HONG KONG MONETARY AUTHORITY

Research Memorandum 04/2019

3 April 2019

ECONOMIC DECLINES ASSOCIATED WITH ABRUPT CONTRACTION IN GROSS CAPITAL INFLOWS: WHICH SUDDEN STOP REALLY HURTS?

Key points

- *Following the turmoil in the second half of 2018, equity inflows to emerging market economies (EMEs) resumed in recent months while debt flows remain weak. A "sudden stop" in debt-related capital inflows–-which undermines investment and adversely impact repayment capabilities of the highly indebted through higher borrowing costs — could in theory bring larger damage to the recipient economy than a contraction in equity-related inflows.*

- *This study provides novel empirical evidence of this conjecture: we estimate the economic declines brought about by the sudden stops in different types of gross capital inflows in 18 EMEs from the 1990s to 2018. Our results show that debt-related sudden stops are associated with larger economic declines in the recipient economy (in terms of the deviation of real GDP from its short-term trend) than the equity-related only sudden stops.*

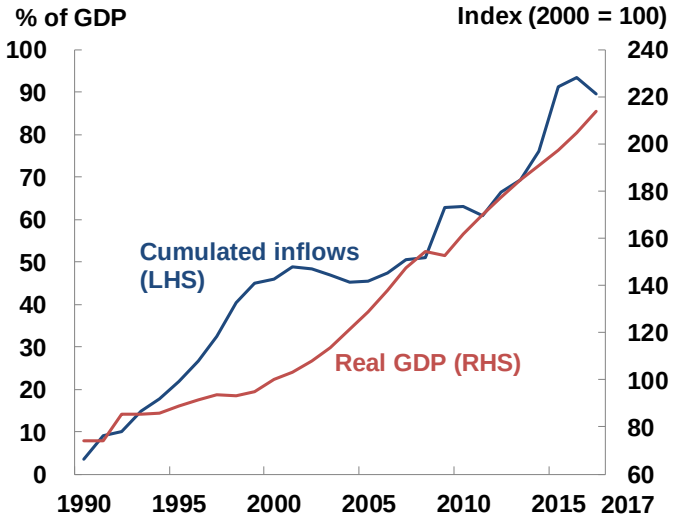
- *The findings suggest that policymakers may need to prioritise policies that aim at mitigating the risk associated with abrupt debt sudden stops.*

Prepared by: *Chi-sang Tam*
Economic Research Division, Research Department
Hong Kong Monetary Authority

1. INTRODUCTION

Driven by financial globalisation and the associated capital account liberalisation, most EMEs have seen a long-term upward trend in cross-border capital inflows (i.e. gross capital inflows from non-residents) over the past few decades (Chart 1).[1] Some episodes, such as the dot-com crash in the early 2000s and the 2008 global financial crisis, put a temporary brake on capital inflows, but the upward momentum resumed soon afterwards and the cumulated gross capital inflows (as a share of GDP) reached new highs in 2014 before moderating.

Chart 1. Cumulated gross capital inflows in EMEs



Note: The blue line shows the average cumulated gross capital inflows of 17 EMEs since 1990. The EMEs are Brazil, Bulgaria, Chile, Colombia, China, Czech Republic, Indonesia, India, South Korea, Mexico, Peru, the Philippines, Romania, Russia, Thailand, Thailand and Ukraine.
Sources: IMF BOPS and author's calculation.

Supporters of capital account liberalisation argue that an increase in capital inflows can contribute to stronger economic growth in EMEs through more efficient resource allocation, more funding alternatives for businesses, more constructive competition in the recipient economy and faster transformation of technology knowhow (e.g. Harrison et al., 2004; Tong and Wei, 2011). Critics, on the other hand, highlight the potential destabilisation

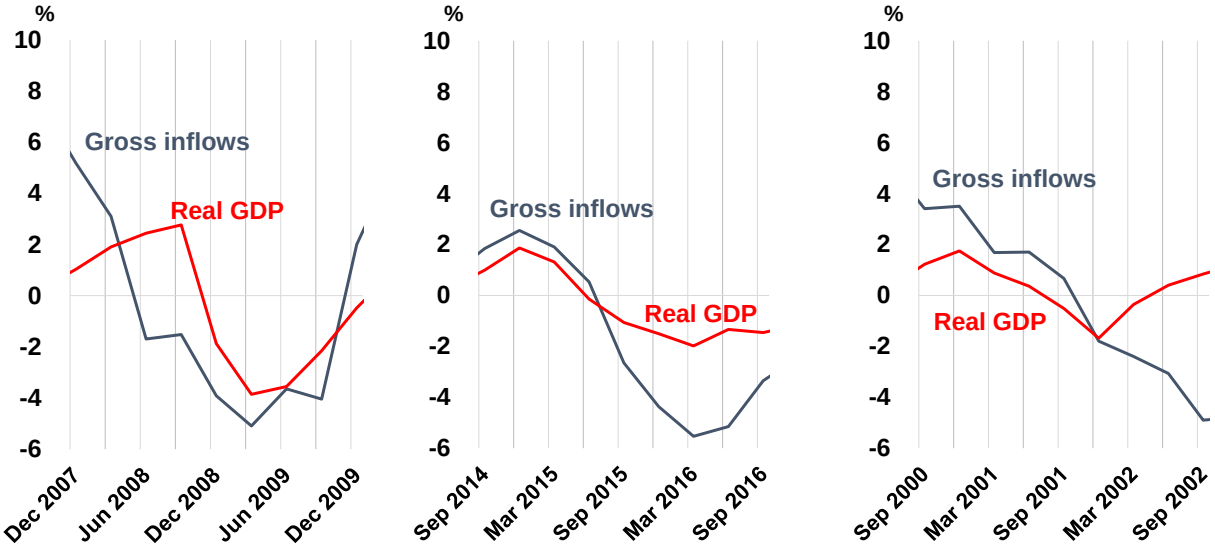
[1] In this paper, as in many recent studies of capital flows in EMEs, we focus on the gross capital inflows, i.e. the changes in liabilities owed by residents to foreign investors. See Tam and Yu (2017) for a comprehensive discussion of the importance of gross capital inflows to EMEs.

effects of foreign capital inflows on the recipient economy in the event its financial system is underdeveloped (e.g. Stiglitz, 2000). Some recent studies have shown the potential disruption to the financial market and the broader economic system that might occur by an abrupt contraction in foreign capital flows (Bruno and Shin 2013; 2015).

In fact, periods when foreign investors pull capital from EMEs during market stress are often associated with economic slowdowns. In Brazil, for example, during the global financial crisis, gross capital inflows declined abruptly as the Brazilian economy experienced a sharp brake on its decade-long expansion. Real GDP shrank by more than 2% year-on-year in the first half of 2009, equivalent to a 4% below-trend growth (Chart 2a).

Chart 2. Brazil as an example:
Changes in gross capital inflows and real GDP during market stress

a. Global financial crisis *b. 2014-16 political crisis* *c. 2000s' S. American crisis*



Note: The dark blue line shows the year-on-year change in 4-quarter rolling sum of gross capital inflows (as a share of GDP). The red line shows the deviation of real GDP from its short-term trend. The short-term trend is the fitted value estimated by regressing the real GDP on the trend variable and a constant (the respective periods are: Q4 2007 – Q4 2009 for Chart 2a; Q3 2014 – Q3 2016 and Q3 2000 – Q3 2002 for Chart 2b and Chart 2c respectively; 17 quarters for each chart).
Sources: CEIC and author's calculation.

That said, not all episodes with a similar decrease in the size of capital inflows were associated with similar economic contraction. For instance, Brazil again experienced a sharp decline in gross capital inflows in the first half

of 2016, triggered by downgrades in sovereign credit rating by major ratings agencies amid the country's political crisis. However, the associated economic effect was some 2% below-trend growth (Chart 2b). As another example, the early 2000s' South American economic crisis also led to a multi-quarter decline in gross capital inflows in Brazil from late 2001, but the economy only experienced a mild slowdown in growth of about 1.5% below-trend for just one quarter in that year. (Chart 2c).

One possible reason for the variety of economic consequences associated with different episodes of abrupt declines in gross capital inflows is the different composition of capital flows. We tackle this problem by investigating which types of sudden stops are associated with the largest decline in real activity: debt, equity, or both debt and equity ("co-occurrence").[2] Indeed, there are some interesting observations if the change in the above gross capital inflows in Brazil's example is broken down into debt- and equity-related flows:

1. During the global financial crisis, the plunge in economic growth was associated with a significant decline in both the debt- and equity-related capital inflows (Chart 3a)

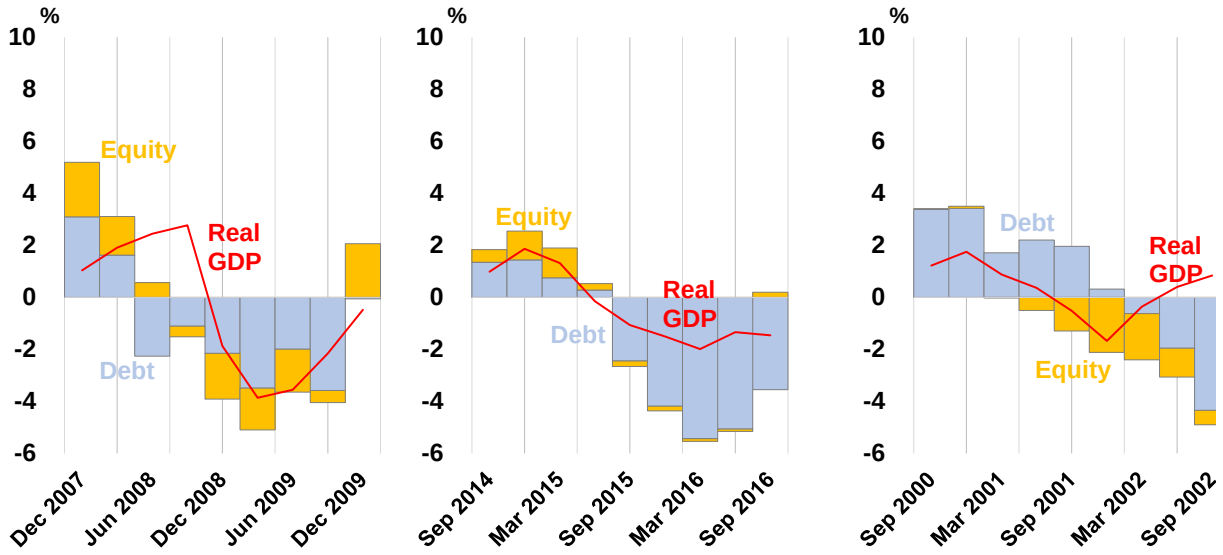
2. The decline in gross capital inflows during the 2014-16 political crisis was largely driven by debt-related flows. The accompanying economic contraction was milder than that during the global financial crisis (Chart 3b).

3. With the sudden stop driven largely by equity-related flows, the moderation in economic growth was short-lived and even milder during the early 2000s' South American crisis (Chart 3c).

[2] The definitions of debt and equity capital inflows based on the balance of payments statistics will be discussed in the next section.

Chart 3. Brazil as an example with breakdowns in capital inflows: Changes in gross capital inflows and real GDP during market stress

a. Global financial crisis *b. 2014-16 political crisis* *c. 2000s' S. American crisis*



Note: The bar shows the year-on-year change in the 4-quarter rolling sum of gross capital inflows (as a share of GDP). The red line shows the deviation of real GDP from its short-term trend (please see note of Chart 2 for details).
Sources: CEIC and author's calculation.

From this example, it seems the type of capital flows leading to the sudden stop is a detrimental factor to the size of the associated economic decline.[3] Inspired by this observation, the key question of this study is: Which type of sudden stop in gross capital inflows – debt-related or equity-related – is more disruptive to the recipient economy? In this study, we found that a sudden stop in debt-related gross capital inflows is associated with a significant decline in real GDP, while a sudden stop in equity-related gross capital inflows has no effect on the recipient economy. This finding is useful for economic surveillance as it provides a clearer direction to policymakers in formulating policy measures to mitigate risks related to capital flows. As sudden stops in debt-related gross capital inflows are proven to be more disruptive than that in equity-related flows, policymakers might pay more attention to surveillance of debt-related capital inflows and implement more targeted measures on related fields without over-managing the equity-related capital inflows and the

[3] In our study, as in Forbes and Warnock (2012a; 2012b) and Cavallo et al. (2015), the term "sudden stop" means an abrupt contraction in gross capital inflows.

corresponding markets.

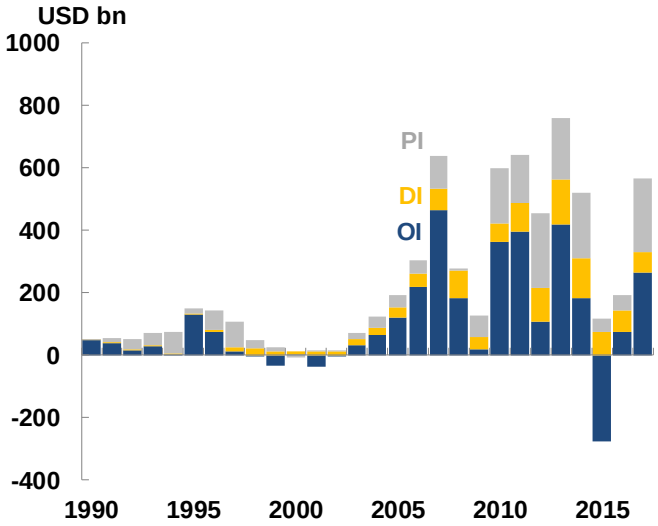
Indeed, there is a voluminous amount of literature on cross-border capital flows (see Hannan, 2018; and Yeyati and Zúñiga, 2016 for literature surveys). However, there is relatively little previous study that has the same focus as ours. To our best knowledge, Cavallo et al. (2015) is the closest. In an empirical study to identify the most disruptive type of sudden stops, Cavallo et al. (2015) found that, compared to the sudden stops driven by foreign direct investment flows and portfolio investment flows, those driven by banking flows (i.e. the category "other investment" in the balance of payments statistics) are more likely to be associated with a larger economic slowdown. That study also found sudden stops driven by portfolio investment inflows had virtually no impact on the economy.

In explaining these results, Cavallo et al. (2015) stressed the point that an abrupt contraction in debt-related gross capital inflows, e.g. banking flows, could force debtors in the recipient economy to deleverage. Given that a sharp credit contraction could destabilise the banking system and the broader economic system more directly than the market sell-offs led by equity-related outflows (i.e. part of portfolio outflows and FDI), the banking flows-related sudden stops are likely to have a larger negative impact.

However, there is a gap between the empirical approach and the explanation in Cavallo et al. (2015). In their empirical study to examine the degree of economic slowdown associated with different types of capital inflows, they estimated the impact of sudden stops driven by foreign direct investment inflows, portfolio investment inflows and other investment inflows separately. This conventional balance of payments' classification could best reflect the *purpose of capital flows* (e.g. foreign direct investment in a firm's equity has the aim of being involved in the management of a firm; while portfolio investment in a firm's equity is simply considered a financial market investment without engaging in the firm's management). However, their proposed explanation of the empirical results is leveraged on the *nature of*

capital flows (i.e. the effect of debt-related flows vs. that of equity-related flows). In fact, capital flows with different purposes could be of the same nature, and some direct investment and portfolio investment flows are debt-creating. For example, a bond funds' overseas investment is classified as portfolio flows, and it is also debt-related. More importantly, gross capital inflows for investment in debt securities (as portfolio investment) and intercompany loans (as foreign direct investment) accounted for a significant proportion of total debt-related gross capital inflows in emerging market economies in the past couple of decades (Chart 4). As such, focusing only on bank-related debt flows overlooks the increasing market-based extension of credit and transfer of risks that warrant equal vigilance, if not greater, for policy discussion and market surveillance (see Baranova et al., 2017 for further discussion on the importance of market-based finance surveillance).

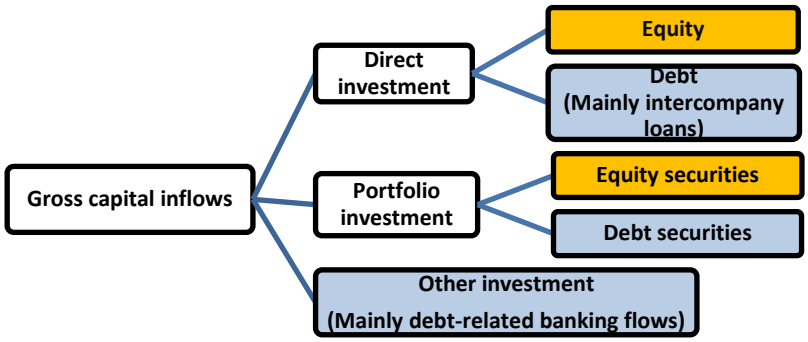
Chart 4. Debt-related gross capital inflows in EMEs



Note: PI, DI and OI refer to portfolio investment, direct investment and other investment respectively. The chart shows the sum of debt-related gross capital inflows in a group of 17 EMEs. The EMEs are the same as those in Chart 1.
Sources: IMF BOPS and author's calculation.

To fill the gap, we directly classify gross capital inflows by their nature: debt-related inflows and equity-related inflows. The concept is illustrated in Chart 5.

Chart 5. Classification of capital inflows under the balance of payments framework



Source: Author.

In Chart 5, debt-related inflows include intercompany loans in direct investment, debt securities investment in portfolio investment and banking flows (i.e. the blue boxes); equity-related inflows include equity investment in direct investment and equity securities investment in portfolio investment (i.e. the orange boxes).[4]

The rest of this paper is arranged as follows: Section 2 identifies the sudden stop episodes and classifies them according to the nature of capital flows. The associated economic declines of different types of sudden stops are estimated in Section 3. Section 4 discusses the results and concludes the study.

2 IDENTIFICATION OF SUDDEN STOP EPISODES

2.1 The principle and methodology

Similar to Tam and Yu (2017), we define a sudden stop in gross capital inflows as an episode with a significant but unexpected slowdown in gross capital inflows from its recent average level. In practice, we follow the definition of sudden stop proposed by Forbes and Warnock (2012a):

[4] Forbes and Warnock (2012b) proposed a similar classification. The only difference is that they did not split foreign direct investment into equity and debt and assumed that all foreign direct investment flows are equity-related.

1. The debt-driven (equity-driven) episode begins if the year-on-year change in the four-quarter rolling-sum of debt-related (equity-related) gross capital inflows falls below its previous-five-year average by more than two rolling standard deviations.

2. The debt-driven (equity-driven) episode continues as long as the year-on-year change in the four-quarter rolling-sum of debt-related (equity-related) gross capital inflows stays below its previous-five-year average by more than one rolling standard deviation.

Conditions 1 and 2 can be formulated as below:

For an economy i, the quarterly debt-related (equity-related) gross capital inflows at time t ($GI_{i,t}^{TYPE};\ TYPE = Debt\ or\ Equity$) are summed with the inflows in the past three quarters in a rolling manner as Equation (1)[5]:

$$CI_{i,t}^{TYPE} = \sum_{k=0}^{3} GI_{i,t-k}^{TYPE} \quad (1)$$

Then the change in flows is derived by comparing the annualised flows at time t (CI_{it}^{TYPE}) with its value a year ago as below:

$$\Delta_4 CI_{i,t}^{TYPE} = CI_{i,t}^{TYPE} - CI_{i,t-4}^{TYPE} \quad (2)$$

At time t, the average value and standard deviation of $\Delta_4 CI_{i,t}^{TYPE}$ over the previous five years (i.e. 20 quarters) are denoted by $\mu^{TYPE,i,t-20,t-1}$ and $\sigma^{TYPE,i,t-20,t-1}$ respectively.[6] Therefore, the thresholds in the criteria I and II above are defined by Equation (3) and Equation (4):

$$A = \mu^{TYPE,i,t-20,t-1} - \sigma^{TYPE,i,t-20,t-1} \quad (3)$$

$$B = \mu^{TYPE,i,t-20,t-1} - 2\sigma^{TYPE,i,t-20,t-1}$$

5 The seasonality in gross capital inflows could be largely removed by the four-quarter rolling sum approach. This is also analogous to the literature's focus on one year of flows.

6 The recent average and standard deviation are calculated over the past 20 quarters, which means that episodes are always defined relative to the recent trend.

(4)

The occurrence of a debt-driven (equity-driven) sudden stop episode in economy i at time t ($SS_{i,t}^{TYPE} = 1$) is defined by Equation (5):

$$SS_{i,t}^{TYPE} = \begin{cases} 1 \;\; if \;\; \begin{cases} \Delta_4 CI_{i,t}^{TYPE} \leq B, & OR \\ SS_{i,t-1}^{TYPE} = 1 \; and \; A \geq \Delta_4 CI_{i,t}^{TYPE} > B \end{cases} \\ 0 \;\; if \;\; \begin{cases} \Delta_4 CI_{i,t} > A, & OR \\ SS_{i,t-1}^{TYPE} = 0 \; and \; A \geq \Delta_4 CI_{i,t}^{TYPE} > B \end{cases} \end{cases} \quad (5)$$

The debt-driven and equity-driven flows of individual economies in our sample and the identified episodes of sudden stop (shaded areas) are shown in Chart A1 and Chart A2 in the appendix. Here are the major observations:

1. Debt-related gross capital inflows and the equity-related gross capital inflows have a similar number of sudden stop episodes. There are 55 and 49 identified episodes in debt- and equity-related inflows, respectively, across all countries.

2. All hardest-hit economies in the 1997 Asian financial crisis – Indonesia, the Philippines, South Korea and Thailand – saw a sudden stop in debt-related inflows in 1997-1998, while only Indonesia and the Philippines experienced an equity-related outflow. The dominance of debt-related episodes may largely reflect the nature of the balance of payments crisis at that time. With the cumulated vulnerabilities of currency mismatch, those hardest hit Asian economies were faced with challenges over their repayment capability for external liabilities amid the foreign currency liquidity shortage and the associated sharp currency depreciation. The external debt-laden sectors were unable to roll-over their debts because of the sharp decline in debt-related gross capital inflows. At the same time, as the region's equity market was less developed and less exposed to international investors, the capital flight from the equity market was therefore less significant.

3. Almost all economies in the sample experienced a "double whammy" – a sudden stop in both debt- and equity-related gross capital inflows during the global financial crisis.

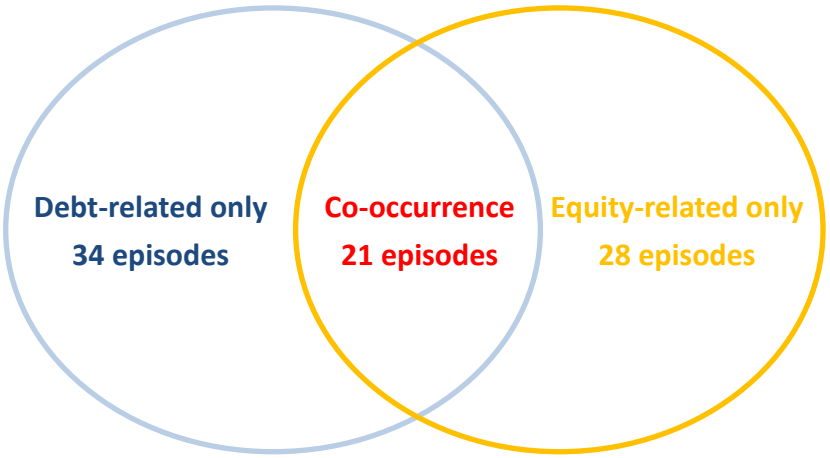
4. The taper-tantrum episode in 2013 did not trigger any sudden stop in gross capital inflows in most EMEs in the sample. This observation is consistent with that of Cheung et al. (2014), which showed that many emerging Asian economies experienced a sudden surge in gross capital outflows (i.e. increase in foreign asset purchases by residents) in the months following the "tapering talk" by the then Fed chairman, while gross capital inflows were relatively stable and positive.

5. The decline in gross capital inflows since 2014 was driven more by debt-related flows, with many EMEs in the sample experiencing a sudden stop in debt-related gross capital inflows. One possible explanation is the broad-based deleverage of US dollar liabilities in EMEs amid the dollar's strengthening since late 2013.

2.2 Classification of identified episodes

There are three types of sudden stop episodes: sudden stop in debt-related gross capital inflows only, sudden stop in equity-related gross capital inflows only and a co-occurrence of debt- and equity-related sudden stops. These types of sudden stops in our sample are summarised in the Venn diagram below (Chart 6).

Chart 6. Classification of sudden stops in gross capital inflows



Source: Author.

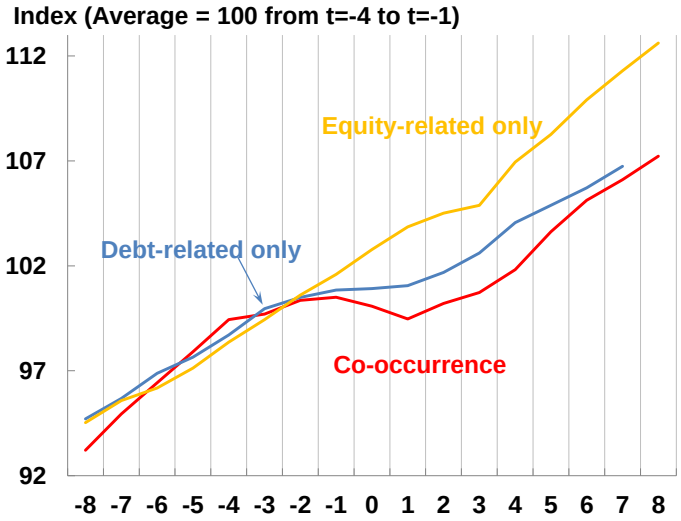
The episodes are listed in Table A1 in the Appendix. There were 23 episodes when both debt- and equity-related gross capital inflow sudden stops occurred at the same time. Indonesia experienced four of these "double whammy" episodes, while Mexico, the Philippines, Thailand and Turkey saw two. On average, the co-occurrence episodes continued for about four quarters, while the debt- and equity-driven episodes continued for 2.8 and 2.7 quarters respectively.

3 GROWTH DECLINES ASSOCIATED WITH SUDDEN STOPS

3.1 Stylised facts

To evaluate the economic impact of different types of sudden stops, we perform a simple event study to assess the change in real GDP surrounding the sudden stops. For every identified sudden stop episode, the starting quarter is defined as $t = 0$. We track the series of real GDP from $t = -8$ (i.e. 8 quarters before the sudden stop began) to $t = 8$ (i.e. 8 quarters after the sudden stop began). This 17-quarter real GDP series of each episode will then be indexed and re-based, with the average real GDP index one year before the beginning of the episode being equal to 100. Chart 7 shows the across-episode average of the real GDP index of each type of sudden stop (i.e. debt-related only, equity-related only and co-occurrence).

Chart 7. Real GDP surrounding sudden stops



Sources: CEIC and author's calculations.

As can be seen, the real GDP has the steepest declines during the co-occurrence episodes (the red line), losing about 1% from $t = -1$ to $t = 1$. The decline associated with the debt-related only episode (the blue line) is similar but smaller. The equity-related only sudden stop (the yellow line) has virtually no impact on the real GDP.

3.2 The baseline model

To conduct the event study more systematically, we pooled the identified episodes and estimate the following fixed effect model:[7]

$$Y_{i,t} = a_i + bTREND_t + \sum_{type} \beta^{type} SS_{i,t}^{type} + e_{i,t} \quad (6)$$

where:

$Y_{i,t}$ is the real GDP index of episode *i*;

$TREND_t$ is a trend variable that equals to 1 when $t = -8$ and equals to 17 when $t = 8$;

$SS_{i,t}^{type}$ is a binary variable that indicates the period of the sudden stop episode (i.e. it is equal to 0 for $t < 0$ and equal to 1 for $t \geq 0$). The superscript *type* indicates the type of sudden stop of episode i (i.e. co-occurrence, debt-related only or equity-related only). It equals to 1 when $t \geq 0$ and episode i is of the referring *type*; it equals to 0 otherwise;

a_i is the fixed effect of episode i. β^{type} is the estimated growth decline associated with the referring *type* of sudden stop. From Chart 9, it is expected the estimated β of co-occurrence episodes is most significant and negative, while that of debt- and equity-related only episodes are less negative.

Equation (6) is estimated by the pooled OLS method with fixed effects. Robust standard errors are clustered by episodes (i.e. clustered by cross section).[8] Table 1 shows the estimation results.

[7] The fixed effect model is similar to that in Cavallo et al. (2015). As we are only looking at the short-term adjustment relative to the short-term trend, the real GDP model does not include any of the traditional growth literature variables.

[8] That means the standard errors are robust to arbitrary within cross-episode residual correlation.

Table 1. Estimates of Equation (6)

Fixed effect model **Dependent variable: Real GDP index**	
Co-occurrence episode (β^{co})	-3.85** (1.518)
Debt-related only episode (β^{debt})	-2.92*** (1.081)
Equity-related only episode (β^{equity})	0.50 (0.959)
Trend (b)	1.03*** (0.073)
Number of time periods	17 (quarter)
Number of cross section	78 (episode)
Adjusted R-squared	0.61

Note: β^{co}, β^{debt} and β^{equity} refer to β of co-occurrence episode, debt-related only episode and equity related only episode respectively. As Equation (6) requires eight quarters of real GDP data after the beginning of every sudden stop episode, there are two identified debt-related only episodes and three equity-related only episodes that cannot be included in the estimation. In addition, as the real GDP series of Colombia starts from 2005, a debt-related only episode of Colombia in 2002 cannot be included in the estimation. So there are only 78 episodes in the estimation (21 co-occurrence episodes; 31 debt-related only episodes and 26 equity-related only episodes). Estimated coefficients' standard errors are in parentheses. ***, ** and * indicate that the estimated coefficient is significant at the 1% level, 5% level and 10% level respectively.
Source: Author's estimation.

According to the results, in the eight quarter period after the start of a co-occurrence episode, real GDP stays below the short-term trend by 3.9% on average, while in the same sense, the growth decline of a debt-related only episode would be about 2.9%. The equity-related only episode, as expected, has no significant impact on real GDP. To ascertain the significance of the difference in the decline, we perform the coefficient Wald test (Table 2).

Table 2. Wald test on Equation (6)'s estimated coefficients

H_0: Column coefficient = Row coefficient

	β^{co}	β^{debt}	β^{equity}
β^{co}			
β^{debt}	0.193 (0.660)		
β^{equity}	4.82** (0.028)	4.36** (0.037)	

Note: F-statistics and the corresponding p-value (in parentheses) are shown in the table. ***, ** and * indicate the pair of coefficients are significantly different at the 1% level, 5% level and 10% level respectively.
Source: Author's estimation.

According to the Wald test, the difference between the impact of co-occurrence episodes and that of debt-related only episodes is insignificant. And, the economic impact of equity-related only episodes is significantly less than that of co-occurrence and debt-related episodes.

3.3 The augmented model with time-varying economic decline

Equation (6) assumes that the economic decline is constant from $t = 0$ to $t = 8$. In other words, the model gives only the average growth decline over this nine-quarter period. However, chart 9 suggests the decline is likely to change after the beginning of the episode. To better comprehend the sudden stop impacts, we estimate the following augmented model:

$$Y_{i,t} = a_i + bTREND_t + \sum_{type}(\beta_0^{type} SSQ_{i,t}^{type} + \beta_1^{type} SS1Y_{i,t}^{type} + \beta_2^{type} SS2Y_{i,t}^{type}) + e_{i,t} \qquad (7)$$

where:

$SSQ_{i,t}^{type}$ is a binary variable that indicates the starting period of the episode. It equals to 1 when t=0 (i.e. the beginning quarter of the sudden stop episode) and episode i is of the referring *type*. It equals to 0 otherwise;

$SS1Y_{i,t}^{type}$ is a binary variable that indicates the first year immediately after the beginning of the episode. It equals to 1 when t=1, 2, 3 or 4 and episode i is of the referring *type*. It equals to 0 otherwise;

$SS2Y_{i,t}^{type}$ is a binary variable that indicates the second year after the beginning of the episode. It equals to 1 when t=5, 6, 7 or 8 and episode i is of the referring *type*. It equals to 0 otherwise.

The estimated coefficients β_0^{type}, β_1^{type} and β_2^{type} indicate the size of economic decline associated with the referring *type* of sudden stop episode in the quarter the episode begins, the first year after the sudden stop episode, and then the second year after the sudden stop episode began. Similar to the baseline model, Equation (7) is estimated by the pooled OLS method with fixed effects. Robust standard errors are clustered by episodes. Table 3 shows the estimates of Equation (7), while Table 4 shows the corresponding Wald test results.

Table 3. Estimates of Equation (7)

Fixed effect model **Dependent variable: Real GDP index**			
	Beginning (β_0^{type})	1st year (β_1^{type})	2nd year (β_2^{type})
Co-occurrence episode (β_{time}^{co})	-2.22** (1.115)	-4.24*** (1.524)	-3.26* (1.964)
Debt-related only episode (β_{time}^{debt})	-1.68** (0.715)	-2.74** (1.091)	-2.80** (1.415)
Equity-related only episode (β_{time}^{equity})	0.30 (0.641)	0.08 (0.894)	1.57 (1.327)
Trend (b)		1.00*** (0.078)	
Number of time period		17 (quarter)	
Number of cross section		78 (episode)	
Adjusted R-squared		0.62	

Estimated coefficients' standard errors are in parentheses. ***, ** and * indicate that the estimated coefficient is significant at the 1% level, 5% level and 10% level respectively.
Source: Author's estimation.

Table 4. Wald test on Equation (7)'s estimated coefficients

a. Test on the estimated coefficients of co-occurrence episodes (β^{co})

H_0: Column coefficient = Row coefficient

	Beginning	1st year	2nd year
Beginning			
1st year	3.34* (0.068)		
2nd year	0.40 (0.526)	1.97 (0.160)	

b. Test on the estimated coefficients of debt-related only episodes (β^{debt})

H_0: Column coefficient = Row coefficient

	Beginning	1st year	2nd year
Beginning			
1st year	3.23* (0.072)		
2nd year	1.10 (0.294)	0.01 (0.936)	

c. Test on the estimated coefficients in the beginning quarter (β_0)

H_0: Column coefficient = Row coefficient

	Co-occurrence	Debt-related	Equity-related
Co-occurrence			
Debt-related	0.14 (0.706)		
Equity-related	3.43* (0.064)	3.35* (0.067)	

d. Test on the estimated coefficients in the first year(β_1)

H_0: Column coefficient = Row coefficient

	Co-occurrence	Debt-related	Equity-related
Co-occurrence			
Debt-related	0.56 (0.453)		
Equity-related	5.50** (0.0192)	3.47* (0.063)	

e. Test on the estimated coefficients in the second year(β_2)

H_0: Column coefficient = Row coefficient

	Co-occurrence	Debt-related	Equity-related
Co-occurrence			
Debt-related	0.03 (0.858)		
Equity-related	3.92** (0.048)	4.62** (0.032)	

Note: F-statistics and the corresponding p-value (in parentheses) are shown in the table. ***, ** and * indicate that the pair of coefficients are significantly different at the 1% level, 5% level and 10% level respectively.
Source: Author's estimation.

Below are some key results:

1. (**Table 4**) Similar to the results for Equation (6), the co-occurrence episodes and debt-related only episodes are associated with significant declines in real GDP, while the same cannot be said about equity-related only episodes.[9]

2. (**The "Co-occurrence" row of Table 3 and Panel a of Table 4**) The growth decline peaks in the first year after the start of a co-occurrence episode. According to the results, real GDP would be 4.2% below the trend in the first year, which is significantly more negative than that in the

[9] Therefore, we skip the Wald test on the significance of the pairwise differences among β_0^{equity}, β_1^{equity} and β_2^{equity}.

episode's beginning quarter. However, there is no difference, in a statistically significant way, in the size of the decline in the first and second year. (as the Wald test's p-value = 16%).

3. (**The "Debt-related" row of Table 3 and Panel b of Table 4**) The economic decline is roughly constant in the eight-quarter period after a debt-related only episode started. The real GDP would be 2.7% and 2.8% below the short-term trend in the first and second years, significantly smaller than the 1.7% decline in the beginning quarter.

4. (**The "Beginning" column of Table 3 and Panel c of Table 4**) Both co-occurrence and debt-related only episodes are associated with significant economic decline in the beginning quarter, but their impacts are not significantly different to each other.

5. (**The "1st year" column of Table 3 and Panel d of Table 4**) In the first year, although the estimated size of the economic slowdown associated with the co-occurrence episodes (-4.2%) is apparently larger than that of the debt-related only episodes (-2.7%), the Wald test indicates that the difference is not significant.

6. (**The "2nd year" column of Table 3 and Panel e of Table 4**) In the second year, the difference between the growth decline associated with the co-occurrence and debt-related only episodes is not significant.

In summary, the co-occurrence and debt-related only episodes are likely to be associated with similar economic declines in the first and second years. These slowdowns are steeper than that during the beginning quarter. The equity-related only sudden stop episodes have no significant impact on real GDP.[10]

[10] The fact that equity episodes are not associated with significant economic decline suggests that "debt" and "co-occurrence" episodes are statistically the same.

4 CONCLUDING REMARKS

In this study, we identify the sudden stops in debt-related gross capital inflows and equity-related gross capital inflows separately. After classifying these episodes into the debt-related only, equity-related only and co-occurrence of both debt- and equity-related sudden stops, we estimate their associated economic effect by a pooled OLS model with fixed effect.

The estimation results suggest that the debt-related sudden stop episodes are more disruptive (in terms of real GDP's deviation from its short-term trend) than the equity-related only sudden stop episodes. This result provides further evidence to the literature that debt inflows are associated with a larger risk to the recipient economy than equity inflows.[11] Therefore, the policy implication in general, is that capital flow management policy measures aimed at mitigating the risk associated with abrupt *debt* flow reversal should be given priority.

Our research also provides the groundwork for future studies on this important issue. First, instead of studying the impact of sudden stops on real GDP, future studies could focus on the impact on particular types of economic activities. For example, the research question could be whether private consumption or capital investment are affected more by a sudden stop in debt-related inflows. Second, with the increasing use by EMEs of macro-prudential measures to address elevated financial vulnerabilities, further research on the effect these have on alleviating the aftermath of sudden stops on debt-related gross capital flows could help policymakers develop more effective measures for the longer term.

[11] Please see Yeyati and Zúñiga (2015) for detailed discussion.

References

Baranova, Y., Coen, J., Noss, J., & Lowe, P., 2017. "Simulating stress across the financial system: the resilience of corporate bond markets and the role of investment funds", *Bank of England Financial Stability Papers*, No. 42.

Bruno, V., & Shin, H. S., 2013. "Capital flows, cross-border banking and global liquidity", *National Bureau of Economic Research Working Papers*, No. w19038.

----------, 2015. "Capital flows and the risk-taking channel of monetary policy"' *Journal of Monetary Economics*, *71*, 119-132.

Cavallo, E., Powell, A., Pedemonte, M., & Tavella, P., 2015. "A new taxonomy of Sudden Stops: Which Sudden Stops should countries be most concerned about?", *Journal of International Money and Finance*, *51*, 47-70.

Cheung, L., Tam, C. S. & Yu, I. W., 2014. "How Severe was the Financial Market Sell-off in the Emerging EMEAP Economies During the Summer of 2013?", *Special Analysis of the Macro-Monitoring Report submitted to the EMEAP Monetary and Financial Stability Committee*, June.

Forbes, K. J., & Warnock, F. E., 2012a. "Capital flow waves: Surges, stops, flight, and retrenchment", *Journal of International Economics*, *88*(2), 235-251.

Forbes, K. J., & Warnock, F. E., 2012b. "Debt-and equity-led capital flow episodes" *National Bureau of Economic Research Working Papers*, No. w18329.

Hannan, S. A., 2018. "Revisiting the Determinants of Capital Flows to Emerging Markets--A Survey of the Evolving Literature", *International Monetary Fund Working Paper,* WP/18/214.

Harrison, A. E., Love, I., & McMillan, M. S., 2004. "Global capital flows and financing constraints", *Journal of development Economics*, 75(1), 269-301.

Levy Yeyati, E., & Zúñiga, J., 2016. "Varieties of Capital Flows: What Do We Know?", *Inter-American Development Bank Discussion Paper,* No IDB-DP-425.

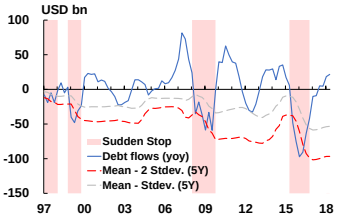
Stiglitz, J. E., 2000. “Capital market liberalization, economic growth, and instability”, *World development*, 28(6), 1075-1086.

Tam, C. S. & Yu, I. W., 2017. “Determinants of the Probability of Abrupt Contraction in Gross Capital Inflows to Emerging Market Economies”, *Hong Kong Monetary Authority Research Memorandum*, 08/2017.

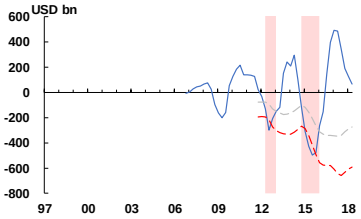
Tong, H., & Wei, S. J., 2010. “The composition matters: capital inflows and liquidity crunch during a global economic crisis”, *The Review of Financial Studies*, 24(6), 2023-2052.

Appendix: Chart A1. Sudden stops in debt-related gross capital inflows

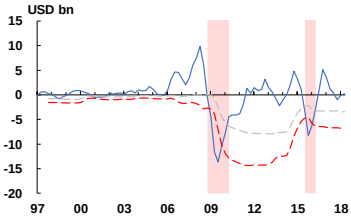
Brazil



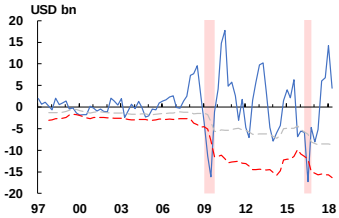
China



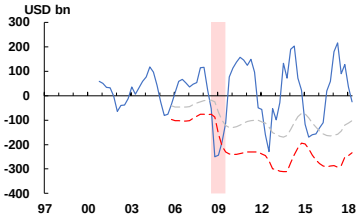
Bulgaria



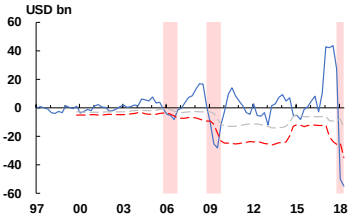
Chile



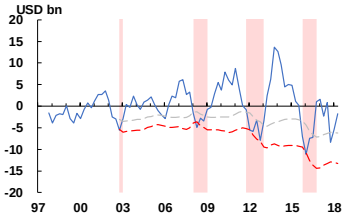
Hong Kong



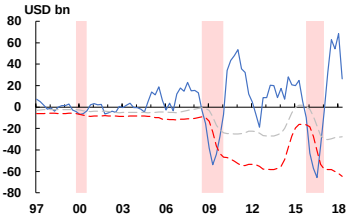
Czech



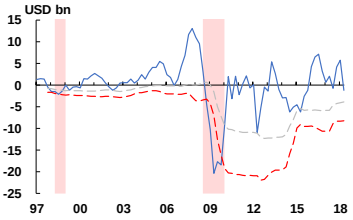
Colombia



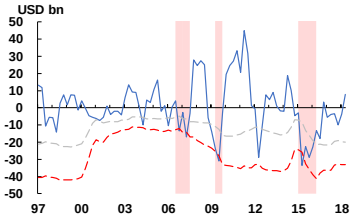
India



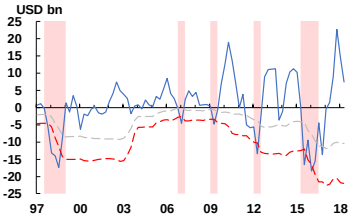
Romania



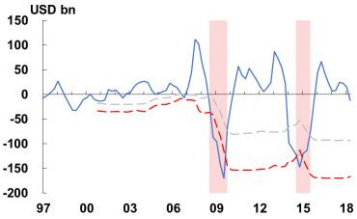
Mexico



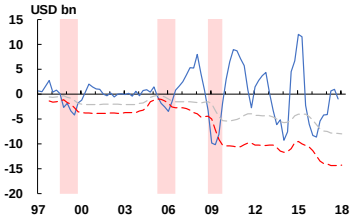
Indonesia



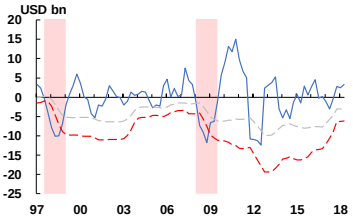
Russia



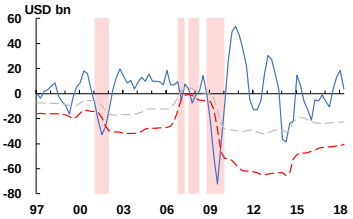
Peru



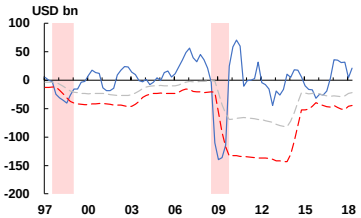
The Philippines



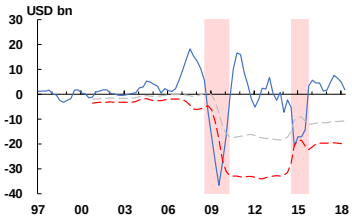
Turkey



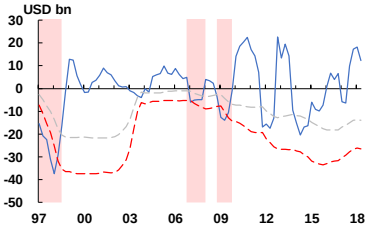
South Korea



Ukraine



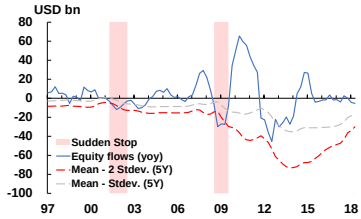
Thailand



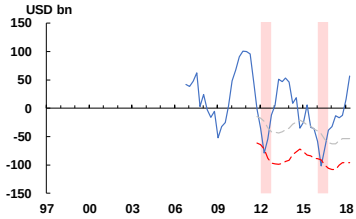
Source: CEIC and Author's estimation.

Appendix: Chart A2. Sudden stops in equity-related gross capital inflows

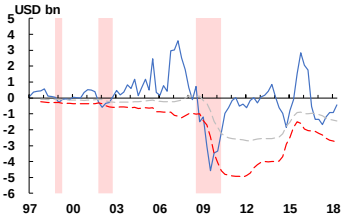
Brazil



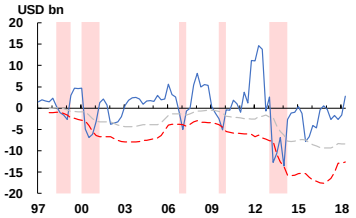
China



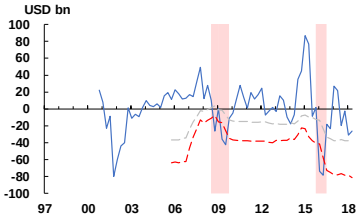
Bulgaria



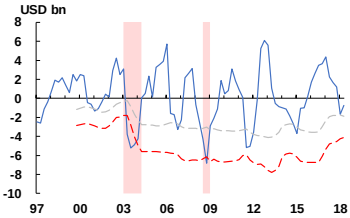
Chile



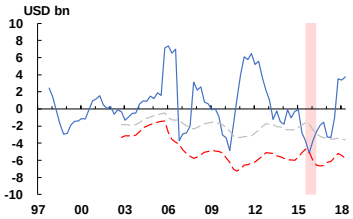
Hong Kong



Czech

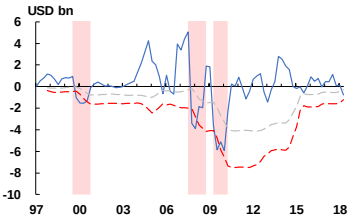


Colombia

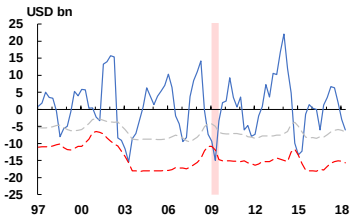


India

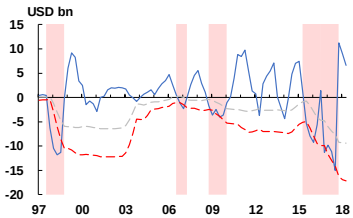
Romania



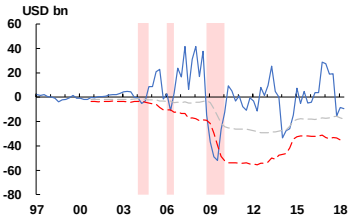
Mexico



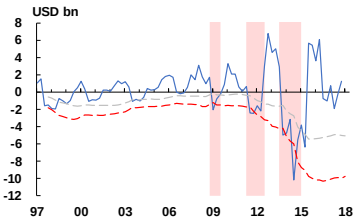
Indonesia



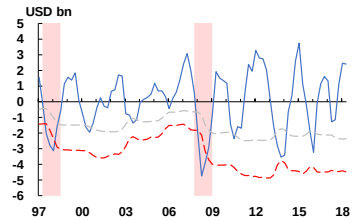
Russia



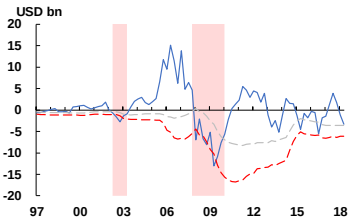
Peru



The Philippines

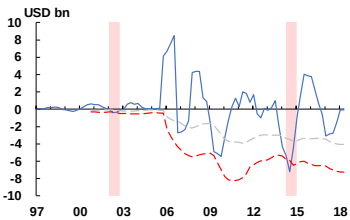


Turkey

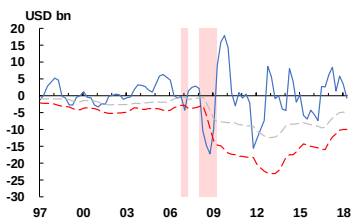


South Korea

Ukraine



Thailand



Source: CEIC and Author's estimation.

Appendix: Table A1. Sudden stop episodes

Debt-related only			Co-occurrence			Equity-related only		
	Start	End		Start	End		Start	End
Brazil	Q2 1997	Q4 1997	**Brazil**	Q4 2008	Q3 2009	**Brazil**	Q1 1995	Q3 1995
	Q1 1999	Q3 1999	**Bulgaria**	Q1 2009	Q1 2010		Q3 2001	Q2 2002
	Q3 2015	Q3 2016	**China**	Q3 2012	Q4 2012	**Bulgaria**	Q1 1999	Q1 1999
Bulgaria	Q4 2015	Q1 2016	**Hong Kong**	Q4 2008	Q3 2009		Q1 2002	Q3 2002
Chile	Q2 2009	Q3 2009	**Indonesia**	Q4 1997	Q4 1998		Q4 2016	Q3 2017
	Q3 2016	Q3 2016		Q1 2007	Q1 2007	**Chile**	Q3 1998	Q1 1999
Colombia	Q4 2002	Q4 2002		Q2 2009	Q4 2009		Q2 2000	Q1 2001
	Q2 2008	Q4 2008		Q3 2015	Q2 2016		Q1 2007	Q1 2007
	Q1 2012	Q4 2012	**India**	Q4 2008	Q4 2009		Q4 2009	Q4 2009
	Q1 2016	Q2 2016	**Mexico**	Q1 1995	Q4 1995		Q2 2013	Q1 2014
China	Q1 2015	Q4 2015		Q2 2015	Q1 2016	**China**	Q2 2016	Q3 2016
Czech	Q1 2006	Q3 2006	**Peru**	Q1 2009	Q3 2009	**Czech**	Q2 2003	Q1 2004
	Q1 2009	Q3 2009	**The Philippines**	Q4 1997	Q4 1998		Q4 2008	Q4 2008
	Q1 2018	Q2 2018		Q2 2008	Q2 2009	**Hong Kong**	Q1 2016	Q2 2016
Indonesia	Q2 1993	Q4 1993	**Romania**	Q3 2009	Q1 2010	**Indonesia**	Q4 2016	Q3 2017
	Q2 2012	Q2 2012	**Russia**	Q1 2009	Q4 2009	**India**	Q4 1998	Q1 1999
India	Q4 1991	Q1 1992	**Thailand**	Q1 2007	Q4 2007	**South Korea**	Q4 1994	Q2 1995
	Q1 2000	Q2 2000		Q1 2009	Q3 2009		Q2 2008	Q2 2008
	Q1 2016	Q4 2016	**Turkey**	Q1 1995	Q4 1995	**Mexico**	Q2 2009	Q2 2009
South Korea	Q4 1997	Q4 1998		Q1 2008	Q4 2009	**Peru**	Q3 2011	Q2 2012
	Q4 2008	Q3 2009	**Ukraine**	Q4 2014	Q3 2015		Q4 2013	Q4 2014
Mexico	Q2 1992	Q2 1992				**Romania**	Q4 1999	Q3 2000
	Q4 2006	Q2 2007				**Russia**	Q2 2004	Q3 2004
	Q3 2009	Q3 2009					Q2 2006	Q2 2006
Peru	Q4 1998	Q3 1999				**Thailand**	Q4 1994	Q4 1994
	Q3 2005	Q2 2006				**Turkey**	Q3 1993	Q3 1993
The Philippines	Q2 1992	Q2 1992					Q3 2002	Q1 2003
Romania	Q3 1998	Q4 1998				**Ukraine**	Q2 2002	Q3 2002
Russia	Q4 2014	Q2 2015						
Thailand	Q3 1992	Q1 1993						
	Q4 1996	Q2 1998						
Turkey	Q2 2001	Q4 2001						
	Q1 2007	Q1 2007						
Ukraine	Q4 2008	Q1 2010						

Source: Author.