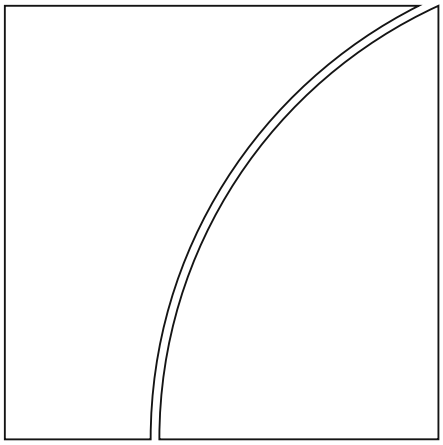

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International reserves and gross capital flow dynamics[1]

Enrique Alberola (Bank for International Settlements), Aitor Erce (European Stability Mechanism) and José María Serena (Bank of Spain)

This paper explores the role of international reserves as a stabiliser of international capital flows, in particular during periods of global financial stress. In contrast with previous contributions, aimed at explaining net capital flows, we focus on the behaviour of gross capital flows. We analyse an extensive cross-country quarterly database, comprising 63 countries for the period 1991–2010, using standard panel regressions. We document significant heterogeneity in the response of resident investors to financial stress and relate it to a previously undocumented channel through which reserves act as a buffer during financial stress. A robust result of the analysis is that international reserves facilitate financial disinvestment overseas by residents – a fall in capital outflows. This partially offsets the drop in foreign capital inflows observed in such periods. For the whole sample, we also find that larger stocks of international reserves are linked to higher gross inflows and lower gross outflows. These results, which challenge current approaches to measuring reserve adequacy, call for refining such tools to better account for the role of resident investors.

Keywords: Gross capital flows, international reserves, systemic crises, capital retrenchment
JEL codes: F21, F32, F33

1. Introduction

In recent decades, the world economy has experienced a process of financial integration, with large increases in cross-border capital flows in both emerging and developed economies. The process has been far from smooth. As shown in Graph 1, where episodes of global financial stress (as defined in Section 2) are depicted with a green shadowed area, cross-border capital flows have been increasing, grinding abruptly to a halt during the 1995–96, 1998–99 and 2001–02 episodes of turmoil. Each time, they resumed soon afterwards, reaching their peak at the onset of the 2008 Great Financial Crisis. After their sharp collapse, financial flows recovered again, but at a significantly lower level than before the

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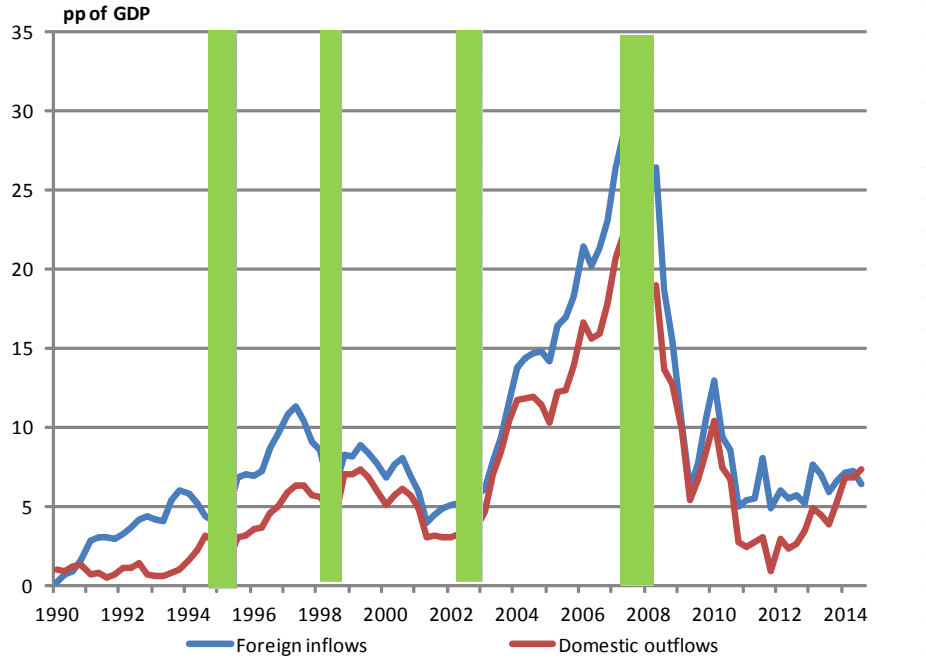
crisis.[2] The picture depicted in Graph 1 is one of waves of increasing integration followed by episodes of sudden reductions in cross-border flows.[3]

While countries – in particular, emerging economies – benefit from access to foreign savings, they can also be severely affected by episodes of disruption in cross-border capital flows. In fact, strong capital inflows can lead to exchange rate misalignments, foster credit booms and currency mismatches, and are subject to sudden stops. These can, in turn, trigger strong exchange rate depreciations and banking crises (Jeanne (2010)) and have long-lasting effects on GDP growth.[4]

Against this background, the challenge for policymakers lies in reaping the benefits of financial integration while managing these risks. Episodes of high capital flows to emerging economies have been managed with different tools. Macroprudential policies and capital controls have sometimes been used during the upswing to prevent credit booms and financial instability. Even more often – in particular, in the past decade – foreign reserve accumulation by central banks has been used to prevent excessive exchange rate misalignments and build up buffers against eventual sudden stops (Gosh et al (2012)).[5]

Graph 1: Gross capital flows in emerging economies



Note: Average of gross capital flows, as % of GDP, for emerging economies – as classified in the Appendix. "Foreign inflows" are investments by foreigners. "Domestic outflows" are investments overseas by residents. Quarters of financial stress are dashed (Q1 95, Q3 98, Q4 01, Q4 08).

Indeed, after the recent crisis, international reserve holdings have skyrocketed again in emerging economies. They exceeded USD 12 trillion in 2013, well above the USD 7.5 trillion at the onset of the

[2] Bussière et al (2015) show that, as reserves have reached their pre-crisis level, the speed of accumulation has slowed down.
[3] A similar picture emerges from Broner et al (2013) and Forbes and Warnock (2012).
[4] Bordo et al (2010) use early 20th century data to show that sudden stops can have lasting effects on GDP growth.
[5] Durdu et al (2009) present a general equilibrium model of reserve accumulation. It rationalises the build-up of large foreign reserves as a precautionary behaviour in an environment where credit constraints can lead to sudden capital stops. Caballero and Panageas (2008) compare self-insurance with active liability management and show that the latter can provide significant gains.

crisis. Emerging economies' international reserves climbed from USD 5 trillion before the crisis to USD 8 trillion in 2013. According to Jeanne and Rancière (2009), leaving aside China, reserve accumulation in emerging economies might be explained by precautionary motives. Financial integration in the last decades and the large shifts in the international financial intermediation in the aftermath of the crisis can also make emerging economies more sensitive to financial shocks (Shin and Turner (2015)), and this may call for a larger stock of reserves.

There is a growing consensus among policymakers that holding large stocks of foreign reserves pays off.[6] However, hard evidence supporting that view is scant, and there is mounting evidence that this policy might impose significant externalities and have major costs for the world economy (IMF (2010)). With this paper, we aim to provide additional elements to evaluate the effects of reserve accumulation. We do so by assessing the effect of international reserve holdings by central banks on the behaviour of cross-border investors, either foreign or domestic, through the analysis of gross capital inflows and outflows during periods of systemic financial stress.[7] Our approach goes beyond most of the empirical literature on the issue, which has focused mostly on the impact of reserves on either foreign flows or net capital flows.[8] By also focusing on resident investors, we follow a recent strand of literature that has suggested that international reserves are held at least partly to prevent and mitigate domestic capital flight. Along these lines, Obstfeld et al (2008) show that international reserves depend on the economy's monetary aggregate (M2), which, they argue, can be viewed as a proxy of the resources that residents can invest overseas.[9] Similarly, Jeanne and Rancière (2009) suggest that considering the level of M2 helps rationalise high levels of foreign reserves.

The literature using net flows has found contradictory evidence regarding the ability of international reserves to lower substantially the probability of experiencing sudden stops. According to Calvo (2007), sudden stops of capital flows are best prevented by orthodox domestic policies and limited balance sheet vulnerabilities, with international reserves playing an indirect role. Edwards (2007) argues that international reserves play a minor role in avoiding sudden stops. Calvo et al (2008) suggest that international reserve holdings could both prevent a sudden stop by mitigating exchange rate depreciation and act as a buffer in the event of such a stop. Along the same lines, IMF (2006) emphasises that international reserves are a relevant tool for self-insuring against external shocks.

Using net flows, however, can be misleading. Consider a sudden stop episode – a sharp reduction in net financial flows – and the consequent increase in financing needs. Does it reflect a reduction in overseas

[6] IMF (2011) analyses the level of reserves worldwide using a variety of reserve adequacy indicators. According to the Fund's preferred metric, most countries hold an excessive amount of foreign reserves.

[7] A related strand of the literature, instead of focusing on the benefits of reserve accumulation, studies its determinants. For instance, Bastourre et al (2009), using GMM techniques in a panel of emerging economies, find a U-shaped relationship between reserves and the development level. They also find that countries with flexible exchange rate regimes have higher ratios of reserves-to-GDP. Chinn and Ito (2006) fail to find a significant relationship between international reserves and an economy's degree of financial openness. Broto et al (2006) shows that a larger stock of reserves reduces the volatility of FDI net flows.

[8] For instance, Obstfeld (2011) argues that international reserves are held to prevent foreign capital flight and, thus, relate to countries' international liabilities.

[9] See also Frankel and Saravelos (2010) or Rose and Spiegel (2010) for empirical models focused on the reserve coverage to domestic monetary aggregates.

investment or an increase in investment overseas by residents? Along these lines, a few recent papers show that the underlying drivers of net financial flows are better understood if the data are divided into gross foreign inflows (ie financial investment in the country by non-residents) and gross domestic outflows (ie financial investment abroad by residents). Rothenberg and Warnock (2011) show that many sudden stop episodes were indeed episodes of resident capital flight and that only a fraction were driven by a contraction of gross foreign inflows. In turn, Forbes and Warnock (2012) show that global factors are important determinants of both resident and foreign sudden stop episodes and that, although domestic macroeconomic characteristics hardly matter, changes in domestic economic growth influence episodes of foreign capital flight. Also closely related to our paper, Broner et al (2013) and Cowan et al (2007) argue that a key difference between developed and emerging economies during financial stress lies in the behaviour of gross domestic outflows. According to Broner et al (2013), who study the behaviour of gross flows along the business cycle, during crises foreign investors flee while domestic investors tend to retrench.[10]

We follow this "gross approach" to study the impact of international reserve accumulation on the behaviour of gross capital flows, focusing on periods of global stress and taking into account both the occurrence of the stress and its intensity. We build an extensive quarterly database on gross capital flows in which we distinguish the behaviour of foreign investors in the economy from that of the economy's resident investors abroad. By looking separately at the domestic and foreign components of capital flows, we address the following questions. Do international reserves play a catalytic role vis-à-vis foreign investors? Do they affect the behaviour of gross domestic outflows? In light of the literature, we perform the analysis measuring reserves in terms of both international financial liabilities, to proxy for the resources that non-residents can pull out of the country, and a narrow monetary aggregate (M2), to proxy for the resources that residents can pull out of the country.

Our main results suggest that the level of international reserves significantly influences the behaviour of gross domestic outflows when financial stress increases. The evidence for the behaviour of gross foreign inflows is less clear. During financial stress, countries with more international reserves experience larger drops in gross domestic outflows. International reserves make residents more willing to invest savings domestically and repatriate capital invested overseas, mitigating the lack of foreign financing. According to our estimates, when financial stress is severe, outflows contract by 1.5 percentage points of GDP more for countries with reserves-to-M2 one standard deviation above the average.[11] Capital inflows, on the contrary, drop during the periods of stress, although under certain specifications larger holdings of reserves mitigate the reduction. In addition, the empirical analysis uncovers that the stock of reserves also matters outside these periods; the higher the stock of reserves, the larger the gross inflows, and the lower the gross outflows. This implies, ceteris paribus, that net flows are larger too.

[10] Broner et al (2013) further show that the various capital flow components respond to crises very differently.

[11] As comparison points, we choose the average and one standard deviation above the average. The effect depends also on the intensity of financial stress. We choose an EMBI value of 1,000 basis points, and refer to it as a "severe financial stress".

The findings in this paper are relevant for at least two reasons. First, we highlight a previously undocumented benefit of holding reserves – the buffering impact of reserves in times of financial stress through their effect on resident investors. The stabilising effect of reserves on the reaction of resident investors underscores potentially strong complementarities between a central bank's solidity and domestic investors' behaviour. Candidate explanations for this complementarity are numerous. It could be that residents are more willing to repatriate assets when they are confident about the strength of their currency or about the ability of the authorities to manage financial instability without resorting to financial repression (Reinhart and Sbraccia (2011)). In fact, Obstfeld et al (2010) argue that one important reason for accumulating reserves is to protect the domestic credit markets. From that perspective, the complementarity between residents and central bank reserves operates through the banking system balance sheet. Similarly, Reinhart and Takeshi (2013) recognise that reserves play a role in mitigating the risks of bank runs. For all these potential reasons, the relationship between reserve accumulation and resident investors that we uncover should be taken into consideration in the design of any financial safety net aimed at limiting countries' incentives to accumulate reserves.

Second, the exercise provides new insights into the growing literature on the dynamic behaviour of gross capital flows. In particular, the robust link we find between the level of reserves and the behaviour of domestic outflows in periods of financial stress helps reconcile the reduction of domestic investors' external exposure in such episodes, as documented in Broner et al (2013), and the recurrent domestic capital flight documented by Rothenberg and Warnock (2011) and Forbes and Warnock (2012).[12]

The rest of the paper is structured as follows. Section 2 describes the data. Section 3 provides preliminary evidence on the link between the behaviour of gross flows and the level of reserves during periods of financial stress. Section 4 presents the econometric exercise and discusses our main results and robustness checks. Section 5 concludes.

2. Data

We construct a database comprising 63 countries for the period 1991–2010. We select countries according to data availability, and are constrained by our use of quarterly data.[13] We use quarterly data, given that some relevant developments may last a few quarters or their impact may be felt in quarters of different years. Our final sample, detailed in Annex I, contains 44 emerging economies and 19 developed countries.[14]

Data on financial flows, as reported in balance of payments data, come from the IMF's International Financial Statistics (IFS). This source allows for disaggregation between financial inflows by foreigners,

[12] While our approach is similar to that of Broner et al (2013), there are significant differences with Rothenberg and Warnock (2011). Rothenberg and Warnock (2011) use contractions in monthly international reserves to classify episodes as either capital flight or true sudden stops, depending on whether the change in reserves is driven by gross domestic outflows or gross foreign inflows.

[13] For instance, the large drop in capital flows in the last quarter of 2008 occurred after several quarters of large inflows. Thus, using annual data would hide this sharp contraction.

[14] We dropped financial-centre countries (Hong Kong, Iceland, Ireland and Luxembourg), as their high and volatile flows drive the results.

investments and disinvestments in the receiving economy, what we call gross foreign inflows (GFI), and financial outflows by residents, investments and disinvestments from the economy to overseas, defined here as gross domestic outflows (GDO). Further disaggregation by instrument allows gross flows to be disentangled into foreign direct investment (FDI) flows, portfolio flows and other investment flows.

Using this information, we construct the following aggregates in GDP terms. First, we define a measure of total financial investments by non-residents in the reporting economy (GFI), which includes all three categories: FDI, portfolio inflows and other inflows. Second, we define an analogous measure of total financial investments by residents in the reporting economy overseas (GDO), excluding central banks' purchases and sales of international reserves. Using these two aggregates, we construct a measure of net capital flows, NF = GFI – GDO.[15] Finally, using the available disaggregation by types of flow, we construct measures of short-term capital flows (hot flows). Thus, we define short-term gross foreign inflows (GFIST) by adding portfolio and other investment flows by non-residents in the reporting economy; and short-term gross domestic outflows (GDOST) using analogous information regarding residents' activity. Chart A.1 in the Appendix depicts the evolution of gross flows and breaks them down between FDI and short-term flows. The latter are more volatile and increased more before the Great Financial Crisis. Interestingly, while domestic short-term outflows are smaller in absolute terms, they have more weight in total domestic outflows than short inflows have in total foreign inflows.

For all of these variables, measured relative to GDP, we construct a four-quarter standardised cumulative version:

$$\hat{x}_{it} = \frac{\sum_{t=-3}^{0} x_{it}}{\sigma_{x_i}} \; where \;\; x_{it} = \{GFI/GDP,\ GDO/GDP,\ NF/GDP,\ GFIST/GDP,\ GDOST/GDP\}$$

Smoothing the series using a cumulative measure has two important advantages. First, it reduces the importance of dating exactly the quarter in which the episode of global financial stress unfolds. Second, it minimises the importance of idiosyncratic country-specific events. However, it also entails a cost, as it washes out the impact of the shock. Additionally, to reduce the impact on the estimation of the most volatile countries, we follow Broner et al (2013) and standardise the series by dividing them by their corresponding standard deviation.

The final component of the database is the stock of reserves, which also comes from the International Financial Statistics (IFS) database. In assessing the level of reserves, the choice of the variable relative to which reserves are measured is fundamental. There is an ample literature on reserve adequacy, which can be used as a guide for the choice. One of the most popular adequacy rules is the Guidotti-Greenspan rule, according to which reserves should cover short-term external liabilities (maturing in less than one year). Other rules look at reserves as a fraction of foreign currency liabilities, short-term external debt,

[15] *NF* does not match the current account, which also includes errors and omissions and exceptional financing items.

imports or monetary aggregates. There is no best measure, as different measures provide different insights.[16]

Given our focus on the distinct behaviour of resident and foreign investors, we look at the level of reserves relative to two measures. First, we define a measure of the total resources that foreigners can pull out of the country, foreign liabilities, as collected by the IMF's international investment position (IIP) data. Additionally, we look at the level of reserves relative to domestic M2, which proxies the resources that residents can invest overseas, and takes into account the risk of experiencing capital flight by residents (Obstfeld et al (2010)). Hence, we define the following variables:

$$RX_{it} = R_{it}/X_{it} \ where \ X_{it} = \{IL_{it}, M2_{it}\}$$

where R_{it} stands for international reserves, IL_{it} represents the international liabilities of the country and $M2_{it}\}$ is the country's M2. Then, RIL_{it} measures the level of reserves relative to potential outflows from non-residents. In turn, $RM2_{it}$ measures the level of reserves relative to potential outflows from residents. Chart A.2 in the Appendix depicts the histogram for each ratio, for emerging economies. Both distributions have similar skewness to the right. A relevant feature of our data set on international reserves is the low density of the right tail. Only 5% of our observations for the coverage ratio, measured relative to M2, are above 80% coverage. This feature of the data will be important later, in the discussion on non-linearities.

The correlation between these two measures of reserves is relatively low, suggesting that, as detailed below, *RILF* and *RM2* provide different insights. Additionally, the low correlation between our reserve indicators and both exchange rate regime and credit rating indicators suggests that the relationship of reserves with any of these two indicators cannot solely explain the results we obtain. We formally test this insight in the coming section.

3. Preliminary evidence

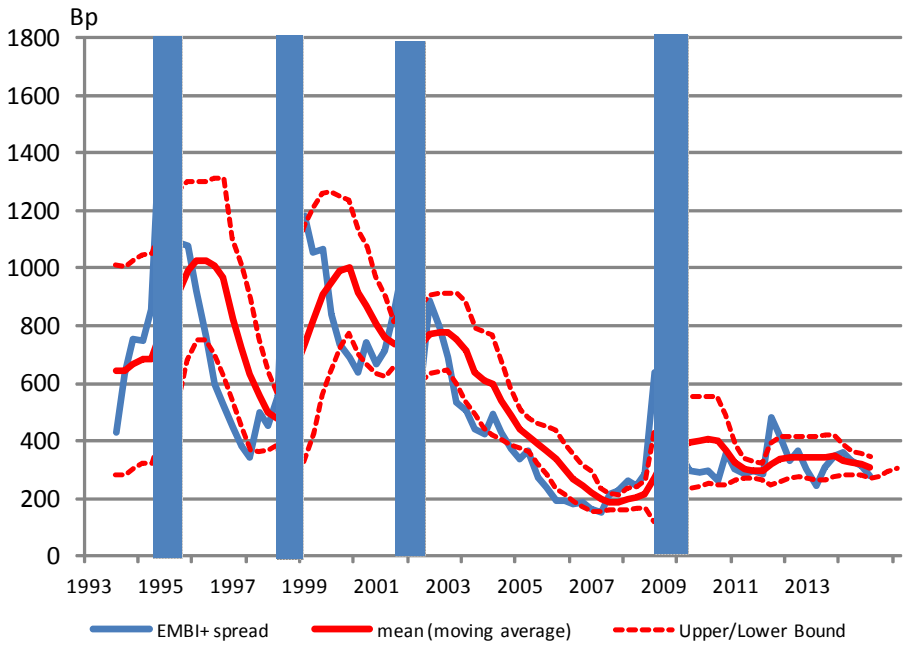
We begin our assessment of the role of reserves in the dynamics of gross flows by plotting their behaviour in periods of financial stress, both unconditionally and by making such behaviour relative to the countries' reserve levels.[17]

Following Calvo et al (2008), we use the Global EMBI+ Index to identify periods of global financial stress in emerging economies.[18] The periods of global financial stress are defined as those quarters in which the Global EMBI+ spread (a) is more than two standard deviations over its eight-quarter moving average and (b) reaches the maximum in a four-quarter window. Graph 2 shows the evolution of the EMBI spread, its time-varying mean and a two standard deviation window around this mean. This methodology returns five events: the first quarter of 1995, the third quarter of 1998, the fourth quarter

[16] See IMF (2011) for a recent analysis of some of the most popular rules of thumb.
[17] For more details, see Alberola et al (2012).
[18] Importantly, the Global EMBI represents the universe of emerging market sovereign issuers and is not driven by one country's economic condition. It is a measure of risk appetite towards emerging economies as an asset class.

of 2001, the fourth quarter of 2008 and the second quarter of 2013. We drop this last event in the analysis because it was not really a high-stress period; the very low volatility at the time explains that a spike in the spreads surpasses the standard deviation bands. The episodes identified as events are shadowed, and they correspond, roughly, to the Tequila, Russian, Argentine and Lehman crises.

Graph 2: Global EMBI. Events of financial stress

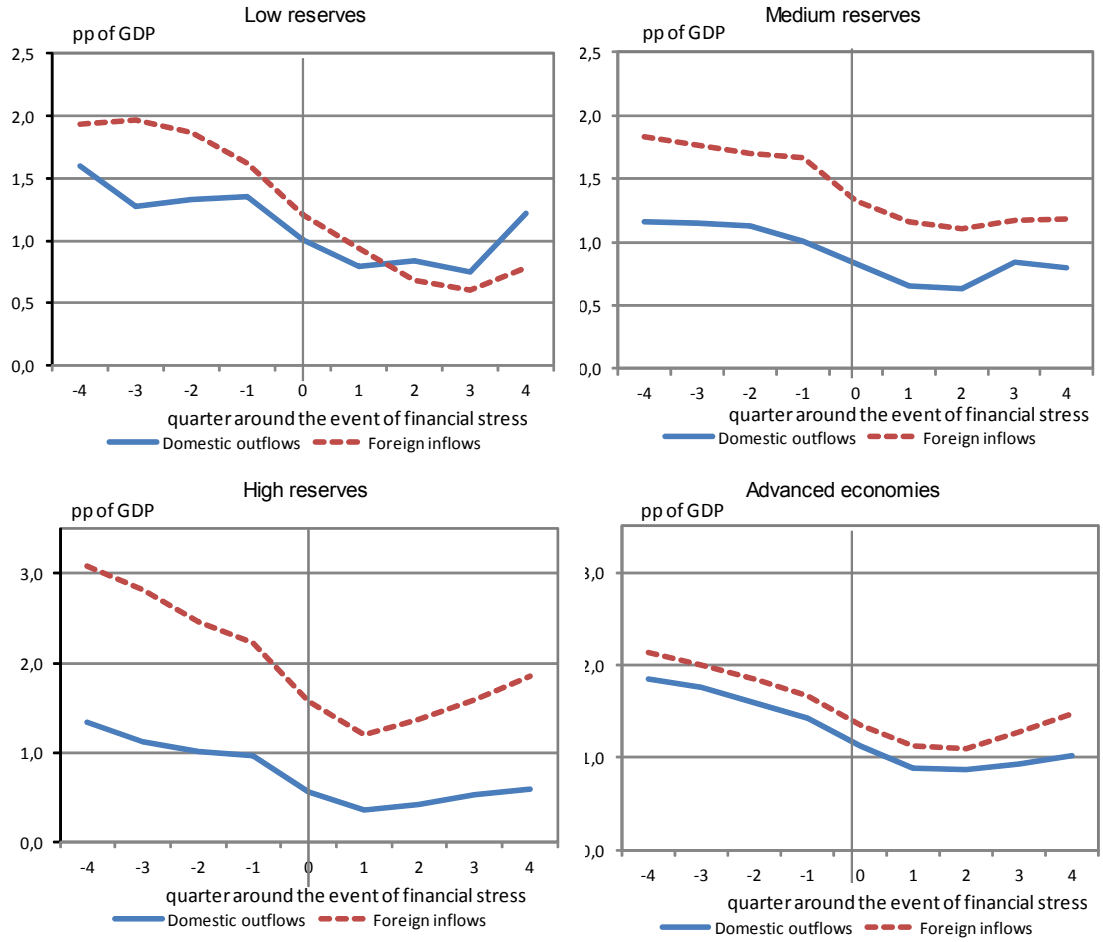


Source: JPMorgan and authors' calculations. Global EMBI-mean is the eight-quarter moving average of the Global EMBI. Upper/Lower bounds are defined as the EMBI-mean plus (minus) the last eight-quarters standard deviation of the Global EMBI. Quarters of financial stress are dashed (Q1 95, Q3 98 Q4 01, Q4 08).

The next step is to identify how gross flows evolve during these episodes conditional on the level of reserves held by the different countries' central banks. Graph 3 highlights this behaviour, grouping countries according to their reserve levels, relative to domestic M2, at the onset of each period of financial stress. In the graph, the high-level group comprises those emerging economies with reserves above the 80th percentile. In contrast, the low-level group contains those countries with reserves below the 20th percentile. The rest of the observations enter into the middle reserves group. The advanced countries form an additional group that serves as a reference.

Graph 3 below displays the average behaviour of gross capital measures for each reserve group. The quarter of the event is defined as $t = 0$, so that we can observe the dynamics for the four periods before and after the event. The red dashed lines represent GFI by non-residents and the solid blue lines GDO. Note that GFI plunge around periods of financial stress for all four groups. Conversely, GDO contract somewhat more in advanced countries and high-reserve emerging economies, but not in medium-reserve and low-reserve countries.

Graph 3. Financial inflows and domestic outflows around episodes of financial stress



Note: Financial inflows and domestic outflows are cumulative last four-quarters flows, measured in GDP terms, standardised by country-specific standard deviation. Emerging economies are classified in three groups according to their ratios of international reserves to M2 in each of the four quarters of financial stress (Q1 95, Q3 98, Q4 01, Q4 08). "High reserves" and "Low reserves" include the 20% of countries with highlest/lowest international reserves — the remaining 60% are included as "Medium reserves". Advanced economies are presented as benchmark, irrespective of their level of reserves.

This preliminary evidence points to the following pattern: a high level of reserves does not prevent the reduction of capital inflows during stress periods, but it stems domestic financial outflows, helping to mitigate the squeeze in net capital inflows.[19]

4. International reserves during periods of stress: a panel data approach

In this section, we formally test our previous findings in a more comprehensive framework by considering a number of determinants of the behaviour of gross capital flows through a panel data analysis. As there is no agreed benchmark for studying the determinants of gross capital flows, we extend the analysis in Cowan et al (2007) and Broner et al (2013). Our baseline model includes the country's credit rating, the growth rate of GDP, the current account, the exchange rate regime, the VIX and the EMBI spread as controls. More specifically, we estimate the following equation:

[19] This graphical evidence is in line with the econometric event analysis in Alberola et al (2012), who confirm that the contraction in outflows is significantly higher the higher the reserves.

$$(1)\quad \hat{x}_{it} = \alpha + \theta_i + \rho_i t + \delta y_{it-1} + \epsilon_{it}$$

The model includes a constant, α; country fixed effects θ_i; country-specific time trends, $\rho_i t$; and a vector, y_{it-1}, that collects the set of (predetermined) economic controls mentioned above and our metrics of international reserves. In the next three sections, we estimate and further augment this model to investigate the role of reserves during financial stress.

Financial markets view emerging economies as an asset class. This, as argued by Forbes and Warnock (2012), makes contagion highly likely. To correct for the potential biases that the presence of cross-sectional correlation could create, we also perform the analysis using the Driscoll-Kraay estimator, which allows us to correct for the presence of cross-sectional correlation.

4.1 Basic model: stress periods as dummies

As a first step, we include a crisis dummy in y_{it-1}. This dummy is a binary variable taking the value 1 in the quarter of the financial shock and each of the four subsequent quarters, and zero otherwise.[20] To gauge the effect of reserves during stress periods, we include among the set of explanatory variables interaction of the crisis dummy with our measures of international reserves. We also include quadratic terms to control for potential non-linear effects associated with sudden stops. The simultaneous introduction of reserve indicators, stress indicators and their interaction allows us to interpret the β coefficients as the specific relationship between reserves and the corresponding gross flows during periods of financial stress.

Table 1 shows the results for GFI and GDO using reserves measured in terms of the domestic M2. Table 2 shows the results when reserves are measured as a fraction of international liabilities.

The first and fourth columns in both tables show the benchmark model for GFI and GDO. Foreign inflows *are* positively associated with higher ratings and GDP growth, and negatively correlated with the current account and the EMBI Index. There is no significant correlation with either the VIX or the exchange rate regime indicators. As regards domestic outflows, GDP growth affects GDO positively, while the EMBI and VIX indices affect them negatively and significantly. These results, which highlight the procyclicality of gross flows, are similar to those in Broner et al (2013).[21] In the remaining columns, we extend the model (as detailed above) and include the ratio of reserves (linear and quadratic), the crisis dummy, and the interactions between them. The results for inflows and outflows are remarkably different.

Foreign inflows are not significantly affected by reserves, regardless of whether they are measured in terms of M2 (Table 1) or international liabilities (Table 2). This holds for normal and stress periods, as reflected by the lack of significance in the interaction between crisis and reserves. Only the non-linear

[20] We chose four quarters to match the window analysed in the event analysis.
[21] Our results are in line with those in Forbes and Warnock (2011), who, focusing on extreme movements in gross flows, find that global factors affect both residents' and foreigners' behaviour, but that domestic macroeconomic factors relate more to foreign flows.

term of reserves measured in terms of foreign liabilities has a significant, negative, impact on foreign inflows. Very large reserves seem to accompany a relatively stronger drop in external financing. When we control for cross-sectional correlation (column 3), the results do not change substantially – only the exchange rate regime indicators become significant.[22]

These results are in stark contrast to those for domestic outflows. As reported in Table 1, the event dummy has a positive and statistically significant effect. In emerging economies, domestic outflows are higher during stress times, everything else equal. This result has to be assessed jointly with the impact of ratios of reserves-to-M2 during times of stress. We find that they have a non-linear and statistically significant impact on GDO. The negative-linear and positive-quadratic coefficients indicate that, while accumulating reserves initially reduces the outflows, there are decreasing returns to scale to this strategy. This result is robust to using a fixed effect estimator (column 5) or a model that corrects for cross-country correlation (column 6). The results in Table 1 also show that, once we expand the model to include reserves and the crisis dummy, the size of the EMBI coefficient is smaller and less significant (column 5). Indeed, once we control for cross-sectional correlation, the coefficient associated with the EMBI is no longer significant (column 6).

All together, the results suggest that, although outflows tend to increase during episodes of financial stress, the stock of reserves mitigates that effect – but such mitigating effect becomes relatively less strong as the coverage ratio increases. A similar, albeit less robust, effect is found when we use reserves-to-financial liabilities (see columns 3 and 4 of Table 2).

4.2 Extensions and robustness checks

The next step to understand the relevance of reserves is to take into account the intensity of the stress. As shown in Graph 2, financial stress fluctuates strongly over time: there are other spikes in financial stress – albeit not to extreme levels – and periods of different financial stability. Moreover, it is evident that the four periods under scrutiny feature different stress intensities.

To gauge the relevance of stress intensity, we interact reserve adequacy ratios with our measure of stress, the EMBI spread $EMBI_{it} * RX_{it}$. As before, we include linear and quadratic terms of reserve adequacy. As in the previous specifications, the joint introduction of reserve indicators, the EMBI and the interaction between them allows us to interpret the β coefficients as the specific relationship between reserves and $\hat{x}_{it}$ as a function of the degree of financial stress.[23]

Table 3 presents the results on gross domestic outflows, total and short-term, respectively. We present the results when international reserves have been scaled using M2. As expected, reserves-to-M2 is a more relevant metric when studying domestic residents' investment decisions.[24] As before, when we correct for cross-sectional correlation using the Driscoll-Kraay estimator (column 1), the ratio of reserves

[22] We find no significant coefficient for the crisis dummy. This is because the information contained in that dummy is already reflected in the EMBI. Still, we need to incorporate the variable to be able to properly read the interaction term.
[23] Accordingly, we drop the crisis indicator, which becomes redundant.
[24] Reserves-to-international liabilities fails to have a significant effect on residents in the robustness checks and extensions.

has a non-linear effect on domestic outflows. Reserves do contribute to reducing domestic outflows, and this effect becomes stronger as the financial stress worsens.

Interestingly, international reserves affect more strongly short-term domestic flows, whose dynamics have a more volatile nature. In the case of short-term outflows, the results also hold (Table 3, column 5).

Our analysis so far has focused on emerging economies. We next investigate whether reserves determine capital flow dynamics in advanced economies too during times of stress. We find that the stabilising impact on domestic outflows we have documented for emerging economies is absent in advanced economies. Indeed, column 2 in Table 3 shows how in advanced economies reserves have quite the opposite effect on domestic outflows: they do increase as financial stress mounts and as international reserves rise. Short-term domestic outflows do not depend on reserves in the subsample of advanced economies (column 6). In advanced economies, probably reflecting their role as a source of funds, domestic outflows do contract when financial stress increases.

Subsequently, we investigate the impact of reserves on domestic capital flows from a forward-looking perspective. In previous results, we have used as a dependent variable four-quarter cumulative financial flows. Although the use of cumulative measures is standard in the literature, their use poses a problem in understanding the estimated coefficient as being associated with present instead of past observations. To assess the relevance of such concern, we construct a new dependent variable: the sum of financial flows in the current quarter, and three quarters ahead. Such measure allows us to investigate, in more detail, the response of capital flows to the explanatory variables. The results, shown in column 7, confirm our previous findings on total and short-term domestic outflow dynamics. Short-term domestic outflows have the expected non-linear relationship with reserve holdings – a linear negative effect and a positive quadratic term – which increases with the degree of financial stress. Interestingly, they increase with financial stress (measured by the EMBI), as we found previously in Table 1. These results do not hold for domestic outflows (column 3), confirming that short-term flows are more responsive to reserves-to-M2 as financial stress mounts.

As documented in Broner et al (2013), domestic outflows and foreign inflows are highly synchronised. For that reason, as a robustness test, we introduce them as explanatory variables in the equation (results are shown in columns 4 and 8). Our main results still hold. The results are similar for both overall and short-term outflows; they tend to increase as financial stress increases, but have the aforementioned non-linear relationship with reserve holdings.

Finally, we investigate whether our results are robust when we control for capital account openness. As a measure of a country's capital account openness, we include the Chinn-Ito index. Results for domestic outflows and short-term domestic outflows are shown in columns 5 and 10. The main findings hold. In fact, we find that, for domestic outflows, the coefficient of the non-linear terms becomes higher. Our results show that capital account openness is negatively related to domestic outflows. This suggests that, after controlling for other determinants, having more restrictions to financial flows fosters domestic outflows.

We turn now to Table 4, which presents the results for gross financial inflows. As in our benchmark estimation, the results are less robust. To address the behaviour of foreign investors, we measure reserves in terms of their ratio to international liabilities, which our previous analysis showed to be a more relevant metric. The sign of the control variables remains similar to that of the benchmark estimations shown in Tables 1 and 2.

In what follows, we focus on the interaction between financial stress and the ratios of reserves. The results show that gross inflows (GFI contract when financial stress increases – the EMBI has a negative sign. Reserves-to-financial liabilities has a non-linear impact on foreign inflows: there is a positive linear effect, which decreases with the level of reserves – since the quadratic term is negative (column 1). This finding is qualitatively similar to the one found for gross domestic outflows (GDO): available financing decreases as financial instability mounts, but reserves have a stabilising role. There are, however, remarkable differences in the size, which are relevant, since, as discussed below, reserve holdings are not enough to prevent a reduction of foreign financing in periods of stress.[25]

The stabilising role of reserves on gross inflows is specific to emerging economies. Column 2 shows that, in advanced economies, the interaction terms (linear and quadratic) are not significant. These results are also robust to the inclusion of gross outflows in the equation – to take into account simultaneity of inflows and outflows in columns 4 and 8 – but not to the use as a dependent variable of the cumulative forward-looking financial inflows in columns 3 and 7. The results are also robust to the inclusion of the Chinn-Ito capital account openness index (columns 5 and 10), which appears to have no statistically significant effect on foreign flows.

Overall, the stabilising role of reserves is more robust on domestic outflows – in particular, for our short-term measure of capital outflows (including other flows and portfolio flows) – and less so for foreign inflows.[26]

4.3 Economic significance of the results

We now discuss the economic significance of the results – the extent to which international reserves impact gross capital flow dynamics as financial stress mounts. The results presented are those obtained from the more robust specification, the one that controls for cross-sectional correlation (column 1 of Table 3 for outflows and column 1 of Table 4 for inflows). We compute and plot the estimated economic joint effect of financial stress and reserves by multiplying the (standardised) effect on capital flows by the median of the country-specific capital flow standard deviation. The standardised effect is obtained

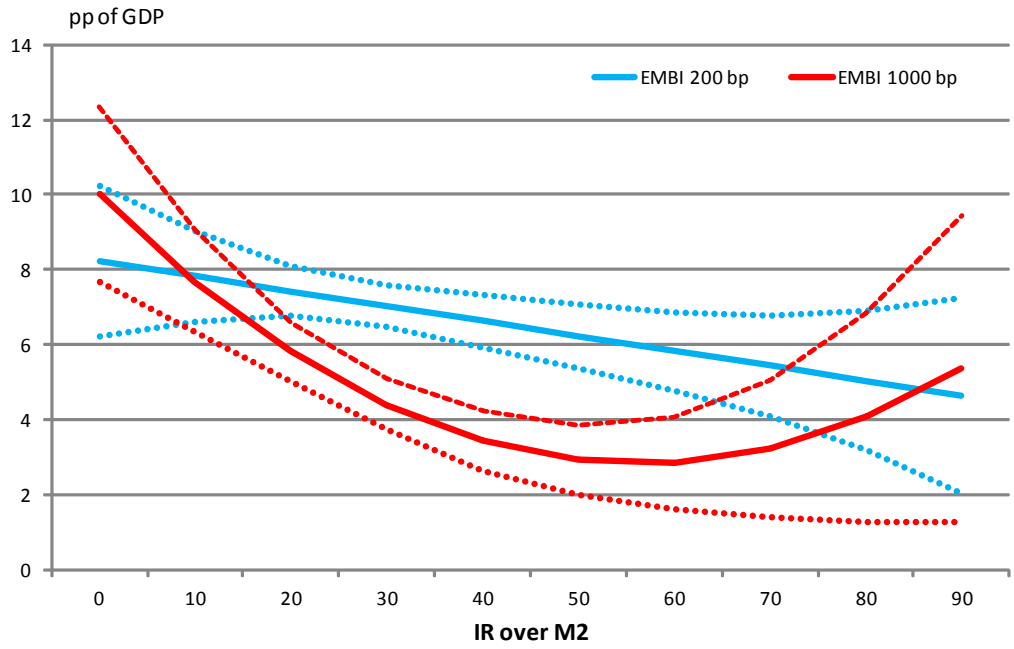
[25] As we discuss below, these differences are so significant that the net effect during financial stress is quite the opposite.

[26] In unreported exercises, we run all regressions on two different time subsamples: 1991–2000 and 2001–10. We find that the results are stronger, particularly for short-term outflows, for the 2001–10 subsample, which has twice the number of observations of the 1991–2000 subsample. We interpret this to mean that the role of reserves has become more important over time.

by computing the effect of various combinations of reserves and financial stress using the estimated coefficients. We include 95% confidence bands of the estimation.[27]

The effect of reserves, in terms of M2, on domestic outflows is shown in Graph 4 below. In order to gauge intuition about the importance of reserves during stress periods, we compare their effect in two different scenarios: one where the EMBI is at 200 basis points, reflecting normal times; and the other reflecting stress times with an EMBI value of 1,000 basis points.[28]

Graph 4. Domestic outflows. Relevance of International Reserves to M2 during financial stress



Note: IR stand for International Reserves. IR measured relative to M2. Graph is constructed using the coefficients of column 1 of Table 3. All the variables, but IR to M2 and the EMBI, are measured at their average values. IR over International Liabilities are measured in an interval which comprises 99% of the observations. Global EMBI is measured at two values: '1000 bp' is the average of the Global EMBI during the four events of financial stress, while '200 bp' is the average value of the last 12 quarters before the global financial crisis. Domestic outflows are rescalated with their corresponding average standard deviation. Dotted lines are 95% confidence intervals.

As shown in the graph, under severe financial stress, a low ratio of reserves – below 10% – can imply higher domestic outflows than in periods of reduced spreads. Moreover, domestic outflows drop sharply until the coverage ratio is around 60%.[29] Beyond that point, confidence bands widen, as there are very few observations with such high levels of reserves.

To further investigate developments in the tails of the distribution of reserves, we run threshold regressions. We use the benchmark equation, keeping the linear interaction term between reserves and the EMBI; however, we replace the quadratic term with dummies which take the value 1 if observations are above a given threshold of reserves, and 0 otherwise. We define three dummies, using as thresholds

[27] We measure the rest of the explanatory variables at their means: that way, we show the marginal effect of international reserves to M2, for the average emerging economy (the VIX is also measured at its mean).
[28] One thousand basis points is the average EMBI spread on the four episodes of financial stress in our sample.
[29] Since the bulk of observations of reserves-to-M2 are below 80%, we focus on the 0–80% interval.

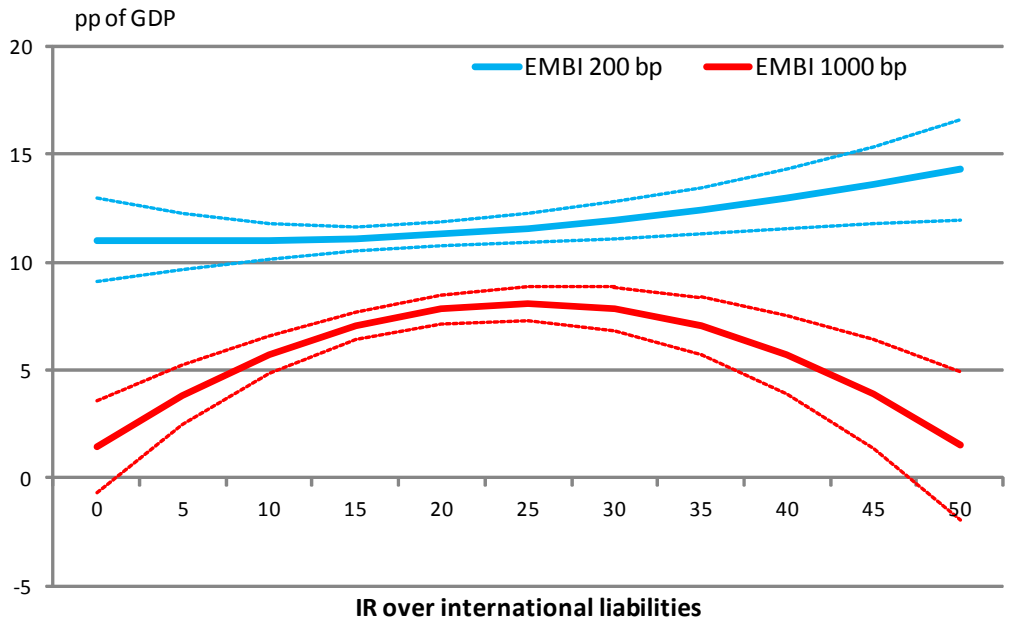
the 10th, 90th and 95th percentiles, which correspond, respectively, to coverage ratios of 10, 64 and 82. The results are reported in Table 5, panel A. Column 1 shows that the coefficient of the 90th percentile dummy is positive and statistically significant, confirming the existence of decreasing returns to reserve accumulation. The 10th percentile dummy, though, is not statistically significant, suggesting that very low reserves might not have a marginally stronger effect. We also split these observations into two groups: those included within the 90th and 95th percentiles, and those above the 95th percentile. We find that only observations in the first bucket display a significant impact on domestic outflows. There is no significant effect specific to the observations with the higher reserves. This shows that results become blurred for very high values of reserves. Overall, these results confirm our interpretation that non-linearities exist; but patterns in the tails of the distributions need to be interpreted with caution. As a result, and given our previous discussion on the lack of observations on that tail, we abstain from extracting any conclusion from the turnaround observed at higher and lower levels of reserves. What matters to our analysis is that, as financial stress increases, higher levels of reserves-to-M2 feature less domestic outflows.

In turn, Graph 5 shows the effect of reserves, in terms of international liabilities, on financial inflows. A first issue worth mentioning is that, at high EMBI levels, financial inflows are lower for any ratio of reserves-to-financial liabilities. At low levels of stress – low spreads – financial inflows are stronger where ratios of reserves are higher. This changes once financial stress mounts. At higher spreads, reserves mitigate the reduction in capital inflows. Interestingly, this effect shows decreasing returns to scale, as additional increases in the coverage ratio improve financial inflows relatively less.

As before, we also run threshold regressions. Again, we look at the 10th, 90th and 95th percentiles, which correspond, respectively, to ratios of reserves-to-international liabilities of 7, 33 and 40.[30] The results, shown in panel B of Table 6, are less robust. Foreign inflows are negatively related to the EMBI, but the interaction term fails to be significant; we find that if reserves-to-international liabilities is above the 90th percentile, foreign inflows are lower during financial stress (column 1); being below the 10th percentile has no statistically significant impact on foreign inflows. We obtain similar results for short-term foreign inflows (columns 4–6). The results suggest that a non-linear effect exists, although it is not as strong as the one on outflows.

[30] The bulk of observations of reserves-to-international financial liabilities are below 50% (slightly below the 99th percentile), so we analyse that interval.

Graph 5.Foreign inflows. Relevance of International Reserves to IL during financial stress



Note: IR stand for International Reserves. IR measured relative to International Liabilities. Graph is constructed using the coefficients of column 1 of Table 4. All the variables, but IR to International Liabilities and the EMBI, are measured at their average values. IR over International Liabilities are measured in an interval which comprises 99% of the observations. Global EMBI is measured at two values: '1000 bp' is the average of the Global EMBI during the four events of financial stress, while '200 bp' is the average value of the last 12 quarters before the global financial crisis. Foreign inflows are rescalated with their corresponding average standard deviation. Dotted lines are 95% confidence intervals.

Summing up, the results of this exercise provide very robust evidence that international reserves might be relevant during financial stress in a somewhat unexpected way. While they do not prevent a reduction in inflows by foreign investors – although higher reserve coverage ratios can mitigate it – they facilitate financial retrenchment by resident investors. The economic significance of the effect during periods of financial stress is substantial. Domestic outflows might contract by up to 6 percentage points of GDP for an average country and mitigate the reduction in capital inflows by in the order of 5 percentage points of GDP.[31] Such reduction contributes to stabilising the generalised drought in foreign financing that emerging economies frequently experience during financial stress.

5. Conclusions

In this paper, we characterise the dynamics of gross capital flows around periods of global financial stress and relate them to the countries' holdings of international reserves. In contrast to previous contributions focusing on net flows, we delve into gross capital inflows and outflows.

We document stark differences across countries in financial flow dynamics around periods of global financial stress depending on the level of reserves. In advanced countries, foreign inflows and domestic

[31] According with our estimates, outflows contract by 1.5 percentage points of GDP more for countries with a ratio of reserves-to-M2 one standard deviation above the average.

outflows contract in a systemic way. Conversely, in emerging economies, while financial inflows do fall no matter the level of reserves, domestic outflow dynamics change depending on international reserve holdings. In high-reserve countries domestic outflows are significantly lower during financial stress, while in low-reserve countries there is no such retrenchment and we even find signs of capital flight. This led us to hypothesise that reserves play a catalytic role vis-à-vis resident investors.

One intriguing result is the non-linearities of the impact of reserve accumulation on the dynamics of flows. Beyond a threshold level, the marginal impact on reserve accumulation of mitigating the fall in inflows or increasing the retrenchment of outflows is negative. The results are not very robust, but they raise the question whether accumulating reserves can also be a symptom of financial vulnerabilities. For instance, Filardo and Siklos (2015) have recently shown the existence of a link between asset price inflation and reserve accumulation.

To assess the robustness of this result, we have presented panel data evidence where we controlled for additional factors. Our results suggest that capital flows are procyclical and that country-specific variables are less important than global factors in explaining gross domestic outflows. More importantly, our panel results provide robust evidence that international reserves are associated with a mitigation of the reduction of financial inflows and with a higher propensity of resident investors to repatriate capital invested abroad during periods of global stress. Cowan et al (2007) and Broner et al (2013) document that, on average, domestic capital retrenches during crises, a result in contrast to the notion of recurrent domestic capital flight documented in Forbes and Warnock (2012) and Rothenberg and Warnock (2011). Our results show that taking into account the stock of reserves held by the central bank is one way to reconcile these two sets of results. Countries with low reserves are more likely to see their residents place their capital abroad during crises. The opposite happens when a country's central bank has an abundant stock of reserves. These results challenge current approaches to measuring reserve adequacy, and call for refining such tools to better account for the role of resident investors.

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Appendix

Countries under study

Advanced economies: Australia, Austria, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Emerging economies: Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Bosnia-Herzegovina, Brazil, Bulgaria, Cambodia, Chile, Colombia, Croatia, the Czech Republic, Ecuador, Estonia, Georgia, Hungary, India, Indonesia, Israel, Jordan, Kazakhstan, Korea, Latvia, Lithuania, Macedonia (FYR), Malaysia, Mexico, Moldova, Morocco, Pakistan, Peru, the Philippines, Poland, Romania, Russia, Singapore, Slovakia, Slovenia, South Africa, Thailand, Turkey, Uruguay and Venezuela.

Data description

Financial flows: Data are from the IFS. The variables used to compute gross financial outflows are direct investment abroad (line 78 bdd), portfolio investment assets (line 78 bfd), other investment assets (line 78 bwd) and changes in reserves (line 79 dbd). On the other hand, gross financial inflows include direct investment in the reporting economy (line 78 bed), portfolio investment liabilities (line 78 bgd) and other investment liabilities (line 78 bid).

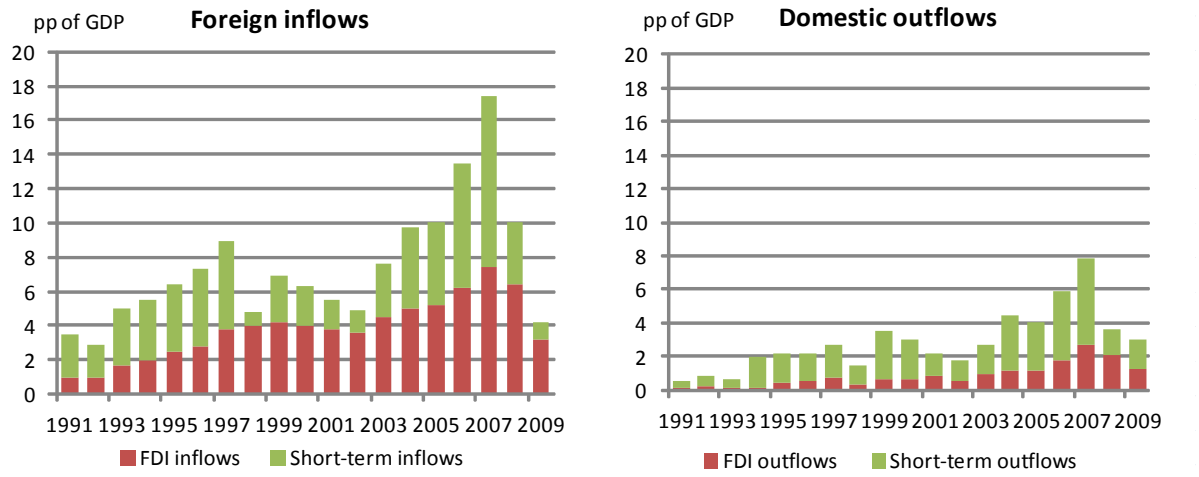
International financial liabilities and M2: We construct data on international financial liabilities, mixing the updated version of the external wealth of nations mark II database (Lane and Milesi-Ferretti (2007)) with data from the IFS. We consider the first source more reliable for earlier dates. Data were annually interpolated to obtain quarterly figures. In terms of IFS coding, the variables employed are international financial liabilities (line 79 lad) and reserve assets (line 79 akd). We measure M2 as the sum of lines 34 and 35, from the IFS.

Data on financial spreads and credit ratings: We use the JPMorgan Emerging Market Bond Index (EMBI) Global (less liquid but more diversified than the EMBI+), which is a traditional, market capitalisation-weighted index. The credit ratings were obtained from Standard & Poor's.

Exchange rate regime: Exchange rate regimes are classified using the Ilzetki et al (2008) classification. This classification takes four values, from 1 to 4, one signifying the most fixed regimes and four the most flexible. We regroup them in three groups: a fixed exchange rate regime group, comprising observations with the value 1; a managed exchange rate regime group, comprising observations with values 2 and 3; and a flexible exchange rate regime, comprising observations with the value 4.

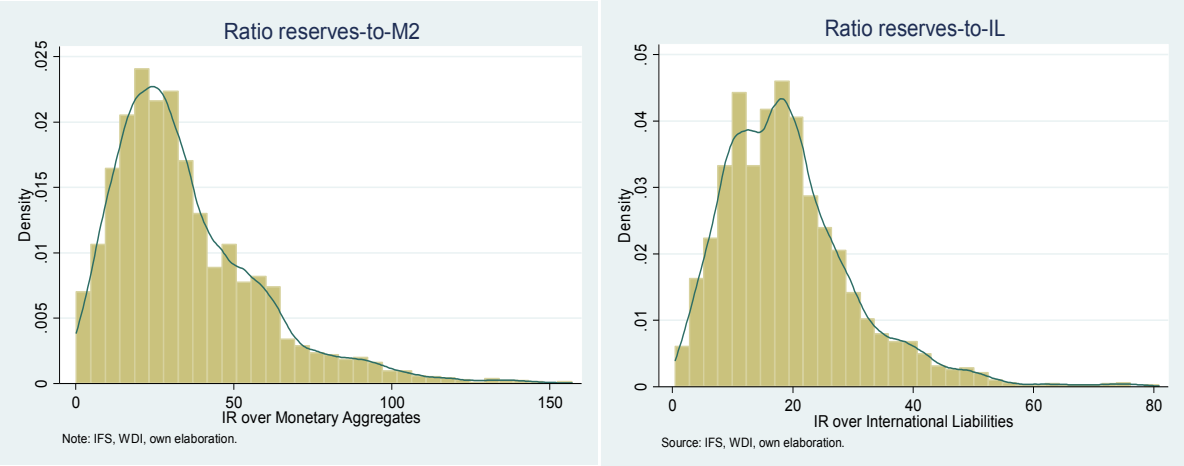
VIX index: We obtained the VIX index, as produced by the Chicago Board Options Exchange, from Datastream.

Chart A.1. Gross capital flows composition



Note: simple average of all emerging economies. Short-term inflows/outflows include portfolio flows and other investment. Gross flows measured in terms of domestic GDP.

Chart A.2. Distributions of international reserve ratios for emerging economies



Note: the chart displays the histogram of the distribution of reserves for each of the two ratios used in the analysis. In each graph, a kernel is overlaid.

Table 1. Gross capital flows, international reserves-to-M2

	Foreign inflows			Domestic outflows		
	(1)	(2)	(3)	(4)	(5)	(6)
	FE	FE	DK	FE	FE	DK
Current account	-0.095***	-0.099***	-0.099***	-0.006	0.008	0.008
	[0.012]	[0.015]	[0.007]	[0.016]	[0.014]	[0.010]
Peg exchange rate	0.279	0.367	0.367**	-0.177	-0.167	-0.167
	[0.304]	[0.315]	[0.144]	[0.227]	[0.197]	[0.182]
Managed exchange rate	0.187	0.199	0.199	-0.141	-0.052	-0.052
	[0.189]	[0.218]	[0.122]	[0.172]	[0.162]	[0.091]
S&P rating	0.100***	0.103***	0.103***	-0.005	-0.001	-0.001
	[0.026]	[0.027]	[0.012]	[0.032]	[0.030]	[0.020]
GDP real growth	0.051***	0.031**	0.031***	0.021**	0.003	0.003
	[0.010]	[0.014]	[0.010]	[0.009]	[0.007]	[0.006]
EMBI	-0.087***	-0.065***	-0.065**	-0.054***	-0.035*	-0.035
	[0.016]	[0.019]	[0.026]	[0.018]	[0.020]	[0.026]
VIX	-0.004	-0.003	-0.003	-0.019***	-0.019***	-0.019***
	[0.004]	[0.004]	[0.006]	[0.006]	[0.006]	[0.005]
EVENT		-0.078	-0.078		0.459*	0.459
		[0.269]	[0.215]		[0.253]	[0.286]
EVENT*IR over M2		-0.010	-0.010		-0.034**	-0.034*
		[0.014]	[0.009]		[0.014]	[0.018]
EVENT*IR over M2, quadratic		0,021	0.021*		0.039**	0.039*
		[0.000]	[0.000]		[0.000]	[0.000]
IR over M2		-0.004	-0.004		-0.024	-0.024***
		[0.016]	[0.005]		[0.018]	[0.007]
IR over M2, quadratic		0.022**			0.015**	0.000**
		[0.000]	[0.000]		[0.000]	[0.000]
Observations	1,948	1,827	1,827	1,855	1,740	1,740
R-squared	0.51	0.54		0.31	0.37	
Number of groups	41	40	40	42	41	41

Note: Dependent variable "Foreign inflows" includes the investments in each country by non-residents; "Domestic" is defined as the investments overseas by residents. IR stands for International Reserves. M2 stands for domestic monetary aggregates. EVENT is a binary variable which takes value 1 in the quarters of financial stress (Q1 95,Q3 98,Q4 01,Q4 08), and the subsequent four quarters All models include country-specific trends and country dummies. Coefficients of variables including quadratic terms are multiplied by 100. Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 2. Gross capital flows, international reserves-to-IL

	Foreign inflows		Domestic outflows	
	(1)	(2)	(3)	(4)
	FE	DK	FE	DK
Current account	-0.108***	-0.108***	0.003	0.003
	[0.012]	[0.006]	[0.016]	[0.008]
Peg exchange rate	0.295	0.295**	-0.108	-0.108
	[0.312]	[0.135]	[0.197]	[0.157]
Managed exchange rate	0.157	0.157	-0.052	-0.052
	[0.197]	[0.112]	[0.164]	[0.104]
S&P rating	0.081***	0.081***	0.033	0.033*
	[0.029]	[0.014]	[0.026]	[0.018]
GDP real growth	0.042***	0.042***	0.022**	0.022**
	[0.010]	[0.008]	[0.008]	[0.010]
EMBI	-0.062***	-0.062**	-0.026	-0.026
	[0.021]	[0.027]	[0.021]	[0.027]
VIX	-0.001	-0.001	-0.017***	-0.017***
	[0.004]	[0.005]	[0.006]	[0.005]
EVENT	-0.383	-0.383*	0.114	0.114
	[0.275]	[0.223]	[0.315]	[0.228]
EVENT*IR over IL	0.030	0.030	-0.034	-0.034**
	[0.020]	[0.018]	[0.028]	[0.016]
EVENT*IR over IL, quadratic	-0.087**	-0.087***	0,056	0.056*
	[0.000]	[0.000]	[0.001]	[0.000]
IR over IL	0.016	0.016	-0.023	-0.023
	[0.022]	[0.014]	[0.026]	[0.018]
IR over IL , quadratic	0,011	0,011	-0,025	-0,025
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	1,859	1,859	1,773	1,773
R-squared	0.54		0.36	
Number of id	40	40	41	41

Note: Dependent variable "Foreign inflows" includes the investments in each country by non-residents; "Domestic" is defined as the investments overseas by residents. IR stands for International Reserves. IL stands for international liabilities. EVENT is a binary variable which takes value 1 in the quarters of financial stress (Q1 95,Q3 98,Q4 01,Q4 08), and the subsequent four quarters. Coefficients of variables including quadratic terms are multiplied by 100. All models include country-specific trends and country dummies. Robust standard errors in brackets, *** p<0.01, **

Table 3. Domestic outflows and international reserves-to-M2, robustness checks and extensions

	Domestic					Domestic short-term				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Emerging	Advanced	Emerging forward looking	Emerging simultaneity	Emerging capital openness	Emerging	Advanced	Emerging forward looking	Emerging simultaneity	Emerging capital openness
Current account	0.005	0.057**	-0.002	0.059***	0.004	0.014	0.057**	-0.003	0.061***	0.018
	[0.009]	[0.025]	[0.012]	[0.008]	[0.011]	[0.009]	[0.026]	[0.013]	[0.008]	[0.011]
Peg exchange rate	-0.166	0.000	-0.174	-0.386**	-0.314	-0.329**	0.000	-0.327*	-0.525***	-0.446**
	[0.169]	[0.000]	[0.153]	[0.148]	[0.200]	[0.156]	[0.000]	[0.173]	[0.148]	[0.198]
Managed exchange rate	-0.061	0.000	-0.011	-0.214**	-0.138		0.000	-0.119	-0.311***	-0.246*
	[0.087]	[0.000]	[0.121]	[0.092]	[0.111]	[0.105]	[0.000]	[0.120]	[0.109]	[0.129]
S&P rating	-0.006	-0.009	-0.032	-0.052***	0.021	-0.005	0.030	-0.023	-0.044**	0.021
	[0.019]	[0.082]	[0.027]	[0.018]	[0.024]	[0.021]	[0.077]	[0.029]	[0.019]	[0.026]
GDP real growth	0.008	0.157***	0.015	-0.009	0.007	0.007	0.116***	0.012	-0.010	0.005
	[0.007]	[0.033]	[0.011]	[0.007]	[0.007]	[0.007]	[0.032]	[0.012]	[0.007]	[0.008]
EMBI	0.042	-0.092***	0.074	0.080*	0.043	0.067	-0.107***	0.128**	0.122***	0.066
	[0.047]	[0.027]	[0.063]	[0.040]	[0.051]	[0.043]	[0.028]	[0.051]	[0.035]	[0.041]
VIX	-0.021***	-0.005	-0.030***	-0.017***	-0.017***	-0.024***	-0.015	-0.030***	-0.021***	-0.020***
	[0.004]	[0.012]	[0.008]	[0.003]	[0.005]	[0.003]	[0.010]	[0.008]	[0.002]	[0.003]
EMBI*IR over M2	-0.005**	0.007*	-0.006	-0.005**	-0.006***	-0.006***	0.007	-0.007**	-0.007***	-0.006***
	[0.002]	[0.004]	[0.004]	[0.002]	[0.002]	[0.002]	[0.004]	[0.003]	[0.002]	[0.002]
EMB*IR over M2, quadratic	0.000**	-0,017	0,006	0.005**	0.006***	0.006***	-0,014	0.008*	0.007***	0.007***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
IR over M2	-0.028**	-0.029	-0.030**	-0.020**	-0.023**	-0.027**	-0.047*	-0.026**	-0.023**	-0.022**
	[0.011]	[0.022]	[0.014]	[0.010]	[0.011]	[0.011]	[0.023]	[0.013]	[0.009]	[0.010]
IR over M2, quadratic	0.000*	-0,031	0.029*	0,006	0.020*	0.021*	-0,003	0.027*	0,011	0.019*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Foreign				0.554***					0.474***	
				[0.031]					[0.032]	
Capital Openness Index					-0.630*					-0.492
					[0.336]					[0.403]
Observations	1,773	1,148	1,736	1,768	1,419	1,784	1,148	1,747	1,779	1,430
Number of groups	41	21	41	40	31	41	21	41	40	31

Note: Dependent variable "Domestic" includes the investments overseas by residents; "Domestic short-term" includes only other investment and portfolio investment overseas. "Foreign" includes includes the investments in each country by non-residents. IR stands for International Reserves. M2 stands for domestic monetary aggregates. All models include country-specific trends and country dummies. Coefficients of variables including quadratic terms are multiplied by 100. All models are estimated with the Driscoll-Kraay estimator. Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 4. Foreign inflows and international reserves-to-IL, robustness checks and extensions

	Foreign					Foreign short-term				
	(1) Emerging	(2) Advanced	(3) Emerging forward looking	(4) Emerging simultaneity	(5) Emerging capital openness	(6) Emerging	(7) Advanced	(8) Emerging forward looking	(9) Emerging simultaneity	(10) Emerging capital openness
Current account	-0.103***	-0.082***	-0.028**	-0.104***	-0.113***	-0.099***	-0.085***	-0.026**	-0.101***	-0.115***
	[0.006]	[0.020]	[0.013]	[0.006]	[0.008]	[0.007]	[0.021]	[0.012]	[0.007]	[0.007]
Peg exchange rate	0.281*	0.000	0.273	0.409***	0.166	0.433***	0.000	0.411*	0.554***	0.316*
	[0.140]	[0.000]	[0.206]	[0.133]	[0.143]	[0.147]	[0.000]	[0.234]	[0.133]	[0.166]
Managed exchange rate	0.175	0.000	0.402**	0.270**	0.132	0.246**	0.000	0.359**	0.342***	0.207
	[0.112]	[0.000]	[0.150]	[0.116]	[0.128]	[0.107]	[0.000]	[0.160]	[0.119]	[0.136]
S&P rating	0.082***	-0.168*	0.129***	0.063***	0.081***	0.073***	-0.088	0.110***	0.057***	0.072***
	[0.015]	[0.091]	[0.018]	[0.014]	[0.018]	[0.016]	[0.074]	[0.019]	[0.018]	[0.017]
GDP real growth	0.045***	0.192***	0.052***	0.032***	0.042***	0.048***	0.168***	0.060***	0.038***	0.046***
	[0.009]	[0.033]	[0.012]	[0.007]	[0.009]	[0.009]	[0.031]	[0.013]	[0.007]	[0.008]
EMBI	-0.176***	-0.052*	-0.060**	-0.120***	-0.190***	-0.196***	-0.067**	-0.049*	-0.161***	-0.205***
	[0.026]	[0.027]	[0.024]	[0.032]	[0.029]	[0.027]	[0.026]	[0.028]	[0.036]	[0.028]
VIX	-0.002	-0.007	-0.030***	0.004	-0.000	-0.006	-0.014**	-0.027***	-0.001	-0.005
	[0.005]	[0.010]	[0.007]	[0.004]	[0.005]	[0.004]	[0.005]	[0.008]	[0.004]	[0.004]
EMBI* IR over IL	0.010***	0.001	0.003	0.006**	0.011***	0.012***	0.003	0.001	0.010***	0.013***
	[0.002]	[0.004]	[0.002]	[0.003]	[0.003]	[0.002]	[0.004]	[0.003]	[0.003]	[0.003]
EMBI* IR over IL, quadratic	-0.023***	0	-0,002	-0.014*	-0.023***	-0.027***	-0,008	0	-0.022***	-0.028***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
IR over IL	0.039***	-0.138***	0.000	0.039***	0.038***	0.062***	-0.122***	0.017	0.064***	0.054***
	[0.011]	[0.031]	[0.017]	[0.012]	[0.013]	[0.009]	[0.034]	[0.017]	[0.010]	[0.011]
IR over IL, quadratic	-0.069***	0.273***	-0,032	-0.044*	-0.068***	-0.109***	0.226***	-0,052	-0.095***	-0.103***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]
Domestic				0.418***					0.321***	
				[0.031]					[0.032]	
Capital Openess Index					-0.116					-0.225
					[0.342]					[0.267]
Observations	1,866	1,366	1,771	1,768	1540	1,866	1,366	1,771	1,768	1,540
Number of groups	40	21	40	40	31	40	21	40	40	31

Note: Dependent variable "Foreign" includes the the investments in each country by non-residents; "Foreign short-term" includes only other investment and portfolio investment by non-residents. "Domestic" is defined as the investment overseas by residents . IR stands for International Reserves.IL stands for International Financial Liabilities. Coefficients of variables including quadratic terms are multiplied by 100. All models include country-specific trends and country dummies. All models are estimated with the Driscoll-Kraay estimator. Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 5. Gross capital flows, threshold regressions

Panel A. Domestic outflows and international reserves-to-M2

	Domestic outflows			Short-term domestic outflows		
	(1)	(2)	(3)	(4)	(5)	(6)
	Dummy percentile 90% IR-to-M2	Dummy percentile 95% IR-to-M2	Dummy percentile 10% IR-to-M2	Dummy percentile 90% IR-to-M2	Dummy percentile 95% IR-to-M2	Dummy percentile 90% IR-to-M2
EMBI	-0.018	-0.016	-0.023	-0.003	-0.003	-0.015
	[0.034]	[0.033]	[0.030]	[0.028]	[0.027]	[0.026]
EMBI*IR over M2	-0.001**	-0.001**	-0.001*	-0.001**	-0.001**	-0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
IR over M2	-0.010**	-0.009**	-0.007	-0.010**	-0.010**	-0.007
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]
EMBI*Dummy IR over M2, p95		0.019			0.028	
		[0.053]			[0.057]	
EMBI*Dummy IR over M2 p90-p95		0.047**			0.049**	
		[0.018]			[0.018]	
EMBI*Dummy IR over M2, p90	0.046**			0.048**		
	[0.019]			[0.019]		
EMBI*Dummy IR over M2, p10			-0.023			0.011
			[0.038]			[0.030]
Observations	1,419	1,419	1,419	1,430	1,430	1,430
Number of groups	31	31	31	31	31	31

Panel B. Foreign Inflows and international reserves-to-IL

	Foreign inflows			Short-term foreign inflows		
	(1)	(2)	(3)	(4)	(5)	(6)
	Dummy percentile 90% IR-to-FL	Dummy percentile 95% IR-to-FL	Dummy percentile 10% IR-to-FL	Dummy percentile 90% IR-to-FL	Dummy percentile 95% IR-to-FL	Dummy percentile 90% IR-to-FL
EMBI	-0.112***	-0.102***	-0.090***	-0.114***	-0.104***	-0.091***
	[0.026]	[0.026]	[0.026]	[0.025]	[0.025]	[0.028]
EMBI* IR over IL	0.002	0.001	0.000	0.002	0.001	0.001
	[0.002]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]
IR over IL	0.014	0.008	0.005	0.015	0.009	0.005
	[0.010]	[0.010]	[0.009]	[0.009]	[0.009]	[0.009]
EMBI*Dummy IR over IL, p95		0.008			-0.005	
		[0.026]			[0.032]	
EMBI*Dummy IR over IL p90-p95		-0.027			-0.031	
		[0.027]			[0.033]	
EMBI*Dummy IR over IL, p90	-0.053**			-0.060**		
	[0.022]			[0.022]		
EMBI* Dummy IR over IL, p10			-0.025			-0.022
			[0.025]			[0.023]
Observations	1,540	1,540	1,540	1,540	1,540	1,540
Number of groups	31	31	31	31	31	31

Note: In Panel A dependent variable is "Domestic" is defined as the investment overseas by residents; in Panel B is "Foreign", defined as investments in each country by non-residents. IR stands for international reserves; FL stands for international liabilities; M2 stands for monetary aggregates. Dummies p10 include observations below percentile 10th; dummies p90(95) include observations above percentile 90th(95th); dummies p90-p95 include observations comprised between percentiles 90th and 95th.All models include the current account, exchange rate dummies, S&P rating, real GDP growth, capital openess index, the VIX, country-specific trends and country dummiesStandard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

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