That governments seemingly have more leeway in the more recent second sub-period for using monetary, fiscal and exchange rate policies in response to sudden stops would suggest that the negative output effects should have been less. Paradoxically, the year-on-year output drop is at least as large in the second sub-period. This suggests that something else is also changing to magnify the output effects, where that something else could be the volume and make-up of international capital flows and/or the prevalence and impact of external shocks.

That stronger fiscal positions, more flexible exchange rates, deeper financial markets, and less foreign currency mismatch have not better insulated emerging markets from sudden stops and their output effects is troubling. Evidently, neither national officials, with their increased policy space, nor the international financial institutions, with their proliferation of new financing facilities, have succeeded in cushioning emerging markets from these effects. It would appear that any benefit from stronger country fundamentals has been offset by larger external shocks.

The question is what to do. One option would be to limit exposure to capital flows and external shocks at the border through the application of capital inflow taxes and regulations, reducing the volume and volatility of capital movements; doing so would be consistent with the IMF's so-called "new institutional view" of capital flow regulation.

A second option would be to invest further in reforms designed to enhance the flexibility of the policy response to capital flow surges and stops (strengthen fiscal positions still further, make exchange rates still more flexible, deepen financial markets further, reduce foreign currency mismatches even more from current levels), on the grounds that existing policy reforms, while an appropriate response to the circumstances of the earlier period, are no longer sufficient in a world of larger and more volatile capital flows.

A third option would be to arrange financial insurance against sudden stops: credit lines with the IMF, with regional arrangements like the Chiang Mai Initiative Multilateralization, and with individual national partners. This will require additional reforms to make the terms and conditions of these facilities more attractive, so that countries experiencing sudden stops are actually willing to take recourse to them. There is reason to think that these options are complements, not incompatible alternatives.

## APPENDIX A

### A1. Countries, Data Availability, and Sudden Stops

| <i>Country</i> | <i>Data from</i> | <i>SS1 start date, duration in quarters</i> |   | <i>SS 2 start date, duration in quarters</i> |    | <i>SS1 modified start date, duration in quarters</i> |    | <i>SS2 modified start date, duration in quarters</i> |    |
|----------------|------------------|---|---|--|----|--|----|--|----|
| Argentina      | 1985             |   |   |  |    | 1998Q4   | 3  | 1998Q4   | 4  |
| Armenia        | 1996             | No SS                                       |   |  |    |  |    |  |    |
| Belarus        | 1996             |   |   |  |    | 2012Q1   | 3  | 2012Q1   | 5  |
| Brazil         | 1984             | 1998Q3                                      | 3 | 1998Q3                                       | 9  | 1998Q3   | 3  | 1998Q3   | 9  |
|                |                  |   |   |  |    | 2008Q4   | 2  | 2008Q4   | 2  |
| Bulgaria       | 1996             |   |   |  |    |  |    |  |    |
| Chile          | 1991             | 2015 Q1                                     | 3 | 2015Q1                                       | 3  | 2008Q4   | 3  | 2008Q4   | 3  |
|                |                  |   |   |  |    | 2015 Q1  | 3  | 2015 Q1  | 3  |
| Colombia       | 1996             | No SS                                       |   |  |    |  |    |  |    |
| Croatia        | 1996             | 2011Q3                                      | 2 | 2011Q3                                       | 7  | 2011Q3   | 2  | 2011Q3   | 7  |
| Czech Republic | 1994             | 2008Q4                                      | 2 | 2008Q4                                       | 2  | 2008Q4   | 2  | 2008Q4   | 2  |
| Guatemala      | 1995             | 2008Q4                                      | 2 | 2008Q4                                       | 4  | 2008Q4   | 4  | 2008Q4   | 4  |
| Hungary        | 1993             | 1996Q1                                      | 2 | 1996Q1                                       | 3  | 1996Q1   | 2  | 1996Q1   | 3  |
|                |                  |   |   |  |    | 2011Q4   | 5  | 2011Q4   | 5  |
| India          | 1992             | 2008Q3                                      | 4 | 2008Q3                                       | 4  | 2008Q3   | 4  | 2008Q3   | 4  |
| Indonesia      | 1993             | 1997Q4                                      | 2 | 1997Q4                                       | 9  | 1997Q4   | 2  | 1997Q4   | 9  |
| Israel         | 1994             | 2011Q3                                      | 4 | 2011Q3                                       | 5  | 2011Q3   | 4  | 2011Q3   | 5  |
| Jordan         | 1985             | 2003Q1                                      | 2 | 2003Q1                                       | 6  | 1993Q1   | 5  | 1993Q1   | 5  |
|                |                  | 2003Q4                                      | 2 |  |    | 2003Q1   | 5  | 2003Q1   | 5  |
|                |                  |   |   |  |    | 2007Q3   | 3  | 2007Q3   | 3  |
| Kazakhstan     | 1995             |   |   |  |    | 2007Q3   | 13 | 2007Q3   | 13 |
| Korea, South   | 1990             | 1997Q4                                      | 2 | 1997Q4                                       | 9  | 1997Q4   | 5  | 1997Q4   | 5  |
|                |                  | 2008Q3                                      | 2 | 2008Q3                                       | 3  | 2008Q3   | 2  | 2008Q3   | 2  |
|                |                  | 2015 Q3                                     | 2 | 2015 Q3                                      | 2  | 2015 Q3  | 2  | 2015 Q3  | 2  |
| Latvia         | 2001             | 2008Q4                                      | 3 | 2008Q4                                       | 3  | 2008Q4   | 3  | 2008Q4   | 3  |
| Lithuania      | 1995             |   |   |  |    | 2008Q4   | 2  | 2008Q4   | 2  |
| Malaysia       | 2000-2009        | 2008Q3                                      | 2 | 2008Q3                                       | 4  | 2008Q3   | 3  | 2008Q3   | 4  |
| Mexico         | 1985             | 1994Q4                                      | 3 | 1994Q4                                       | 4  | 1994Q2   | 5  | 1994Q2   | 6  |
| Pakistan       | 1995             | 1998Q1                                      | 4 | 1998Q1                                       | 13 | 1998Q1   | 9  | 1998Q1   | 13 |
|                |                  | 1999Q2                                      | 5 |  |    |  |    |  |    |
| Peru           | 1991             | 1998Q4                                      | 4 | 1998Q4                                       | 10 | 1998Q4   | 4  | 1998Q4   | 4  |
|                |                  |   |   |  |    | 2008Q3   | 4  | 2008Q3   | 4  |

## A1. (continued)

| <i>Country</i>    | <i>Data from</i> | <i>SS1 start date, duration in quarters</i> | <i>SS 2 start date, duration in quarters</i> | <i>SS1 modified start date, duration in quarters</i> | <i>SS2 modified start date, duration in quarters</i> |
|-------------------|------------------|---|--|--|--|
| Philippines       | 1990             | 1997Q3 3                                    | 1997Q3 6                                     | 1997Q3 3<br>2008Q1 4                                 | 2008Q1 6<br>2008Q1 6                                 |
| Poland            | 2000             | 2008Q4 2                                    | 2008Q4 2                                     | 2008Q3 3   | 2008Q3 3   |
| Romania           | 1991             | 2008Q4 3                                    | 2008Q4 3                                     | 2008Q4 3   | 2008Q4 3   |
| Russia Federation | 1994             |   |  | 1998Q4 8   | 1998Q4 8   |
|                   |                  | 2008Q4 2                                    | 2008Q4 10                                    | 2008Q4 2   | 2008Q4 2   |
|                   |                  | 2014Q1 5                                    | 2014Q1 5                                     | 2014Q1 5   | 2014Q1 5   |
| South Africa      | 1985             | 2000Q4 3                                    | 2000Q4 10                                    | 2000Q4 3   | 2000Q4 10  |
|                   |                  | 2008Q3 2                                    | 2008Q3 4                                     | 2008Q3 2   | 2008Q3 4   |
| Sri Lanka         | 1985             |   |  | 2001Q1 7   | 2001Q1 7   |
| Thailand          | 1985             | 1997Q2 6                                    | 1997Q2 15                                    | 1997Q2 6   | 1997Q2 15  |
|                   |                  | 2008Q3 3                                    | 2008Q3 4                                     | 2008Q3 3   | 2008Q3 4   |
| Turkey            | 1985             | 1994Q1 3                                    | 1994Q1 5                                     | 1994Q1 3   | 1994Q1 5   |
|                   |                  | 2000Q4 3                                    | 2000Q4 8                                     | 2000Q4 3   | 2000Q4 8   |
|                   |                  | 2008Q4 3                                    | 2008Q4 6                                     | 2008Q4 3   | 2008Q4 6   |
| Ukraine           | 1994             |   |  | 2008Q4 5   | 2008Q4 5   |
|                   |                  | 2014Q1 4                                    | 2014Q1 4                                     | 2014Q1 4   | 2014Q1 4   |
| Venezuela, RB     | 1994             | 2006Q1 2                                    | 2006Q1 3                                     | 2006Q1 2   | 2006Q1 3   |
| Vietnam           | 2005             |   |  |  |  |

SS1 denote sudden stop dates identified using the filters laid out in the text: a sudden stop episode starts when portfolio and other flows by nonresidents decline below the average of the previous 20 quarters by more than one standard deviation, and for more than one quarter; and in at least in one quarter of this period, flows are two standard deviations or more below the average. Sudden stops end when capital flows recover to a level above mean minus one standard. In SS2 a sudden stop ends when the flows have recovered to the average of the past 20 quarters. In SS1 modified and SS2 modified we make some judgment calls by looking at the trends in the data and include sudden stops even if the respective criteria are missed by a whisker. By design SS2 lasts longer than SS1.

## APPENDIX B

**B1. Correlations between Domestic Variables**

In the main body of the text we include only subsets of our country characteristics and policy variables in the regressions on the grounds that a number of these variables are highly correlated with one another. It is also interesting that some of these correlations seem to have changed significantly over time. In the first half of the period correlation is stronger between capital flows and current account deficit and weaker between capital flows and reserves—suggestive of that the capital flows were instrumental in financing current account deficit than in the accumulation of reserves. The domestic banking sector seems to have played a less prominent role in mediating the capital flows in the first half of the period. In comparison, in the last decade capital flows correlate more strongly with reserves than in the past; and larger capital inflows go hand in hand with larger banking sector and rapid credit growth. These patterns suggest that the concerns related to financial sector stability matter more in recent sudden stops.

**Table B1. Correlation Coefficients between Selective Domestic factors, 1991-2002**

|                                  | <i>Capital flows/ GDP</i> | <i>Current account deficit/ GDP</i> | <i>Reserves/ GDP</i> | <i>Credit/ GDP</i> | <i>Credit growth</i> | <i>Change in real exchange rate (%)</i> |
|----------------------------------|---------------------------|-------------------------------------|----------------------|--------------------|----------------------|---|
| Capital flows/ GDP               | 1                         |                                     |                      |                    |                      |   |
| Current account deficit/GDP      | 0.62<br>(0.0)             | 1                                   |                      |                    |                      |   |
| Reserves/GDP                     | 0.017<br>(0.62)           | -0.05<br>(0.26)                     | 1                    |                    |                      |   |
| Credit/GDP                       | 0.066<br>(0.05)           | -0.12<br>(0.01)                     | 0.36<br>(0.0)        | 1                  |                      |   |
| Credit growth                    | 0.28<br>(0.0)             | 0.25<br>(0.0)                       | 0.004<br>(0.92)      | -0.03<br>(0.50)    | 1                    |   |
| Change in real exchange rate (%) | -0.19<br>(0.0)            | 0.003<br>(0.95)                     | -0.03<br>(0.32)      | 0.009<br>(0.79)    | -0.071<br>(0.08)     | 1                                       |

**Table B1. (continued)**  
Domestic factors, 2003-2015

|                                  | <i>Capital flows/<br/>GDP</i> | <i>Current account deficit/<br/>GDP</i> | <i>Reserves/<br/>GDP</i> | <i>Credit/<br/>GDP</i> | <i>Credit Growth</i> | <i>Change in real exchange rate (%)</i> |
|----------------------------------|-------------------------------|---|--------------------------|------------------------|----------------------|---|
| Capital flows/<br>GDP            | 1                             |   |                          |                        |                      |   |
| Current account deficit/GDP      | 0.56<br>(0.0)                 | 1                                       |                          |                        |                      |   |
| Reserves/GDP                     | 0.08<br>(0.00)                | -0.15<br>(0.00)                         | 1                        |                        |                      |   |
| Credit/GDP                       | 0.13<br>(0.05)                | -0.10<br>(0.00)                         | 0.51<br>(0.00)           | 1                      |                      |   |
| Credit growth                    | 0.54<br>(0.0)                 | 0.27<br>(0.00)                          | -0.12<br>(0.00)          | -0.22<br>(0.00)        | 1                    |   |
| Change in real exchange rate (%) | -0.29<br>(0.0)                | -0.06<br>(0.04)                         | -0.03<br>(0.24)          | 0.04<br>(0.16)         | -0.35<br>(0.00)      | 1                                       |

In parentheses are the *p* values to accept the null hypothesis that the correlation coefficients are equal to zero.

**Table B2. Variables and Sources of Data**

| <i>Variable</i>                   | <i>Definition</i>   | <i>Sources</i>  |
|-----------------------------------|---|---|
| Portfolio liabilities             | Transactions with nonresidents in financial securities (such as corporate securities, bonds, notes, and money market instruments)   | IFS (line 78bgd)  |
| Other liabilities                 | Other transactions with nonresidents, major categories are: transactions in currency and deposit loans and trade credits  | IFS (line 78bid)  |
| Direct foreign liabilities        | Equity capital, reinvested earnings   | IFS (line 78bgd)  |
| Capital flows                     | Sum of portfolio and other liabilities  | IFS   |
| Public debt                       | Gross general government debt (in some cases central government debt), % of GDP   | IFS/National sources  |
| Fiscal balance                    | Revenue (including grants) minus expense, net acquisition of nonfinancial assets. % of GDP.   | WEO   |
| Capital controls                  | Overall restrictions index of all asset categories  | Klein and others, (2015)  |
| Fed funds rate                    | Fed fund rate (%) (US policy rate)  | IFS   |
| World GDP                         | World GDP (% per annum)   | WDI, World Bank   |
| VIX                               | CBOE Volatility Index   | Bloomberg   |
| Net foreign currency position     | An index which takes values between (-1; 1); value of -1 corresponds to zero foreign-currency foreign assets and only foreign-currency liabilities, +1 corresponds to only foreign-currency foreign assets and no domestic-currency foreign liabilities | Lane and Shambaugh (2014), updated version of Lane and Milesi-Ferretti (2007) dataset |
| Political risk                    | Risk ratings range from a high of 100 (least risk) to a low of 0 (highest risk)   | Political risk services (PRS)   |
| Exchange regime                   | de facto exchange rate regime classification  | Ilzetzki, Reinhart, and Rogoff (2008)   |
| Investment growth                 | Quarterly investment growth   | IFS   |
| Nominal GDP                       | Quarterly Nominal GDP   | GEM, World Bank   |
| Real GDP                          | Quarterly Real GDP  | IFS   |
| Foreign reserves                  | Foreign Exchange Reserves in Million USD (End of period data)   | IFS   |
| Exchange rate                     | Official exchange rate local currency per USD (Monthly average)   | IFS   |
| Stock price index                 | National Stock Price Indices, monthly average in current prices   | IFS and Haver   |
| Current account balance           | Sum of net exports of goods and services, net primary income, and net secondary income, % of GDP  | National sources  |
| Domestic credit to private sector | Financial resources provided to the private sector by financial corporations  | WDI   |
| Real effective exchange rate      | Nominal effective exchange rate index adjusted for relative movements in national price or cost indicators of the home country, selected countries, and the Eurozone  | JPMorgan Real Broad Effective Exchange Rate Index                                     |
| Nominal effective exchange rate   | Ratio (base 2010 = 100) of an index of a currency's period-average exchange rate to a weighted geometric average of exchange rates for currencies of selected countries and the Eurozone.   | JPMorgan Nominal Broad Effective Exchange Rate Index                                  |
| Real exchange rate                | Computed as nominal exchange rate*US consumer price index/ consumer price index   | Exchange rate from IFS; CPI from WDI  |
| Inflation                         | CPI inflation calculated as % change over previous year. (% yoy)  | IFS   |
| Inflation targeting               | dummy variable takes a value of 1 after a country moves to an inflation targeting regime and 0 before that  |   |
| External liabilities              | External liabilities include portfolio equity, FDI and debt liabilities.  | Lane and Milesi-Ferretti (2007)   |
| G4-money supply                   | Sum of US, UK, Japan and Eurozone money supply (M2)   | Haver   |

## APPENDIX C

**C1. Sensitivity Analysis**

We can further compare the impact of global and domestic variables during the sudden stops and tranquil periods in the two halves of the sample period as per the equation below.

External or Domestic Factor  $k_{it} = \alpha_i + \beta_k \text{Sudden Stop}_{it} + \gamma_k \text{Dummy for 2003-2014} + \tau \text{Sudden Stop}_{it} * \text{Dummy for 2003-2014} + \varepsilon_{it}$ .

Regressions are estimated with country fixed effects and robust standard errors. The average value of each variable in non-crisis years prior to 2003 are given in row (i); variable averages during sudden stops until 2002 is given by (i) + (ii). Average value in tranquil years post 2002 is given by (i) +(iii). Variable averages during sudden stop after 2003 is given by (i) +(ii)+(iii) +(iv). A significant coefficient in (iv) indicates that the (Average value of variable in SS-lagged value in tranquil years)<sub>2003-2014</sub> - (Average value of variable in SS-lagged value in nonstop years)<sub>1991-2002</sub> is significant] This is the difference in difference estimate of the change in variables across sudden stops in two sub-periods compared to their relative tranquil averages.

Differences are evident across sub-periods. A high U.S. fed funds rate is more strongly associated with sudden stops in the first sub-period than the second. The disproportionate importance of U.S. interest rates in triggering sudden stops—given the importance of dollar funding in global financial markets—is well known. Less obvious, especially given all the talk surrounding “tapering,” is that this role appears to have diminished in the 2000s. The VIX is significantly higher during sudden stop episodes only in the second sub-period, pointing to the growing importance of global as opposed to U.S. and financial as opposed to monetary factors. Whereas the external factors associated with the likelihood of sudden stops have changed over time, there is less evidence of such changes in the associated domestic factors. Two exceptions are the ratio of reserves to GDP (which was lower prior to sudden stop episodes in the 1990s compared to tranquil periods, but not in the 2000s) and foreign currency positions (which similarly were lower in sudden stop episodes in the 1990s but not subsequently).

**Table C1. External and (lagged) Domestic Variables in Sudden Stop and Normal Years**

|                               | (1)                      | (2)                | (3)                        | (4)                                     | (5)                          | (6)                   | (7)                              |
|-------------------------------|--------------------------|--------------------|----------------------------|---|------------------------------|-----------------------|----------------------------------|
| <i>Dependent variables</i>    | <i>Fed fund rate (%)</i> | <i>VIX, Log</i>    | <i>Capital flows / GDP</i> | <i>Change in real exchange rate (%)</i> | <i>Domestic credit / GDP</i> | <i>Reserves / GDP</i> | <i>Foreign currency position</i> |
| Sudden stop (ii)              | 0.63***<br>[3.32]        | 0.12<br>[1.56]     | 0.86***<br>[3.62]          | -0.41<br>[1.53]                         | 2.64<br>[0.91]               | -1.19<br>[1.29]       | -0.04*<br>[1.75]                 |
| Sudden stop in 2003-2014 (iv) | -1.25***<br>[3.03]       | 0.51***<br>[4.50]  | -0.23<br>[0.71]            | 0.071<br>[0.21]                         | 0.34<br>[0.10]               | 2.62*<br>[1.99]       | 0.057***<br>[2.83]               |
| Dummy 2003 (iii)              | -2.63***<br>[35.43]      | -0.16***<br>[6.00] | 0.13<br>[1.00]             | -1.23***<br>[5.92]                      | 11.8***<br>[3.34]            | 6.36***<br>[6.18]     | 0.19***<br>[5.80]                |
| Constant (i)                  | 4.38***<br>[100.55]      | 3.01***<br>[186.3] | 0.73***<br>[9.63]          | 0.39***<br>[3.10]                       | 37.94***<br>[17.63]          | 10.15***<br>[16.42]   | -0.22***<br>[11.02]              |
| No. observations              | 2,257                    | 2,257              | 2,209                      | 2,229                                   | 2,194                        | 2,224                 | 1,539                            |
| R-squared                     | 0.336                    | 0.098              | 0.015                      | 0.084                                   | 0.14                         | 0.323                 | 0.419                            |
| No. of countries              | 34                       | 34                 | 34                         | 34                                      | 34                           | 34                    | 27                               |

Dependent variables are averages of eight previous quarters, except VIX and federal fund rate which are current quarter values. Capital flows are portfolio and other flows by nonresidents as percent of GDP; real exchange rate is in percent change; an increase denotes a depreciation. Robust t-statistics in parentheses. \*\*\*, \*\* and \* indicate significance at 1, 5, and 10% levels.

**Table C2. Probability of a Sudden Stop: Alternative Regression Models**

|                             | <i>Logit regressions</i> |                    | <i>Probit with random effects</i> |                    | <i>Probit with country fixed effects</i> |                    |
|-----------------------------|--------------------------|--------------------|-----------------------------------|--------------------|--|--------------------|
|                             | <i>1991-2002</i>         | <i>2003-2014</i>   | <i>1991-2002</i>                  | <i>2003-2014</i>   | <i>1991-2002</i>                         | <i>2003-2014</i>   |
| VIX, log                    | 0.841*<br>[1.88]         | 1.362***<br>[7.47] | 0.332<br>[1.46]                   | 0.605***<br>[5.86] | 0.596***<br>[2.73]                       | 0.779***<br>[7.29] |
| US policy rate              | 0.905***<br>[4.43]       | 0.695**<br>[2.08]  | 0.375***<br>[4.04]                | 0.274<br>[1.47]    | 0.317<br>[1.56]                          | 0.308**<br>[2.12]  |
| Capital flows/<br>GDP       | 1.049***<br>[6.06]       | 0.146<br>[1.17]    | 0.493***<br>[4.54]                | 0.075<br>[1.04]    | 1.021***<br>[4.26]                       | 0.032<br>[0.29]    |
| Domestic credit/<br>GDP     | -0.128<br>[0.68]         | 0.448***<br>[3.63] | -0.09<br>[0.75]                   | 0.179***<br>[2.66] | 0.196<br>[0.79]                          | 0.410<br>[1.47]    |
| No. observations            | 862                      | 1316               | 862                               | 1316               | 515                                      | 914                |
| Pseudo<br><i>R</i> -squared | 0.116                    | 0.285              | .                                 | .                  | 0.237                                    | 0.348              |

Dependent variable is a binary variable which is equal to 1 if a sudden stop occurs and 0 otherwise. The first quarter of sudden stop is included in the regressions, and all subsequent quarters dropped. Domestic variables are averages of previous eight quarters. All variables have been standardized around zero mean and standard deviation equal to 1. \*\*\*, \*\* and \* indicate significance at 1, 5, and 10% levels, respectively.

**Table C3. Probability of a Sudden Stop: Additional Domestic Variables**

(probit model, marginal effects in %)

|                           | (1)               | (2)               | (3)               | (4)               | (5)               | (6)               | (7)               | (8)               | (9)               | (10)              | (11)               | (12)              |
|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|-------------------|
|                           | 1991-2002         | 2003-2014         | 1991-2002         | 2003-2014         | 1991-2002         | 2003-2014         | 1991-2002         | 2003-2014         | 1991-2002         | 2003-2014         | 1991-2002          | 2003-2014         |
| VIX, log                  | 0.89*<br>[1.93]   | 1.09***<br>[6.34] | 0.51<br>[1.49]    | 1.11***<br>[6.22] | 0.91*<br>[1.86]   | 1.15***<br>[6.53] | 1.25**<br>[2.46]  | 1.22***<br>[5.82] | 0.87*<br>[1.89]   | 1.13***<br>[6.60] | 0.88*<br>[1.70]    | 0.91***<br>[6.43] |
| US policy rate            | 1.01***<br>[4.39] | 0.38<br>[1.54]    | 0.56***<br>[2.96] | 0.40<br>[1.31]    | 0.92***<br>[4.22] | 0.52*<br>[1.78]   | 0.80***<br>[3.25] | 0.49<br>[1.37]    | 0.99***<br>[4.88] | 0.50*<br>[1.72]   | 0.89***<br>[5.45]  | 0.52***<br>[2.68] |
| Capital flows/GDP         | 1.23***<br>[5.96] | 0.09<br>[0.72]    | 0.88***<br>[5.43] | 0.12<br>[1.04]    | 1.33***<br>[5.14] | 0.16<br>[1.37]    | 0.54***<br>[3.50] | 0.20<br>[1.36]    | 1.31***<br>[6.52] | 0.12<br>[1.00]    | 1.24***<br>[6.00]  | 0.06<br>[0.67]    |
| Domestic credit/GDP       | -0.27<br>[1.28]   | 0.38***<br>[3.83] | -0.20<br>[1.21]   | 0.30**<br>[2.56]  | -0.23<br>[0.98]   | 0.34***<br>[3.05] | -0.22<br>[1.55]   | 0.28**<br>[2.49]  | -0.30<br>[1.31]   | 0.31***<br>[3.08] | -0.06<br>[0.26]    | 0.37**<br>[2.13]  |
| GDP growth                | 0.20<br>[0.65]    | 0.26<br>[1.06]    |                   |                   |                   |                   |                   |                   |                   |                   |                    |                   |
| Fiscal deficit/GDP        |                   |                   | -0.29<br>[1.05]   | -0.28*<br>[1.65]  |                   |                   |                   |                   |                   |                   |                    |                   |
| Debt/GDP                  |                   |                   |                   |                   | -0.07<br>[0.43]   | 0.07<br>[0.32]    |                   |                   |                   |                   |                    |                   |
| Capital controls          |                   |                   |                   |                   |                   |                   | 0.11<br>[0.76]    | -0.01<br>[0.08]   |                   |                   |                    |                   |
| Political risk            |                   |                   |                   |                   |                   |                   |                   |                   | 0.05<br>[0.30]    | 0.10<br>[0.58]    |                    |                   |
| Foreign currency position |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   | -0.91***<br>[3.42] | -0.04<br>[0.22]   |
| No. Observations          | 861               | 1307              | 660               | 1286              | 777               | 1306              | 454               | 1073              | 846               | 1316              | 603                | 875               |
| Pseudo R-squared          | 0.124             | 0.269             | 0.156             | 0.283             | 0.132             | 0.277             | 0.205             | 0.265             | 0.130             | 0.278             | 0.162              | 0.363             |

Dependent variable is a binary variable which is equal to 1 if a sudden stop occurs and 0 otherwise. The first quarter of sudden stop is included in the regressions, and all subsequent quarters dropped. Domestic variables are averages of previous eight quarters. All variables have been standardized around zero mean and standard deviation equal to 1. Regressions are estimated with robust standard errors, and observations clustered by countries. Z statistics reported in parentheses. \*\*\*, \*\* and \* indicate significance at 1, 5, and 10% levels, respectively.

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