The Global Financial Cycle and capital flow episodes: A wobbly link?

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Abstract

Not very wobbly. We contribute to the literature on the influence of the global financial cycle (GFC) on large shifts in international capital flows. First, we build a new factor-based measure of the GFC, which also distinguishes between price-based and quantity-based indicators. Second, we systematically compare our measure to other existing indicators of the GFC, also before and after the global financial crisis, also including the Covid-19 period. Third, we estimate the impact of the GFC on *episodes* of large capital flows (sudden stops, flights, retrenchments, surges) and currency crises, and test for the stability of the relation through time and possible non-linearity. We find a significant link between the GFC and capital flow stops, surges, as well as currency crises, which is robust across time and of sizable economic magnitude. In terms of the linearity and stability of the relationship, results are mixed, but we find that at least some measures of the GFC, such as the VIX, play a lesser role post crisis.

Keywords: Capital flows, global financial cycle, push factors, structural factor analysis.

JEL codes: F32, F33, F36, F42, F44

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1 Introduction

Following the seminal contributions by Rey (2013) and Passari and Rey (2015), academics and policy-makers have recently focused on whether global financial conditions influence capital flows, and by how much, with an emphasis on emerging market (EME) borrowers. Among others, Koepke (2015) provides a survey of the literature on the drivers of capital flows. However, no consensus exists on the proper definition of the global financial cycle (henceforth GFC) and on its quantitative impact for emerging markets. For example, Cerutti et al. (2017) argue that the quantitative importance of the global financial cycle for capital flows to emerging markets is limited.

In this paper, we revisit the nexus between the GFC and capital flows to emerging markets by taking a novel perspective along three lines. First, we propose a new measure of the GFC obtained from a simple factor model. Moreover, we also construct price-based and quantity-based versions of the measure, a step that is – to our knowledge – novel in the literature. Second, we compare our measure with existing estimates of the GFC, for example by looking at correlations between the different indicators, to understand how robust and consistent the available estimates are, also before and after the global financial crisis. Last and most central to the paper, we analyze the impact of the GFC on different types of capital flows *episodes* (sudden stops, surges, retrenchments, flights and currency crises), looking at *extreme* rather than *normal* movements in capital flows, in the spirit of Forbes and Warnock (2012). Our focus on extreme episodes is motivated by the fact that they are more likely to be costly, whereas normal volatility in capital flows is presumably innocuous and less relevant from a welfare perspective.

With this main idea in mind, we focus on five key questions: (i) how consistent and reliable is the measurement of the GFC, contrasting our GFC measures with other existing ones?; (ii) are the GFC measures important drivers of capital flow episodes?; (iii) is the relationship robust across time?; (iv) do some GFC measures have a broader effect across the various types of episodes?; and finally (v) does the relationship exhibit non-linearities?

Our analysis provides the following answers to these questions. First, we learn that the GFC measures are strongly positively correlated, with the expected signs, and correlations are relatively stable across sub-sample (pre and post crisis) with however the VIX somewhat less correlated with other GFC measures post crisis, and the correlations with a global stock market factor on the low side. The GFC measures are counter-cyclical in terms of US growth and oil prices. The Asian crisis, the global financial crisis, the China shock of 2015 and the

Covid-19 crisis stand out as episodes of large global financial tightening. Most GFC measures are strongly correlated, again with the expected sign, with capital flows. Moreover, we find that for the whole sample period (1990-2020) we find that our, as well as other, measures of the GFC and consistently associated to all capital flow episodes, with the expected sign, with the exception of flights. Results are more mixed for currency crises: for these, only the quantity based measures of the GFC and the VIX show up as statistically significant predictors of crises. Finally, we conduct an extensive analysis of linearity and stability over time, whose results are mixed. The effect of some possible GFC measures, including ours, the VIX and the US dollar, appears to have become weaker post crisis for sudden stops. For currency crises, we find some evidence of convexity (loosely consistent with the idea of occasionally binding constraints) for currency crises using our GFC measure, but not the VIX. By contrast the USD, while insignificant for currency crises in the whole sample, becomes strongly significant only post crisis. Overall, the short answer to the question posed in our title is that the nexus between the GFC and capital flows is not very wobbly, although how wobbly is certainly a matter of subjective judgement.

The paper is organized as follows. Section 2 provides background on the existing literature. In Section 3 we describe the methodology and the data behind our measures of the GFC and compare them to other existing measures and to variables measuring global economic conditions and monetary policy. Section 4 turns to the role of the global financial cycle in driving capital flow episodes. Section 5 concludes.

2 Literature review

Our work is connected to three recent strands of literature, namely the drivers of capital flows, especially with a focus on large capital flows gyrations, the role of global push and local pull factors, and the global financial cycle, including its changing impact. This section, provides an overview of these various strands.

2.1 Drivers of capital flows

Economists have long been interested in what drives international capital flows. The era of financial globalization since the mid-1990's has led to a sharp increase in cross border flows and financial holdings. This steady increase has come to an abrupt halt with the 2008-2009 crisis, especially for flows intermediated by banks, as discussed in Milesi-Ferretti and Tille

(2011). While flows have subsequently recovered, this rebound has been partial and quite heterogeneous across regions and types of flows, with banking flows in particular remaining below pre-crisis levels Bussière et al. (2016); McQuade and Schmitz (2016). Koepke (2019) provides a review of the literature.

In addition to explaining flows broadly, researchers have been focusing on episodes of sharp movements in these flows. So-called sudden stops in net inflows have been of particular interest, as they led to sharp downturns in the affected economies. Researchers have pointed that such episodes tend to mirror previous times of unusually high capital inflows booms (Agosin and Huaita, 2012; Furceri et al., 2012). The literature has also shown the need to take a more detailed look as some forms of capital flows are more prone to sudden stops than other. Levchenko and Mauro (2006) for instance find that banking flows are more prone to large and persistent contractions. Gupta et al. (2007) find that about 60% of currency crises are contractionary, while the rest are expansionary, hence finding significant heterogeneity across episodes. They also find that high capital inflows before the crisis and financial openness increase the probability of a contractionary crisis, while trade openness decreases it.

Over the last decade, the literature has moved beyond a focus on sudden stops towards a broader perspective of capital flow episodes. A first angle takes a finer look at gross and net capital flows. A sudden stop in net inflows can be driven by a reduced appetite of foreign investors (lower gross inflows), but also by a retrenchment by domestic investors (a shift to negative gross outflows). Cavallo et al. (2015) find that stops driven by foreign investors tend to have more adverse macroeconomic consequences, even when the reduction in gross inflows does not lead to a stop in net inflows. Rotheberg and Warnock (2011) similarly find that episodes driven by a retrenchment by domestic investors tend to be shorter and less damaging.

The literature has also broadened its scope beyond times of sudden stops to include more episodes where capital flows were larger than historical norms. Ghosh et al. (2012) look at times of surges of capital inflows, while Forbes and Warnock (2012) consider a detailed taxonomy of episodes of gross inflows and outflows.

A more recent stream of the literature goes beyond the average impact of various factors on capital flows and refines the analysis to the impact on the tails of the distributions of capital flows. This approach is motivated by the fact that some drivers may be more relevant in driving extreme episodes than in normal times. Adrian et al. (2019) show that the impact

of the price of risk is non-linear, and Chari et al. (2020) document the impact of changes in risk appetite by global investors on the tails of the distribution of capital flows. Gelos et al. (2019) present a quantile regression analysis and show the contrasted impact of various drivers not only on different segments of the distribution of flows, but also depending on the time horizon.

2.2 Push versus pull factors driving capital flows

The most standard approach of researchers split the drivers of capital flows in two categories, namely "push" factors that reflect global conditions and "pull" factors related to the recipient countries' specific characteristics (Koepke (2019)). The tendency for episodes of large capital flows to be clustered in specific periods suggests that global factors played a major role. This is supported by the empirical evidence that finds a sizable role for push factors Ghosh et al. (2012); Forbes and Warnock (2020, 2012). Davis et al. (2021) find that the same global factors that drive gross capital outflows also impact gross inflows, but with an asymmetric exposure and hence an impact also on net capital flows. More on the side of pull factors, Catão and Milesi-Ferretti (2014) find that net foreign liabilities, especially in debt, and the current account are powerful predictors of external crises, whereas higher official reserve holdings tend to reduce the likelihood of crises. Edwards (2007) finds that a flexible exchange rate regime reduces the probability of experiencing a capital flow contraction, and the more so, the higher capital mobility.

While global factors matter, their role displays a substantial degree of heterogeneity across regions and periods. Comelli (2015) finds that the explanatory power of global factors for sudden stops is contrasted across various regions of emerging markets (EME). Fratzscher (2011) focuses on the 2008 financial crisis and its aftermath, drawing on a detailed dataset of fund-level investment flows. He finds that the role of global factors is more pronounced for some regions, and that while global factors played a major role in the most acute phase of the 2008 crisis, their contribution has been more moderate in the subsequent years when flows became more responsive to country specific "pull" factors. Li et al. (2019) find that for sudden stops in equity flows, global factors play a more important role in high-income economies, while sudden stops in bond blows global variables matter more for emerging economies. Banking flows have been of particular interest given their volatile behavior in the global financial crisis. Amiti et al. (2017) contrast the role of global supply factors against that of country specific demand and supply factors. They find that in crisis times country

specific factors matter more, with a role for supply factors as countries depending on banks exposed to adverse shocks are particularly affected. Bruno and Shin (2015) develop a model of global and local banks and point to the liquidity cycle of global banks as a major driver of international flows.

2.3 The global financial cycle

The relevance of push factors for capital flows has stimulated a line of research focusing on the global dimension of financial conditions, the so-called "Global Financial Cycle". Passari and Rey (2015), Eller et al. (2020) and (e.g. Rey, 2013, 2016) argue that financial spillovers transmit policy shock in the core countries to other economies, regardless of their exchange rate regime. These contributions have led to an active debate on whether the usual policy trilemma between stable exchange rates, capital mobility and policy autonomy, has been replaced by a dilemma between the last two option with little to no impact of the exchange rate regime. Rey (2016) argues in favor of the dilemma view, but other contributions provide evidence in favor of the standard trade-offs Aizenman et al. (2016). In addition to a global cycle, Aldasoro et al. (2020a) document the existence of domestic cycles at a lower frequency, and more closely related to credit and house prices than the global cycle, which mostly reflects (at least in their most common incarnation) equity prices.

Theoretical contributions put global financial intermediaries at the heart of the cycle. These intermediaries amplify the cross-country transmission of shocks in the presence of financial frictions. Devereux and Yetman (2010) find that borrowing constraints affecting global investors lead to strong international co-movements in macroeconomic variables. Kollmann et al. (2011) include a global bank in a DSGE model and show that when the bank is subject to an equity requirement losses on loans in one country are transmitted globally.

Bruno and Shin (2015) show that the funding conditions of banks in core economies are strongly transmitted to financial intermediaries and macroeconomic conditions in peripheral countries, leading to a global liquidity cycle. Coimbra and Rey (2017) develop a model where financial cycles emerge as movements in interest rate change aggregate leverage through shifts in the composition of financial intermediaries with different leverage constraints. Cesa-Bianchi et al. (2018) propose a model of the GFC centred on the leverage of broker-dealers. In their empirical analysis, they show that an increase in the leverage of US broker-dealers leads to a boom in cross border credit flows, house prices and consumption, as well as a real exchange rate appreciation and current account deterioration in emerging economies.

While several contributions have emphasized the presence of a global financial cycle, the magnitude of its impact on macroeconomic variables remains unclear and two recent contributions offer a more skeptical view. Choi et al. (2017) find that it accounts for a limited share of the variance of macroeconomic variables. Cerutti et al. (2017) focus on its role for international capital flows, and their evidence does not support the view that the GFC explains a dominant part of capital flows to emerging markets.

A central element of the literature is the construction of measures of the global financial cycle. This is a non-trivial tasks given the many dimension of financial activities. Should researcher consider price or quantity indicators, and should they focus on specific segments of financial markets? While the VIX has long been used as an indicator of risk and risk appetite, its focus on equity markets may be too narrow for an analysis of overall capital flows. Another approach is to combine several indicators and extract the common element through a factor analysis. Eickmeier et al. (2014) use a principal component approach, and identify three factors (global monetary policy, credit supply, and credit demand) using sign restrictions. A similar approach is taken by Choi et al. (2017) who then show that emerging economies respond to the financial cycle using interest rates and reserves. Miranda-Agrippino and Rey (2015a) and **?** construct a measure of the global financial cycle by focusing on the common component of the price of risky assets. They show that this measure is sensitive to monetary policy in the United States, and that its movements impact the activity of global banks and international capital flows. Miranda-Agrippino and Rey (2015a) point that their measure of the global cycle in asset prices moves in step with a common component of global capital flows.

Recent contribution has shows that the impact of the global financial cycle on capital flows may not be stable over time. Avdjiev et al. (2020) find that the sensitivity of the main global liquidity components (international loan and bond flows) to global factors varied considerably over the past decade, with the estimated sensitivity to US monetary policy peaking around the time of the 2013 Fed "taper tantrum" and then reverting toward pre-crisis levels thereafter. They attribute this pattern to changing co-movements in the monetary policy stances of the major economies, as well as the growing role of well capitalized banking systems. Forbes and Warnock (2020) find that while global push factors play a sizable role overall, this role has proved weaker since the global financial crisis. Kaminsky et al. (2020) take a long view and shows that regional cycles matter aside from the global cycle, and that the impact of the later has changed through time and geography. The changing behavior

over time can also reflect the non-linear impact of global factors of flows, as documented by Adrian et al. (2019).

While researchers have focused on a global cycle driven by conditions in international financial markets, other global cycles also appear relevant. Davis et al. (2021) show that in additional to a global financial cycle similar to the risky asset price cycle of Miranda-Agrippino and Rey (2015a) there is a cycle linked to commodity prices that matters especially for emerging economies. Miranda-Agrippino et al. (2020) indicate that while the global impact of the monetary policy of the United States operates through financial markets, that of the policy of China reflects international trade flows. Ha et al. (2020) focus on G7 countries and contrast financial and macroeconomic cycles. They document different global cycles for different segments of financial markets, and show that they lead to spillovers through the impact on the global macroeconomic cycle instead of directly.

3 Factor-based measures of the global financial cycle: Price versus quantities

3.1 Methodology and data

In this section we build a price and a quantity measure of the global financial cycle. It is derived essentially as a common factor of the measures already available.[1] The concept is to consider the global financial cycle as a *latent* variable on which we only have imperfect measures available - hence a common component of possible existing measures may be a good summary indicator. In this way, we do not make any assumption on the fundamental driver of the GFC, and thus do not take a stand on whether it originates from, say, global risk aversion shocks or US monetary policy, as in other recent contributions.[2] In other words, we consider the GFC as a latent state of the world which we observe behind a "veil of ignorance".

Another important aspect of our measures is that they are distinguished between price and quantities indicators. This reflects two possible (non excessively exclusive) views of

[1] In the working paper version of this paper we also introduce an alternative measure based on sign restrictions imposed on factors, which is very similar to the one shown here.

[2] Choi et al. (2017) also use a factor model to identify global liquidity factors, and distinguish between policy-driven, market driven, and risk aversion. They find that the effects of changes in global liquidity factors on growth in emerging markets are partly different depending on whether they are policy or risk awareness driven. More recently **?** do a SVAR decomposition of the drivers of the GFC. They find that global risk shocks are the main driver of the GFC, and US monetary policy and demand shocks are relevant but explain a smaller portion of its variability over time.

global financial integration, i.e. driven by quantities such as capital flows (e.g., Lane and Milesi-Ferretti (2001)) or by arbitrage conditions for prices and risk premia (e.g., Dedola and Lombardo (2012)). The idea to systematically compare a price-based version and a quantity-based version of the GFC is, to our knowledge, novel in the literature. Indeed, price and quantities could give different signals. We believe that understanding the reliability and robustness of available indicators of the GFC is the first necessary step in order to make progress on the question of the nexus between the GFC and capital flows.[3]

Specifically, we denote the vector of N_x variables (de-trended using the one-side HP filter and standardised) by x_t. We estimate a standard factor model,

$$x_t = \alpha + \beta F_t + \epsilon_t \tag{1}$$

where F_t is a set of N_F factors, with $N_F < N_x$. In practice, we restrict ourselves to the first principal component.

The N_x variables cover several measures of prices and quantities pertaining to financial integration, at a quarterly frequency from 1990 to 2020 (hence also covering the Covid-19 crisis). The price vector includes the US shadow interest rate, the excess bond premium of Gilchrist and Zakrajsek (2012), the world equity price index, the world relative equity index for banks, the EMBI spread, and the USD nominal effective exchange rate. On the inclusion of the relative equity price index for banks, the idea is that leverage of financial intermediaries is a key driver of the GFC and that bank profitability, as reflected in equity valuation, is closely related to leverage.[4] In the baseline price-based measure we do *not* include the VIX, but we include it in an alternative measure. Indeed, there is a debate on the usefulness of the VIX as a measure of the GFC especially post global financial crisis (e.g., Forbes and Warnock (2020)). Therefore, we show a price based measure of the GFC with and without the VIX.

On the inclusion of the USD nominal effective exchange rate, we follow Bruno and Shin (2015), Hofmann et al. (2016) and Avdjiev et al. (2019) and aim to capture the financial channel of the exchange rate: dollar appreciation hurts dollar borrowers' balance sheets and

[3] In work done in parallel with ours, Aldasoro et al. (2020b) compare the price-based measured of the GFC in Miranda-Agrippino and Rey (2015b) with one quantity-based measure of the GFC defined as the first principal component of the total external flows to GDP in 31 countries, finding (as we also do later) that the two measures largely overlap and are strongly correlated. They also find that this estimate of the GFC is more correlated with capital flows in advanced economies, while capital flows to emerging markets are associated with a second principal component of flows.

[4] See also the recent work by Baron et al. (2020) on banking crises, which also motivates the use of bank equity prices as a measure of the intermediation capacity of banks.

lenders' risk-taking capacity, particularly so in emerging markets.

Turning to quantities, we include a measure of the share of private credit to GDP in the G7 (proxying for credit overall in advanced economies), the leverage of broker-dealers (Bruno and Shin (2015)), and total portfolio flows to emerging markets in the x vector. The inclusion of the latter variable may raise some questions as we later relate episodes of extreme capital flow to our GFC measures. While the concern is relevant in theory, in practice we show that all our measure of the GFC are strongly positively correlated, and the inclusion of flows in the x vector does not materially change any of the results we will show later.

Finally, note that we also combine price and quantity variables in an overall measure of the GFC.

Table 1 provides a detailed presentation of the data and data sources, while Figure 1 shows the variables used in the construction of the GFC.

[Include Table 1 and Figure 1 here.]

3.2 Different GFC measures: Stylised facts

In this section we show the price and quantity based versions of the GFC up to 2020 and also show correlations between these measures and the constituent components, as well as with selected macroeconomic variables (central bank balance sheets, US growth, oil prices). We also split the same between pre and post global financial crisis. Finally, we compare our measures to other existing ones. This gives a sense of the robustness of the GFC estimates and their relation with EME stress and capital flows.

Note first that the GFC measures are all standardised and defined so that a high reading means tighter financing conditions. Figure 2 shows that there is a high correlation between the price-based and the quantity-based measure and including the VIX in the list of price indicators does not appear to make a material difference. The GFC measures have four main peaks: the late 1990s (Asian financial crisis and Russian default), the global financial crisis (which is a 8 standard deviation event), the China shock in 2015, and the Covid-19 crisis in 2020. Note that the global financial tightening in the latter event was very sharp if referred to March 2020, but on our quarterly data it is actually much less serious than the global financial crisis, due to strong and immediate policy reaction.

In Figure 3 we compare our price based indicator to the global stock market factor of Habib and Venditti (2019), which is itself very similar to the indicator of Miranda-Agrippino

and Rey (2015b). Also in this case there is a strong positive correlation between the two indicators.

[Include Figures 2-3 here.]

Table 2 reports correlations between different GFC measures over the whole sample. The signs and magnitudes of correlations are largely what one could expect, again with very high positive correlations between the different GFC indicators and negative correlation with portfolio flows to EME. The differences between the pre-crisis sample, 1990-2007 (Table 3) and the post crisis sample, 2010-2020 (Table 4) are small, but it is interesting that the VIX appears to be less correlated with other GFC indicators in the post crisis sample, including the USD, as noted by other authors (Forbes and Warnock (2020)).

[Include Tables 2-4 here.]

Table 5 reports correlations between our GFC measures and other variables of interest. It shows that the GFC measures have a strong negative correlation with US real GDP growth and oil prices, a weak *negative* correlation with US short term and long term interest rates, and a quite strong positive correlation with the G7 central bank balance sheet[5] as share of GDP. The latter correlations are surprising, since they indicate that lower US rates and a larger central bank balance sheet are associated with *tighter* global financing conditions. This may reflect, of course, the endogenous reaction of monetary policy to negative shocks more than the impact of US monetary policy on the GFC, and it is therefore inappropriate to draw a causal conclusion out of these correlations. The correlations are largely the same in the pre-crisis sample (Table 6) but there is less correlation with US growth in the post crisis sample (Table 7).

[Include Tables 5-7 here.]

Overall, from this analysis we learn that the GFC measures are strongly positively correlated, with the expected signs, the correlations are relatively stable across sub-sample (pre and post crisis) with the VIX somewhat less correlated with other GFC measures post crisis. The GFC measures are counter-cyclical in terms of US growth and oil prices. The Asian crisis, the global financial crisis, the China shock of 2015 and the Covid-19 crisis stand out as episodes of large global financial tightening.

[5]Note that the G7 central bank balance sheet includes the whole euro area, not only the euro area G7 countries. Also note that this measure is detrended and is negatively correlated with US interest rates, as expected.

4 Capital flow episodes and global financial cycle

4.1 Country sample

We use a quarterly version of the Scheubel and Stracca (2019) database, which provides annual data from 1990 to 2017 for 189 countries, which we extend to 2020. As a robustness check, we also consider emerging and developing countries, which constitute the bulk of our sample, separately from advanced ones. Note, however, that not all countries have experienced capital flow episodes and our identification is achieved by those observations which switch regime (from not having an episode to having one) at least once.[6] Data availability is further reduced by the availability of the co-variates, so that we end up with sample sizes between 5,000 and 20,000 quarterly observations, depending on the specification. Table 8 contains a description of how the quarterly data are constructed and which data are originally at that frequency or interpolated.

[Include Table 8 here.]

4.2 Definition of capital flow episodes and currency crises

Our analysis focuses on episodes of large movements in capital flows, following the approach of Forbes and Warnock (2012) and Ghosh et al. (2012). We rely on quarterly data and distinguish between gross outflows (purchases of foreign assets by residents) and gross inflows (purchases of domestic assets by non-residents), as in Forbes and Warnock (2012). In this section we largely follow **?**, giving only a short description here to account for the fact that we use quarterly data in this paper.[7]

An episode of large flows is defined as follows. Denote capital flows of type x in quarter t by c_t^x, with $x \in i, o$ indicating inflows or outflows. $S_{c_t}^x = c_t^x + c_{t-1}^x + c_{t-2}^x + c_{t-3}^x$ denotes the 4-quarter moving sum and $\Delta c_t^x = S_t^x - S_{t-4}^x$ denotes the year-over-year change in the moving sum of flows. We denote the sixteen-quarter moving average of this change in flows by $m = \frac{\left(\sum_{h=1}^{16} \Delta c_{t-h}^x\right)}{16}$ and the sixteen-quarter moving standard deviation of flows by $\sigma = \sqrt{\frac{\sum_{t=1}^{16}(\Delta_{c_t}^x - m)^2}{16}}$.

We define capital flow episodes as quarters where the year-on-year change in the moving 4-quarter sum of flows is at least two standard deviations above the mean for one quarter

[6] The number of countries experiencing switches depends on the type of episode, but is generally below 50 for each of them.

[7] In particular, refer to Table 1 in that paper.

(and by one standard deviation above the mean subsequently for at least one additional quarter). Our approach focuses on *private* capital flows, unlike for example Forbes and Warnock (2012).[8]

We define currency crises as in Laeven and Valencia (2012) but adjust the methodology to quarterly data. We compute the year-on-year exchange rate depreciation and then define the onset of a currency crisis as a quarter with a year-on-year depreciation larger than 30% and with an average depreciation during the previous year of at least 10%, i.e. $ccstart = 1\ iff\ \frac{FX_t - FX_{t-4}}{FX_{t-4}} \geq 30 \wedge \frac{FX_{t-5} - FX_{t-8}}{FX_{t-8}} \geq 10$. If this is the case for several consecutive quarters, we take only the initial quarter as the crisis episode.

We define episodes for both advanced and emerging and developing economies (EME), but a large majority of the identified episodes are in the latter. Table 9 reports the frequency of each capital flow episode in our sample, split between advanced economies and EME. While currency crises are much more common in EME, other capital flow episodes are at least equally common in advanced countries, due to the higher volatility in their capital flows (probably in turn reflecting higher capital account openness). While we show most of our results for all countries, we also report results for EME separately in some of the tables.

[Include Table 9 here.]

Figure 4 shows the time clustering of sudden stops, a key capital flow episode (left panel), and of currency crises (right panel). In each panel the blue line shows the percentage of countries with an episode, and the red line shows our baseline GFC measure. The number of sudden stops peaked in the late 1990s and during the global financial crisis, while the frequency of currency crises show a declining trend over time (which pertains in particular to EME) that was partially reversed in the crisis.

[Include Figure 4 here.]

4.3 Does the GFC drive capital flow episodes?

4.3.1 Baseline regressions

After identifying capital flow episodes and currency crises, we now assess the role of the GFC in driving them. We do so by running the following logit regression with country fixed

[8] Following previous studies (e.g. Alfaro et al., 2014, 2008), we categorize foreign direct investment (FDI) flows as private flows. Other components (portfolio investment, derivatives, other investment) are accounted for separately for the central bank/monetary authorities, general government, deposit-taking corporations and other sectors. We exclude all flows from and to central banks and general government. A detailed explanation of the computations of private flows is provided in Appendix B of **?**.

effects,

$$Pr(EPISODE_{it} = 1) = k_i + \beta GFC_t + \gamma X_{i,t-1} + \epsilon_{i,t} \quad (2)$$

where $X_{i,t-1}$ is a vector of country-specific controls, which includes (i) de iure financial openness (the Chinn-Ito index)Chinn and Ito (2006), (ii) an external vulnerability index which is defined in Appendix A , (iii) the composite risk rating from the International Country Risk Guide (ICRG) which measures the quality of the country's institutions; (iv) a dummy if the country has a fixed exchange rate arrangement (according to the classification of Klein and Shambaugh (2008)), (v) the current account to GDP ratio, (vi) the foreign currency debt to GDP ratio, (vii) average inflation in the last 3 years, as well as two measures of access to the global financial safety net, namely (viii) IMF access (which we define as 430% of a country's IMF quota given that this is the cumulative maximum amount a country can receive from the IMF without exceptional access) and (ix) the ratio between foreign exchange reserves and GDP.[9] Because including controls substantially narrows the sample, we also estimate equation (2) *without* the X vector of controls, with results that are generally consistent with the baseline regression. Standard errors are robust for heteroscedasticity and serial correlation.

The vector of controls X includes variables that have originally a quarterly frequency (see Table 8) with lag $t-1$, and variables that have an original annual frequency with lag $t-4$. Moreover, we follow a general-to-specific approach in order to include only variables that are statistically significant. Although we have a relatively large sample size, the control variables are often not available for several individual countries or for an extended period, and including them all together would unduly restrict the overall sample size of our regressions.

The key coefficient in our analysis is β, which we expect to be *positive* for all episodes (with for instance an increase in the GFC increasing the probability of a crisis), except surges where the coefficient should be negative. In terms of scaling, the tables with the regression results show the coefficients associated with *one standard deviation* change in the specific GFC measure.

4.3.2 Robustness analysis

We assess whether the relationship between the GFC and capital flow episodes is robust to different definitions of the cycle and different periods. We do so by running a variant of the regression using interactions:

[9]For more information on the variables please refer to the original paper, Scheubel and Stracca (2019).

$$Pr(EPISODE_{it} = 1) = k + \beta GFC_t + \gamma X_{i,t-1} + \delta GFC_t Z_t + \epsilon_{i,t} \quad (3)$$

where Z_t is a vector of variables including (i) the GFC itself, the interaction being then a quadratic term; (ii) a dummy for the global financial crisis (2008-09); and (iii) a dummy for the post-2007 sample. This allows us to test for non-linearities as well as possible variation over time. For reasons of sample size we add each component of the Z vector one by one, and do not consider them simultaneously even though this would be the ideal choice if we had more degrees of freedom.

A short discussion of equation (3) is worthwhile. The effect of the GFC may be asymmetric between tighter and looser conditions. This could be the case in the presence of occasionally binding financial constraints. A worsening of the GFC may then bring about a crisis, whereas an improvement does not necessarily have an effect. In other words, the relationship between GFC and capital flow episodes and crisis could be *convex*, which in our specification would correspond to a *positive* sign for the quadratic term GFC^2, indicating a larger impact of movements in a GFC in stressed times when the GFC is already negative. We also consider another variant where we include separately a variable equal to the GFC measure when this is at least one standard deviation below its mean, i.e. when conditions are particularly 'tight'.[10]

4.3.3 Adding global controls

Finally, we add some variables of global significance (US real GDP growth, US interest rates, and the growth rate of the oil price in USD) in order to understand if the effect of the GFC is absorbed by these variables (suggesting that the effect of the GFC is not strictly speaking "financial") or comes in addition to them. The estimated regression is then:

$$Pr(EPISODE_{it} = 1) = k + \beta GFC_t + \gamma X_{i,t-1} + \eta X_t + \epsilon_{i,t} \quad (4)$$

where X_t is a vector of global controls with US variables and oil prices.

[10]For recent contributions on occasionally binding constraints see, for example, Akinci and Chahrour (2015), who show that they can match a set of stylized facts about Sudden Stop events. In their paper, good news about future productivity raises leverage during times of expansions, increasing the probability that the constraint binds, and a Sudden Stop occurs, in future periods. During the sudden stop, the nonlinear effects of the constraint induce output, consumption and investment to fall substantially below trend. Other important references in this literature are Devereux and Yu (2014) and Mendoza (2010). Consistent with this view, Nier et al. (2014) assesses the key drivers of private capital flows to EME and finds that during periods of stress the VIX becomes a dominant driver of capital flows while other determinants generally lose their significance.

5 Results

5.1 Baseline results

Tables 10 to 14 report the baseline results for the baseline specification (2). Each table corresponds to one type of episode. In each table, we first consider our baseline GFC price based measure with controls (column 1) and without controls in order to increase the sample size (column 2). We then use the quantity-based version of our measure (column 3) and the combined measure (column 4). In columns 5 to 8 we consider four different definitions of the GFC, namely the excess bond premium of Gilchrist and Zakrajsek (2012), the global stock market factor of **?**, the VIX, and the dollar NEER (all de-trended and standardized).

Table 10 reports results for *sudden stops*. The GFC measures are all statistically and economically significant with the expected sign. Among the control variables, the external vulnerability indicator comes out strongly significant. IMF access is statistically significantly negatively signed in some specifications.

Table 11 looks at *currency crises*: here the GFC measures are less consistently significant, but our quantity based and the combined measures are significant, as well as the VIX (the price based measure is also positive and significant once the controls are removed). Perhaps surprisingly, the USD is not significant. A higher composite risk rating (quality of institutions), higher IMF access, and higher reserve holdings all reduce the probability of experiencing a currency crisis.

Table 12 shows results for *surges*: here, as expected, the GFC is consistently negative and significant, implying that looser global financing conditions do increase the likelihood of large inflows into countries. Surges are also more likely in pegs and with larger IMF access and higher composite risk rating in some specifications, whereas they are less likely with a current account surplus and with higher financial openness.

Table 13 refers to *flights*: here the GFC measures are never significant, while we find that flights are more common in pegs.

Finally, Table 14 reports results for *retrenchments*: here the GFC measures are always positive and significant, again as expected, apart from the global stock market factor. The coefficients for the GFC measures, however, as somewhat smaller than for stops.

[Include Tables 10-14 here.]

Overall, for the whole sample period we find that our, as well as other, measures of the GFC and consistently associated to all capital flow episodes, with the expected sign, with

the exception of flights. This is generally in line with previous literature (e.g., (Forbes and Warnock (2012)). Results are more mixed for currency crises: there, only the quantity based measures of the GFC and the VIX show up as statistically significant predictors of crises.

5.2 Linearity and stability over time

After looking at results for the whole sample, we now turn to evaluate the stability and functional form of the nexus between the GFC and capital flow episodes by estimating equations ((3)) and ((4)).[11] For brevity, we focus on sudden stops and currency crises.[12] Both tables are structured as follows. For reference, we first show the previous baseline results with controls (column 1). We then include global controls (column 2), focus on emerging and developing economies (column 3), include the square of the GFC (column 4), include the GFC if it is one standard deviation above its mean, i.e. "very tight" (column 5), and include the interaction of the GFC with the crisis years 2008-2009 (column 6) and with the post crisis years 2010-2020 (column 7).

In terms of the GFC measures, in this analysis we include the combined GFC, the VIX and the USD.

Table 15 shows results for the combined measure of the GFC and sudden stops. We find no clear evidence for non-linearity or instability, and adding global controls also does not materially affect the results. We find, however, that the coefficient for emerging markets is larger than for the whole sample, suggesting that the GFC may be more important for them, and a weakening of the GFC impact post crisis (column 7).

Table 16 shows results for currency crises and the same definition of the GFC: here we detect some sign of non-linearity (column 5), which points to a larger effect for high levels of the GFC, i.e. a *convexity* in the relationship. It is also interesting that the GFC is more, not less important for currency crises after the global financial crisis (last column of the table).

Tables 17 and 18 repeat the same exercise for sudden stops and crisis and the VIX: here there is no general indication of non-linearity, but there is clear evidence of a weaker link post global financial crisis for stops, with the total effect going essentially to zero in the post-2010 sample. Note that we find no similar evidence for currency crises, where we find a weaker relation *during*, not after the global financial crisis. For crises, we also find that the relation

[11] Avdjiev et al. (2017) and **?** find evidence of time variation in the influence of the GFC on capital flows, but there are several differences between their set-up and ours, for example the focus on capital flow *episodes* in our analysis.

[12] We do not report results for other types of episodes for brevity, but are available on request.

is mildly *concave* for the VIX.

Finally, Tables 19 and 20 report results respectively for sudden stops and currency crises using the USD as a measure of the GFC. Here several interesting results emerge. For stops, we find that the USD becomes insignificant once global controls are included. Second, the relationship between the USD and stops is stronger during the global financial crisis and is much weaker in the post crisis sample, similar to other GFC measures such as the VIX. For currency crises, the time variation is the opposite: the USD effect is now larger post crisis, but generally insignificant (as we have already seen for the full sample) or even wrongly signed before 2010.

[Include Tables 15-20 here.]

All in all, the results of this sensitivity analysis as mixed. We find that the effect of some possible GFC measures, including ours, the VIX and the USD, appears to have become weaker post crisis for sudden stops. For currency crises, we find some evidence of convexity (consistent with the idea of occasionally binding constraints) for currency crises using our GFC measure, but not the VIX. By contrast the USD, while insignificant for currency crises in the whole sample, becomes strongly significant only post crisis.

6 Conclusions

In this paper we revisit the question of whether a push factor associated with the global financial cycle (see Rey (2013) and Passari and Rey (2015)) is a prominent and stable fixture for capital flows and exchange rate pressure for emerging markets. We make three contributions to the existing literature. First, we construct a new measure of the GFC based on a factor approach, including price-based and a quantity-based variants. Second, we compare them to other existing measures in the literature, allowing us to take a view on how robust and consistent existing measures of the GFC are. Finally, and most central, we study the links between different types of large capital flow *episodes* (sudden stops, surges, retrenchments, flights and currency crises) in the spirit of Forbes and Warnock (2012). We also look at whether the relationship is robust across different GFC indicators, different samples and testing for linearity.

Our analysis uncovers four main results. First, GFC measures are strongly positively correlated, with the expected signs, and correlations are relatively stable across sub-sample

(pre and post crisis) with however the VIX somewhat less correlated with other GFC measures post crisis, and the correlations with a global stock market factor on the low side. The GFC measures are counter-cyclical in terms of US growth and oil prices. Second, most GFC measures are strongly correlated, again with the expected sign, with capital flows. Third, we find that for the whole sample period (1990-2020) we find that our, as well as other, measures of the GFC and consistently associated to all capital flow episodes, with the expected sign, with the exception of flights. Results are more mixed for currency crises: for these, only the quantity based measures of the GFC and the VIX show up as statistically significant predictors of crises. Finally, we conduct an extensive analysis of linearity and stability over time, whose results are mixed. The effect of some possible GFC measures, including ours, the VIX and the US dollar, appears to have become weaker post crisis for sudden stops. For currency crises, we find some evidence of convexity (loosely consistent with the idea of occasionally binding constraints) for currency crises using our GFC measure, but not the VIX. By contrast the USD, while insignificant for currency crises in the whole sample, becomes strongly significant only post crisis.

Overall, we conclude that the nexus between our measure of the GFC and capital flow episodes is strong, well established and not a very wobbly one, although this may be less so for other measures, and it is not a universal law and the influence is not always statistically significant for all indicators. Finally, note that we do not take a stance in this paper on the relative weight of domestic (pull) and global (push) factors in driving capital flows (Cerutti et al. (2017)) as we focus on the global dimension only, where we largely confirm the idea that the GFC is consistently important for capital flows.

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Table 1: Data used for the factor-based measure of the GFC

Indicator	*Availability at quarterly frequency*	*Details on calculation*
Leverage of US broker dealers	1990:Q1-2020:Q4	Own calculation based on Federal Reserve Board data.
Total Credit to Non Financial Sector over GDP (BIS, End of Period), G7 countries (France, Germany, Italy, Canada, Japan, UK, US)	1990:Q1-2020:Q4	Credit to GDP aggregated for G7 countries. The weighted average is based on the shares of 2010 GDP in PPP.
Portfolio Inflows to EME	1993:Q1-2020:Q4	Aggregated IIF series for 25 EME since 2005:Q1 on, summing the non-resident portfolio investments in equity and debt. Previous observations are imputed aggregating IFS data for the 25 countries included in the EM25. Note that the two series showed a correlation higher than 0.97 for the overlapping sample.
USD nominal effective exchange rate (NEER)	Source: Bloomberg	
EMBI Spread	1993:Q3-2020:Q4	Source: Bloomberg.
VIX/VXO	1990:Q1-2020:Q4	VIX Level.
Datastream World Total Shares Price	1990:Q1-2020:Q4	Level
Datastream Bank Total Share Price	1995:Q1-2020:Q4	Level.

Figure 1: Variables used for the construction of the GFC measures

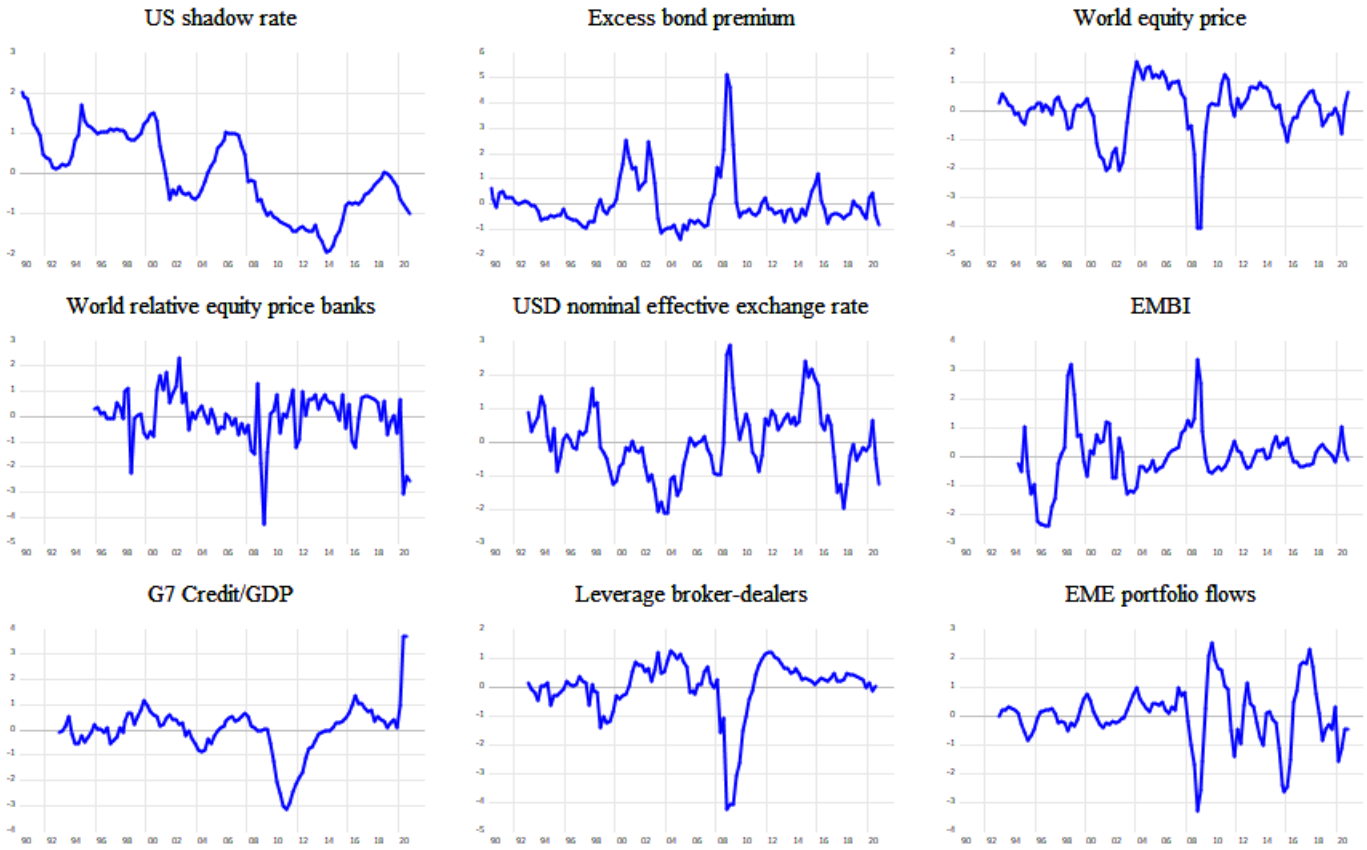

Figure 2: Factor-based measures of the GFC

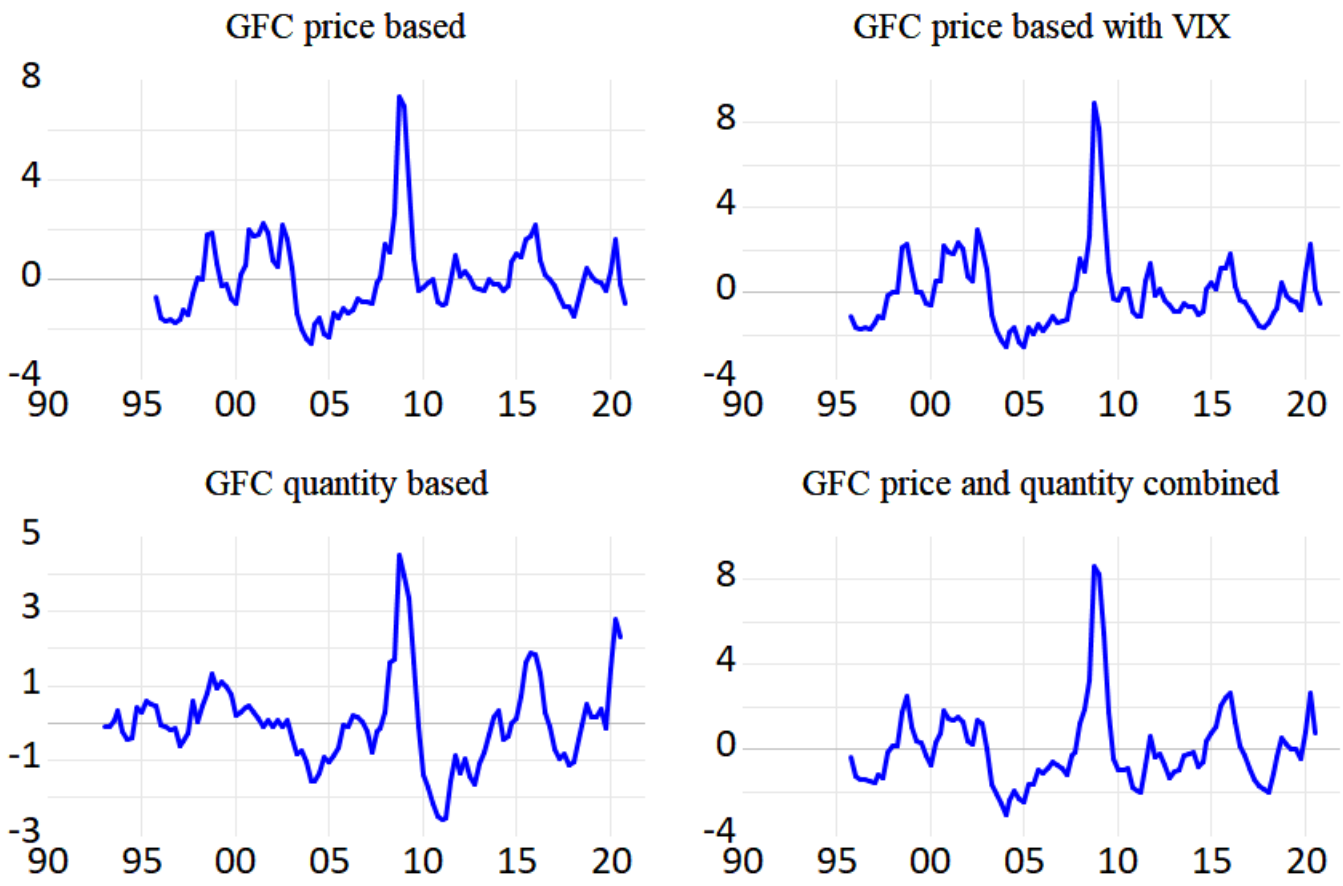

Figure 3: Price-based measure of the GFC (solid blue line) vs. global stock market factor (dashed green line)

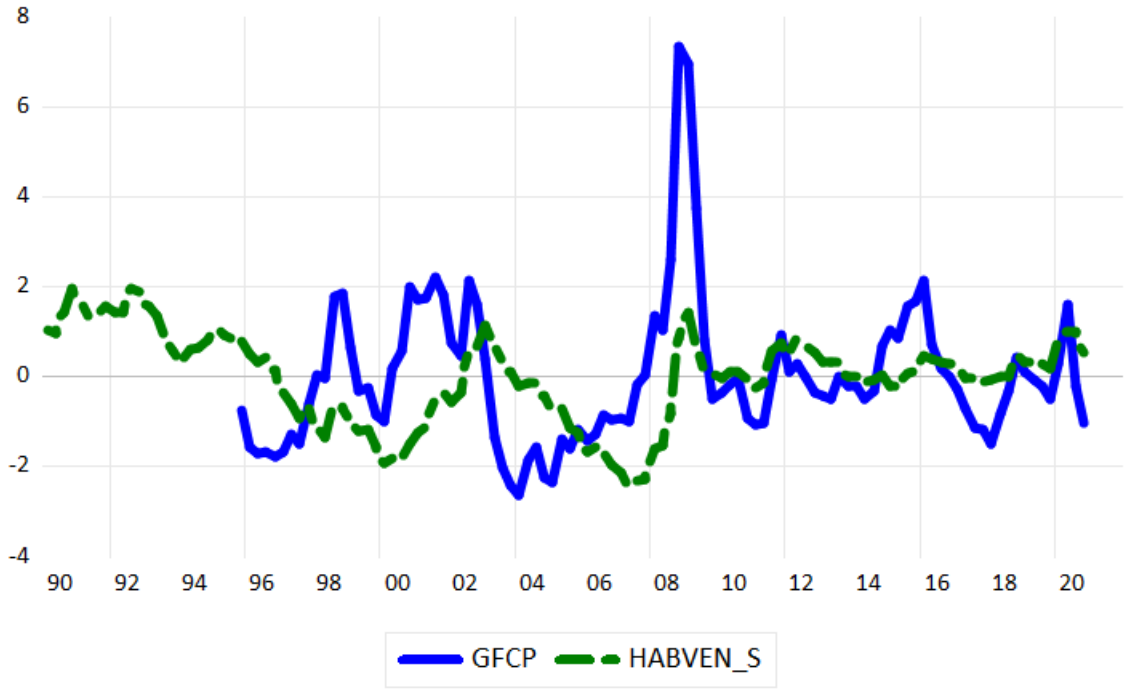

Table 2: Correlations between different GFC measures (common sample, 1990 to 2020).

	(1)								
	GFC price	GFC price with VIX	GFC quantity	GFC combined	EBP	GSMF	USD NEER	VIX	EME portfolio flows
GFC price	1								
GFC price with VIX	0.98***	1							
	(0.000)								
GFC quantity	0.71***	0.71***	1						
	(0.000)	(0.000)							
GFC combined	0.97***	0.95***	0.86***	1					
	(0.000)	(0.000)	(0.000)						
EBP	0.90***	0.92***	0.62***	0.87***	1				
	(0.000)	(0.000)	(0.000)	(0.000)					
GSMF	0.21***	0.20***	0.066***	0.17***	0.13***	1			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
USD NEER	0.57***	0.48***	0.45***	0.58***	0.30***	0.22***	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
VIX	0.75***	0.86***	0.55***	0.74***	0.76***	0.20***	0.23***	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
EME portfolio flows	-0.66***	-0.63***	-0.74***	-0.74***	-0.56***	-0.24***	-0.52***	-0.47***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Correlations between different GFC measures: pre-crisis, 1990-2007.

	(1)								
	GFC price	GFC price with VIX	GFC quantity	GFC combined	EBP	GSMF	USD NEER	VIX	EME portfolio flows
GFC price	1								
GFC price with VIX	0.99***	1							
	(0.000)								
GFC quantity	0.84***	0.83***	1						
	(0.000)	(0.000)							
GFC combined	0.98***	0.97***	0.93***	1					
	(0.000)	(0.000)	(0.000)						
EBP	0.93***	0.93***	0.74***	0.90***	1				
	(0.000)	(0.000)	(0.000)	(0.000)					
GSMF	0.23***	0.27***	0.19***	0.23***	0.25***	1			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
USD NEER	0.59***	0.56***	0.69***	0.66***	0.40***	0.12***	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
VIX	0.88***	0.93***	0.75***	0.86***	0.83***	0.39***	0.46***	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
EME portfolio flows	-0.81***	-0.80***	-0.81***	-0.84***	-0.75***	-0.36***	-0.60***	-0.70***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Correlations between different GFC measures: post crisis, 2010-2020.

	(1)							
	GFC price	GFC price with VIX	GFC quantity	GFC combined	EBP	GSMF	USD NEER	VIX
GFC price	1							
GFC price with VIX	0.92***	1						
	(0.000)							
GFC quantity	0.69***	0.61***	1					
	(0.000)	(0.000)						
GFC combined	0.95***	0.88***	0.87***	1				
	(0.000)	(0.000)	(0.000)					
EBP	0.81***	0.82***	0.54***	0.77***	1			
	(0.000)	(0.000)	(0.000)	(0.000)				
GSMF	0.39***	0.57***	0.37***	0.43***	0.36***	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
USD NEER	0.78***	0.60***	0.36***	0.65***	0.41***	0.078***	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
VIX	0.38***	0.71***	0.17***	0.36***	0.46***	0.62***	0.082***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Correlations between GFC measures and selected macro variables (common sample, 1990 to 2020).

	(1)							
	GFC price	GFC quantity	GFC combined	US real GDP growth	Oil price growth	US shadow rate	US long term rate	G7 CB balance sheet/GDP
GFC price	1							
GFC quantity	0.77***	1						
	(0.000)							
GFC combined	0.97***	0.89***	1					
	(0.000)	(0.000)						
US real GDP growth	-0.68***	-0.48***	-0.65***	1				
	(0.000)	(0.000)	(0.000)					
Oil price growth	-0.49***	-0.36***	-0.45***	0.41***	1			
	(0.000)	(0.000)	(0.000)	(0.000)				
US shadow rate	-0.12***	0.16***	-0.033***	0.070***	0.17***	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
US long term rate	-0.097***	0.042***	-0.052***	0.10***	0.21***	0.76***	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
G7 CB balance sheet/GDP	0.57***	0.47***	0.58***	-0.45***	-0.23***	-0.17***	-0.054***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Correlations between GFC measures and selected macro variables: pre-crisis, 1990-2007.

	(1)							
	GFC price	GFC quantity	GFC combined	US real GDP growth	Oil price growth	US shadow rate	US long term rate	G7 CB balance sheet/GDP
GFC price	1							
GFC quantity	0.87***	1						
	(0.000)							
GFC combined	0.98***	0.95***	1					
	(0.000)	(0.000)						
US real GDP growth	-0.78***	-0.68***	-0.77***	1				
	(0.000)	(0.000)	(0.000)					
Oil price growth	-0.52***	-0.42***	-0.49***	0.57***	1			
	(0.000)	(0.000)	(0.000)	(0.000)				
US shadow rate	-0.28***	-0.18***	-0.26***	0.24***	0.11***	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
US long term rate	-0.31***	-0.32***	-0.34***	0.40***	0.20***	0.76***	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
G7 CB balance sheet/GDP	0.72***	0.81***	0.78***	-0.64***	-0.50***	-0.48***	-0.59***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Correlations between GFC measures and selected macro variables: post crisis, 2010-2020.

	(1)							
	GFC price	GFC quantity	GFC combined	US real GDP growth	Oil price growth	US shadow rate	US long term rate	G7 CB balance sheet/GDP
GFC price	1							
GFC quantity	0.71***	1						
	(0.000)							
GFC combined	0.96***	0.87***	1					
	(0.000)	(0.000)						
US real GDP growth	-0.093***	-0.034**	-0.091***	1				
	(0.000)	(0.002)	(0.000)					
Oil price growth	-0.57***	-0.38***	-0.50***	0.047***	1			
	(0.000)	(0.000)	(0.000)	(0.000)				
US shadow rate	-0.13***	0.22***	0.010	-0.040***	0.16***	1		
	(0.000)	(0.000)	(0.356)	(0.000)	(0.000)			
US long term rate	-0.38***	-0.39***	-0.38***	0.035**	0.24***	0.0052	1	
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.643)		
G7 CB balance sheet/GDP	0.26***	-0.048***	0.13***	-0.051***	0.077***	-0.34***	-0.20***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Data frequency

Variables	Original frequency	Notes
Financial openness (Chinn Ito index), External Vulnerability indicator, IMF Access, Peg (Klein and Shambaugh)	Annual	Linear interpolation
ICRG composite risk rating, Average annual inflation in the past 3 years, Foreign exchange reserves to GDP, Current account to GDP, Foreign currency debt to GDP,	Quarterly	
Capital flow episodes (sudden stops, surges, flights, retrenchments)	Quarterly	The dummy for sudden stop is set to zero if there has been another episode in the same quarter for the country, in order to only have mutually exclusive episodes.
Currency crises	Quarterly	Computed following the same criteria as in Laeven and Valencia: the dummy is equal to 1 if there is a nominal depreciation of the currency of at least [30] percent that is also at least a [10] percent increase in the rate of depreciation compared to the year before.

Figure 4: Global prevalence of sudden stops and currency crises and the GFC (combined definition)

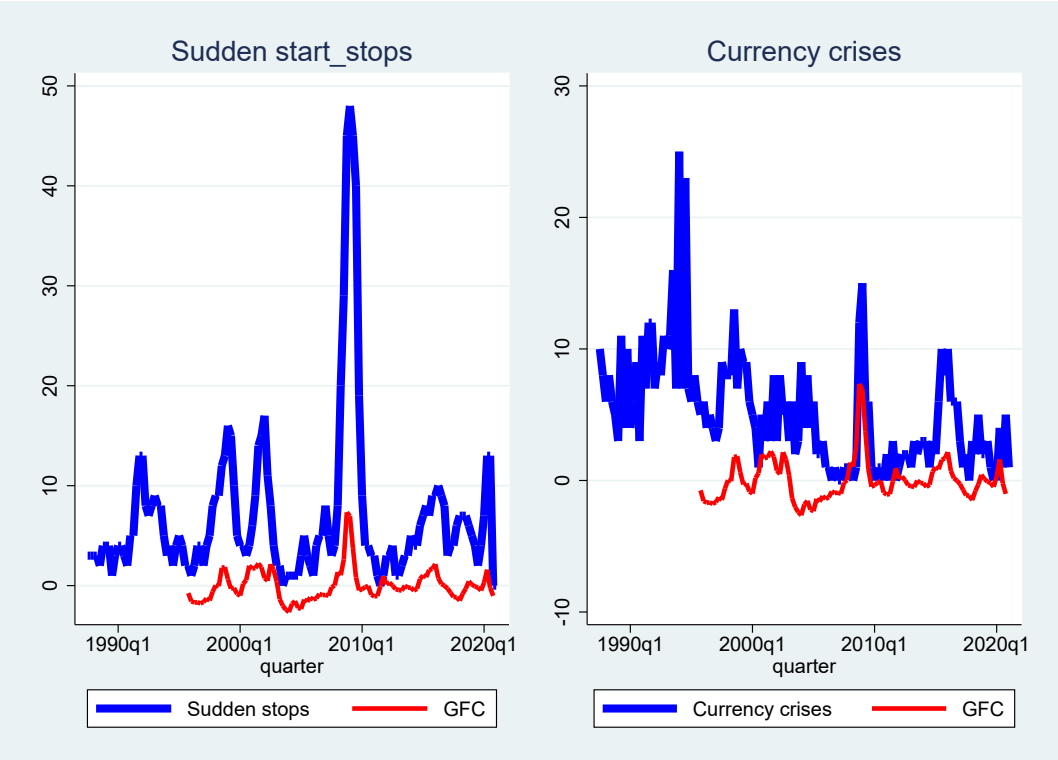

Table 9: Frequency of capital flow episodes.

Episode	All countries	Advanced countries	Emerging and developing countries
Sudden stop	3,4%	3,4%	3,3%
Currency crisis	2,8%	0,6%	3,2%
Flight	3,3%	3,6%	2,9%
Surge	3,5%	3,5%	3,5%
Retrenchment	3,3%	3,5%	3,0%

Notes: Quarterly data for 189 countries, 1990-2020. For more information on the data see **?**.

Table 10: GFC effect on the probability of a sudden stop.

	(1) GFC price	(2) GFC price no controls	(3) GFC quantity	(4) GFC combined	(5) EBP	(6) GSMF	(7) VIX	(8) USD
GFC	0.395***	0.498***	0.593***	0.343***	0.477***	0.444***	0.478***	0.619***
	(0.044)	(0.024)	(0.068)	(0.038)	(0.057)	(0.108)	(0.056)	(0.095)
Chinn-Ito index, t-4	-0.101		-0.103	-0.103	-0.142	-0.102	-0.151*	-0.081
	(0.097)		(0.093)	(0.097)	(0.088)	(0.085)	(0.088)	(0.090)
External vulnerability index, t-4	3.278**		2.747**	2.991**	3.340***	3.611***	3.297***	4.021***
	(1.379)		(1.244)	(1.386)	(1.105)	(1.057)	(1.102)	(1.192)
Peg (Klein and Shambaugh), t-4	0.039		0.011	0.019	0.282	0.274	0.327	-0.035
	(0.249)		(0.235)	(0.250)	(0.213)	(0.203)	(0.215)	(0.227)
Composite risk rating, t-1	-0.011		-0.008	-0.011	0.002	0.005	0.001	-0.003
	(0.017)		(0.015)	(0.017)	(0.014)	(0.014)	(0.014)	(0.015)
Current account/GDP, t-1	-0.003		-0.002	-0.003	-0.002	-0.003	-0.001	-0.002
	(0.005)		(0.003)	(0.005)	(0.002)	(0.002)	(0.002)	(0.003)
Foreign currency debt/GDP, t-1	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	-1.287		-0.000	-1.385	-0.003	-0.042	0.009	-0.013
	(1.130)		(0.084)	(1.156)	(0.075)	(0.076)	(0.076)	(0.090)
IMF Access, t-4	-0.018		-0.032	-0.010	-0.086**	-0.064*	-0.080**	0.003
	(0.040)		(0.036)	(0.040)	(0.040)	(0.039)	(0.038)	(0.035)
Foreign exchange reserves/GDP, t-1	-0.000		-0.000	-0.000	-0.000	-0.001	-0.000	-0.001
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Observations	973	5,635	1,025	973	1,077	1,077	1,077	1,025
Pseudo-R2	0.150	0.117	0.134	0.152	0.115	0.0540	0.121	0.0828

Notes: Results from logit regressions with sudden stop episode as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis. EBP, GSMF and USD refer respectively to the excess bond premium, the global stock market factor and the dollar nominal effective exchange rate, appropriately de-trended and standardised.

Table 11: GFC effect on the probability of a currency crisis.

	(1) GFC price	(2) GFC price no controls	(3) GFC quantity	(4) GFC combined	(5) EBP	(6) GSMF	(7) VIX	(8) USD
GFC	0.102	0.165***	0.287**	0.113*	0.172	-0.007	0.247**	0.071
	(0.084)	(0.025)	(0.116)	(0.068)	(0.116)	(0.208)	(0.100)	(0.188)
Chinn-Ito index, t-4	0.001		0.011	0.000	-0.008	-0.005	-0.022	0.008
	(0.149)		(0.149)	(0.149)	(0.144)	(0.144)	(0.144)	(0.149)
External vulnerability index, t-4	-0.547		-1.441	-0.721	-0.487	-0.407	-0.625	-0.744
	(2.173)		(2.153)	(2.186)	(1.934)	(1.918)	(1.953)	(2.092)
Peg (Klein and Shambaugh), t-4	-0.572		-0.564	-0.570	-0.564	-0.552	-0.540	-0.567
	(0.459)		(0.460)	(0.460)	(0.452)	(0.452)	(0.453)	(0.460)
Composite risk rating, t-1	-0.080***		-0.086***	-0.081***	-0.087***	-0.086***	-0.088***	-0.084***
	(0.027)		(0.027)	(0.027)	(0.025)	(0.025)	(0.025)	(0.027)
Current account/GDP, t-1	0.001		0.001	0.001	0.000	0.000	0.000	0.001
	(0.001)		(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Foreign currency debt/GDP, t-1	-0.000		-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	-0.128		-0.177	-0.125	-0.150	-0.157	-0.142	-0.189
	(0.409)		(0.378)	(0.405)	(0.283)	(0.290)	(0.287)	(0.391)
IMF Access, t-4	-0.236***		-0.237***	-0.234***	-0.233***	-0.232***	-0.234***	-0.237***
	(0.083)		(0.083)	(0.083)	(0.080)	(0.080)	(0.080)	(0.086)
Foreign exchange reserves/GDP, t-1	-0.008**		-0.008**	-0.008**	-0.007**	-0.007**	-0.007**	-0.008**
	(0.003)		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	1,498	18,864	1,576	1,498	1,652	1,652	1,652	1,576
Pseudo-R2	0.105	0.00986	0.120	0.109	0.112	0.106	0.122	0.103

Notes: Results from logit regressions with currency crisis as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis. EBP, GSMF and USD refer respectively to the excess bond premium, the global stock market factor and the dollar nominal effective exchange rate, appropriately de-trended and standardised.

Table 12: GFC effect on the probability of a surge.

	(1) GFC price	(2) GFC price no controls	(3) GFC quantity	(4) GFC combined	(5) EBP	(6) GSMF	(7) VIX	(8) USD
GFC	-0.340***	-0.442***	-0.160**	-0.258***	-0.347***	-0.523***	-0.362***	-0.455***
	(0.072)	(0.035)	(0.078)	(0.064)	(0.104)	(0.090)	(0.097)	(0.095)
Chinn-Ito index, t-4	-0.172*		-0.172**	-0.172*	-0.161*	-0.179**	-0.155*	-0.182**
	(0.089)		(0.084)	(0.088)	(0.082)	(0.083)	(0.083)	(0.087)
External vulnerability index, t-4	1.213		1.696	1.464	1.651	1.237	1.747*	1.319
	(1.218)		(1.104)	(1.211)	(1.039)	(1.073)	(1.043)	(1.110)
Peg (Klein and Shambaugh), t-4	0.395*		0.248	0.383*	0.200	0.178	0.165	0.304
	(0.213)		(0.201)	(0.213)	(0.196)	(0.201)	(0.196)	(0.204)
Composite risk rating, t-1	0.024		0.032**	0.026*	0.024*	0.020	0.025*	0.027*
	(0.015)		(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.015)
Current account/GDP, t-1	-0.009**		-0.007**	-0.009**	-0.002	-0.002	-0.002	-0.007**
	(0.004)		(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)
Foreign currency debt/GDP, t-1	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	0.039		0.059	0.051	0.020	0.055	0.015	0.064
	(0.101)		(0.075)	(0.100)	(0.070)	(0.072)	(0.069)	(0.074)
IMF Access, t-4	0.051**		0.055**	0.053**	0.064***	0.051**	0.069***	0.028
	(0.025)		(0.024)	(0.025)	(0.023)	(0.024)	(0.024)	(0.025)
Foreign exchange reserves/GDP, t-1	0.000		0.000	0.000	0.000	0.001	0.000	0.000
	(0.001)		(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	973	5,635	1,025	973	1,077	1,077	1,077	1,025
Pseudo-R2	0.0655	0.0428	0.0353	0.0563	0.0392	0.0595	0.0429	0.0585

Notes: Results from logit regressions with flight as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis. EBP, GSMF and USD refer respectively to the excess bond premium, the global stock market factor and the dollar nominal effective exchange rate, appropriately de-trended and standardised.

Table 13: GFC effect on the probability of a flight.

	(1) GFC price	(2) GFC price no controls	(3) GFC quantity	(4) GFC combined	(5) EBP	(6) GSMF	(7) VIX	(8) USD
GFC	-0.073	-0.018	0.033	-0.039	-0.103	-0.111	-0.023	-0.058
	(0.053)	(0.026)	(0.071)	(0.045)	(0.078)	(0.093)	(0.067)	(0.092)
Chinn-Ito index, t-4	-0.108		-0.127	-0.109	-0.147*	-0.153*	-0.147*	-0.128
	(0.091)		(0.088)	(0.091)	(0.082)	(0.082)	(0.082)	(0.088)
External vulnerability index, t-4	0.280		0.121	0.304	0.426	0.320	0.378	0.188
	(1.225)		(1.161)	(1.226)	(1.046)	(1.052)	(1.047)	(1.147)
Peg (Klein and Shambaugh), t-4	0.472**		0.432**	0.465**	0.493**	0.488**	0.482**	0.447**
	(0.216)		(0.206)	(0.215)	(0.195)	(0.196)	(0.195)	(0.207)
Composite risk rating, t-1	0.009		0.010	0.010	0.011	0.010	0.011	0.010
	(0.015)		(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.015)
Current account/GDP, t-1	-0.004		-0.002	-0.004	0.000	0.000	0.000	-0.002
	(0.004)		(0.003)	(0.004)	(0.000)	(0.000)	(0.000)	(0.003)
Foreign currency debt/GDP, t-1	-0.000		0.000	-0.000	-0.000	-0.000	-0.000	0.000
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	0.038		-0.007	0.041	0.057	0.065	0.058	-0.005
	(0.107)		(0.099)	(0.107)	(0.062)	(0.062)	(0.062)	(0.098)
IMF Access, t-4	0.017		0.020	0.017	0.009	0.005	0.009	0.015
	(0.027)		(0.027)	(0.027)	(0.026)	(0.026)	(0.026)	(0.028)
Foreign exchange reserves/GDP, t-1	-0.003		-0.002	-0.003	-0.003*	-0.003*	-0.003*	-0.002
	(0.002)		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	976	5,647	1,030	976	1,083	1,083	1,083	1,030
Pseudo-R2	0.0164	0.000111	0.0125	0.0147	0.0215	0.0210	0.0195	0.0128

Notes: Results from logit regressions with flight as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis. EBP, GSMF and USD refer respectively to the excess bond premium, the global stock market factor and the dollar nominal effective exchange rate, appropriately de-trended and standardised.

Table 14: GFC effect on the probability of a retrenchment.

	(1) GFC price	(2) GFC price no controls	(3) GFC quantity	(4) GFC combined	(5) EBP	(6) GSMF	(7) VIX	(8) USD
GFC	0.186***	0.206***	0.279***	0.162***	0.270***	-0.094	0.239***	0.183**
	(0.041)	(0.021)	(0.065)	(0.035)	(0.056)	(0.097)	(0.055)	(0.092)
Chinn-Ito index, t-4	0.052		0.037	0.052	-0.014	-0.007	-0.017	0.039
	(0.094)		(0.090)	(0.094)	(0.087)	(0.086)	(0.087)	(0.089)
External vulnerability index, t-4	1.699		0.621	1.534	0.604	0.909	0.603	1.330
	(1.268)		(1.181)	(1.273)	(1.109)	(1.091)	(1.105)	(1.151)
Peg (Klein and Shambaugh), t-4	0.273		0.169	0.270	0.145	0.170	0.166	0.168
	(0.224)		(0.212)	(0.224)	(0.206)	(0.203)	(0.206)	(0.212)
Composite risk rating, t-1	-0.000		0.000	-0.000	0.009	0.007	0.009	0.002
	(0.015)		(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.015)
Current account/GDP, t-1	-0.004		-0.003	-0.004	0.000	0.000	0.000	-0.003
	(0.004)		(0.003)	(0.004)	(0.001)	(0.001)	(0.001)	(0.003)
Foreign currency debt/GDP, t-1	-0.000		-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	0.169*		0.076	0.163*	0.060	0.053	0.062	0.071
	(0.097)		(0.078)	(0.097)	(0.070)	(0.071)	(0.070)	(0.078)
IMF Access, t-4	0.019		0.026	0.020	0.024	0.022	0.024	0.033
	(0.029)		(0.028)	(0.029)	(0.027)	(0.027)	(0.027)	(0.028)
Foreign exchange reserves/GDP, t-1	-0.000		-0.000	0.000	-0.000	-0.001	-0.000	-0.001
	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	976	5,647	1,030	976	1,083	1,083	1,083	1,030
Pseudo-R2	0.0414	0.0204	0.0354	0.0416	0.0350	0.0111	0.0306	0.0183

Notes: Results from logit regressions with retrenchment as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis. EBP, GSMF and USD refer respectively to the excess bond premium, the global stock market factor and the dollar nominal effective exchange rate, appropriately de-trended and standardised.

Table 15: Combined GFC measure: effect on the probability of a sudden stop.

	(1) Baseline	(2) Adding global controls	(3) Emerging and developing economies	(4) Linear relationship I?	(5) Linear relationship II?	(6) Driven by crisis?	(7) Different post crisis?
GFC combined	0.343***	0.375***	0.555***	0.343***	0.271*	0.351***	0.439***
	(0.038)	(0.096)	(0.149)	(0.105)	(0.163)	(0.102)	(0.101)
Chinn-Ito index, t-4	-0.103	-0.103	0.001	-0.105	-0.105	-0.104	-0.107
	(0.097)	(0.096)	(0.116)	(0.096)	(0.097)	(0.096)	(0.097)
External vulnerability index, t-4	2.991**	2.917**	0.861	2.819**	2.869**	2.825**	2.861**
	(1.386)	(1.389)	(1.890)	(1.396)	(1.394)	(1.395)	(1.393)
Peg (Klein and Shambaugh), t-4	0.019	0.016	0.302	0.024	0.020	0.025	0.065
	(0.250)	(0.250)	(0.401)	(0.251)	(0.251)	(0.251)	(0.254)
Composite risk rating, t-1	-0.011	-0.013	-0.037	-0.013	-0.013	-0.013	-0.014
	(0.017)	(0.017)	(0.028)	(0.017)	(0.017)	(0.017)	(0.017)
Current account/GDP, t-1	-0.003	-0.003	-0.037	-0.003	-0.003	-0.003	-0.003
	(0.005)	(0.005)	(0.025)	(0.005)	(0.005)	(0.005)	(0.005)
Foreign currency debt/GDP, t-1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	-1.385	-1.530	-2.170	-1.514	-1.543	-1.514	-1.597
	(1.156)	(1.205)	(1.477)	(1.204)	(1.210)	(1.204)	(1.241)
IMF Access, t-4	-0.010	-0.010	-0.013	-0.009	-0.010	-0.008	-0.015
	(0.040)	(0.041)	(0.054)	(0.041)	(0.041)	(0.041)	(0.042)
Foreign exchange reserves/GDP, t-1	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
US real GDP growth		0.150	0.302	0.256	0.235	0.258	0.293
		(0.230)	(0.327)	(0.272)	(0.255)	(0.280)	(0.234)
US shadow rate		0.050	-0.030	0.033	0.024	0.033	0.022
		(0.134)	(0.199)	(0.136)	(0.140)	(0.136)	(0.136)
Oil price growth (USD)		-0.002	0.021	-0.000	-0.001	-0.000	-0.002
		(0.011)	(0.017)	(0.011)	(0.011)	(0.011)	(0.011)
GFC squared				0.011			
				(0.015)			
GFC¿1					0.149		
					(0.195)		
GFC*dummy for 2008-2009						0.081	
						(0.121)	
GFC*dummy for 2010-2020							-0.322**
							(0.148)
Observations	973	973	476	973	973	973	973
Pseudo-R2	0.152	0.153	0.144	0.154	0.154	0.154	0.160

Notes: Results from logit regressions with sudden stop episode as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis.

Table 16: Combined GFC measure: effect on the probability of a currency crisis.

	(1) Baseline	(2) Adding global controls	(3) Emerging and developing economies	(4) Linear relationship I?	(5) Linear relationship II?	(6) Driven by crisis?	(7) Different post crisis?
GFC combined	0.113*	-0.236	-0.168	-0.212	-0.633**	-0.185	-0.353*
	(0.068)	(0.170)	(0.217)	(0.188)	(0.287)	(0.181)	(0.194)
Chinn-Ito index, t-4	0.000	0.033	0.026	0.037	0.027	0.043	0.047
	(0.149)	(0.154)	(0.194)	(0.155)	(0.154)	(0.155)	(0.155)
External vulnerability index, t-4	-0.721	-1.989	-5.097**	-1.886	-2.404	-1.699	-1.680
	(2.186)	(2.283)	(2.523)	(2.304)	(2.314)	(2.309)	(2.311)
Peg (Klein and Shambaugh), t-4	-0.570	-0.480	-2.031*	-0.490	-0.427	-0.506	-0.536
	(0.460)	(0.468)	(1.117)	(0.469)	(0.472)	(0.468)	(0.468)
Composite risk rating, t-1	-0.081***	-0.105***	-0.168***	-0.104***	-0.109***	-0.104***	-0.105***
	(0.027)	(0.029)	(0.041)	(0.029)	(0.029)	(0.029)	(0.029)
Current account/GDP, t-1	0.001	0.001	0.002	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Foreign currency debt/GDP, t-1	-0.000	-0.000	-0.000	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	-0.125	-0.162	-0.180	-0.164	-0.174	-0.164	-0.155
	(0.405)	(0.406)	(0.544)	(0.411)	(0.425)	(0.416)	(0.381)
IMF Access, t-4	-0.234***	-0.298***	-0.268***	-0.298***	-0.305***	-0.298***	-0.292***
	(0.083)	(0.088)	(0.096)	(0.088)	(0.089)	(0.088)	(0.088)
Foreign exchange reserves/GDP, t-1	-0.008**	-0.007**	-0.005	-0.007**	-0.007*	-0.007**	-0.007**
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
US real GDP growth		-0.466	-0.394	-0.563	-0.286	-0.745	-0.762
		(0.472)	(0.569)	(0.570)	(0.472)	(0.598)	(0.557)
US shadow rate		0.659***	0.662**	0.670***	0.709***	0.702***	0.703***
		(0.239)	(0.304)	(0.241)	(0.248)	(0.246)	(0.244)
Oil price growth (USD)		-0.032*	-0.029	-0.033*	-0.024	-0.035*	-0.032*
		(0.019)	(0.024)	(0.019)	(0.020)	(0.019)	(0.019)
GFC squared				-0.008			
				(0.027)			
GFC¿1					0.601*		
					(0.359)		
GFC*dummy for 2008-2009						-0.182	
						(0.227)	
GFC*dummy for 2010-2020							0.432*
							(0.229)
Observations	1,498	1,498	958	1,498	1,498	1,498	1,498
Pseudo-R2	0.109	0.142	0.224	0.142	0.152	0.144	0.153

Notes: Results from logit regressions with currency crisis as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis.

Table 17: VIX effect on the probability of a sudden stop.

	(1) Baseline	(2) Adding global controls	(3) Emerging and developing economies	(4) Linear relationship I?	(5) Linear relationship II?	(6) Driven by crisis?	(7) Different post crisis?
VIX	0.478***	0.306***	0.364***	0.315**	0.472***	0.244**	0.423***
	(0.056)	(0.095)	(0.138)	(0.127)	(0.156)	(0.119)	(0.112)
Chinn-Ito index, t-4	-0.151*	-0.143	0.017	-0.143	-0.103	-0.145	-0.146*
	(0.088)	(0.088)	(0.111)	(0.088)	(0.097)	(0.089)	(0.089)
External vulnerability index, t-4	3.297***	3.105***	1.328	3.115***	2.696*	2.968***	3.026***
	(1.102)	(1.125)	(1.685)	(1.130)	(1.386)	(1.137)	(1.138)
Peg (Klein and Shambaugh), t-4	0.327	0.322	0.678*	0.322	0.094	0.323	0.328
	(0.215)	(0.217)	(0.349)	(0.217)	(0.253)	(0.218)	(0.218)
Composite risk rating, t-1	0.001	-0.002	-0.032	-0.002	-0.018	-0.002	-0.001
	(0.014)	(0.015)	(0.023)	(0.015)	(0.017)	(0.015)	(0.015)
Current account/GDP, t-1	-0.001	-0.002	-0.038	-0.002	-0.003	-0.001	-0.002
	(0.002)	(0.002)	(0.024)	(0.002)	(0.005)	(0.002)	(0.002)
Foreign currency debt/GDP, t-1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	0.009	-0.006	0.021	-0.005	-1.600	-0.008	-0.002
	(0.076)	(0.076)	(0.078)	(0.076)	(1.218)	(0.076)	(0.077)
IMF Access, t-4	-0.080**	-0.085**	-0.078	-0.086**	-0.034	-0.081**	-0.086**
	(0.038)	(0.040)	(0.048)	(0.040)	(0.042)	(0.040)	(0.039)
Foreign exchange reserves/GDP, t-1	-0.000	-0.000	-0.001	-0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
US real GDP growth		-0.086	0.054	-0.100	0.053	0.029	0.100
		(0.206)	(0.294)	(0.243)	(0.237)	(0.247)	(0.224)
US shadow rate		0.178	0.175	0.181	0.142	0.160	0.184
		(0.111)	(0.161)	(0.115)	(0.131)	(0.113)	(0.115)
Oil price growth (USD)		-0.014*	-0.008	-0.015	-0.016	-0.012	-0.014*
		(0.008)	(0.012)	(0.009)	(0.010)	(0.009)	(0.008)
GFC squared				-0.004			
				(0.042)			
GFC¿1					-0.083		
					(0.213)		
GFC*dummy for 2008-2009						0.173	
						(0.202)	
GFC*dummy for 2010-2020							-0.592**
							(0.293)
Observations	1,077	1,077	511	1,077	973	1,077	1,077
Pseudo-R2	0.121	0.129	0.106	0.129	0.155	0.130	0.134

Notes: Results from logit regressions with sudden stop episode as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis.

Table 18: VIX effect on the probability of a currency crisis.

	(1) Baseline	(2) Adding global controls	(3) Emerging and developing economies	(4) Linear relationship I?	(5) Linear relationship II?	(6) Driven by crisis?	(7) Different post crisis?
VIX	0.247**	0.114	0.205	0.492*	-0.011	0.457**	0.117
	(0.100)	(0.186)	(0.229)	(0.261)	(0.222)	(0.228)	(0.212)
Chinn-Ito index, t-4	-0.022	0.003	-0.017	0.031	0.024	0.039	0.003
	(0.144)	(0.147)	(0.183)	(0.149)	(0.152)	(0.149)	(0.147)
External vulnerability index, t-4	-0.625	-1.605	-3.516	-1.104	-2.058	-0.879	-1.607
	(1.953)	(2.042)	(2.339)	(2.051)	(2.283)	(2.055)	(2.044)
Peg (Klein and Shambaugh), t-4	-0.540	-0.475	-2.034*	-0.515	-0.471	-0.521	-0.475
	(0.453)	(0.459)	(1.099)	(0.458)	(0.469)	(0.458)	(0.459)
Composite risk rating, t-1	-0.088***	-0.096***	-0.132***	-0.092***	-0.094***	-0.093***	-0.096***
	(0.025)	(0.025)	(0.032)	(0.024)	(0.027)	(0.024)	(0.025)
Current account/GDP, t-1	0.000	0.000	0.001	0.000	0.001	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Foreign currency debt/GDP, t-1	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	-0.142	-0.163	-0.195	-0.151	-0.149	-0.150	-0.163
	(0.287)	(0.292)	(0.320)	(0.321)	(0.415)	(0.325)	(0.292)
IMF Access, t-4	-0.234***	-0.259***	-0.227**	-0.269***	-0.266***	-0.276***	-0.259***
	(0.080)	(0.083)	(0.089)	(0.084)	(0.087)	(0.084)	(0.083)
Foreign exchange reserves/GDP, t-1	-0.007**	-0.007**	-0.005	-0.006*	-0.007**	-0.006*	-0.007**
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
US real GDP growth		-0.255	-0.158	-0.811*	-0.076	-0.936*	-0.250
		(0.400)	(0.467)	(0.478)	(0.422)	(0.491)	(0.438)
US shadow rate		0.456**	0.430	0.570**	0.538**	0.569**	0.456**
		(0.223)	(0.271)	(0.235)	(0.234)	(0.237)	(0.223)
Oil price growth (USD)		-0.005	-0.003	-0.020	-0.008	-0.020	-0.005
		(0.017)	(0.021)	(0.018)	(0.019)	(0.017)	(0.017)
GFC squared				-0.175**			
				(0.081)			
GFC¿1					0.191		
					(0.340)		
GFC*dummy for 2008-2009						-0.956**	
						(0.388)	
GFC*dummy for 2010-2020							-0.015
							(0.542)
Observations	1,652	1,652	1,024	1,652	1,498	1,652	1,652
Pseudo-R2	0.122	0.136	0.208	0.151	0.137	0.155	0.136

Notes: Results from logit regressions with currency crisis as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis.

Table 19: USD effect on the probability of a sudden stop.

	(1) Baseline	(2) Adding global controls	(3) Emerging and developing economies	(4) Linear relationship I?	(5) Linear relationship II?	(6) Driven by crisis?	(7) Different post crisis?
USD NEER	0.619***	0.019	0.583**	0.015	-0.037	0.071	0.427**
	(0.095)	(0.151)	(0.227)	(0.154)	(0.161)	(0.156)	(0.201)
Chinn-Ito index, t-4	-0.081	-0.092	0.030	-0.093	-0.092	-0.102	-0.093
	(0.090)	(0.094)	(0.114)	(0.094)	(0.096)	(0.094)	(0.094)
External vulnerability index, t-4	4.021***	3.432***	0.202	3.490***	3.311**	2.915**	3.133**
	(1.192)	(1.256)	(1.765)	(1.262)	(1.397)	(1.265)	(1.258)
Peg (Klein and Shambaugh), t-4	-0.035	0.061	0.189	0.069	0.048	0.068	0.110
	(0.227)	(0.237)	(0.375)	(0.238)	(0.248)	(0.240)	(0.240)
Composite risk rating, t-1	-0.003	-0.013	-0.038	-0.013	-0.018	-0.012	-0.014
	(0.015)	(0.015)	(0.025)	(0.015)	(0.017)	(0.016)	(0.016)
Current account/GDP, t-1	-0.002	-0.002	-0.023	-0.002	-0.003	-0.002	-0.002
	(0.003)	(0.003)	(0.024)	(0.003)	(0.005)	(0.003)	(0.003)
Foreign currency debt/GDP, t-1	0.000	0.000	-0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	-0.013	0.003	0.030	0.002	-1.480	0.001	0.003
	(0.090)	(0.084)	(0.087)	(0.084)	(1.197)	(0.085)	(0.086)
IMF Access, t-4	0.003	-0.051	-0.022	-0.052	-0.037	-0.040	-0.052
	(0.035)	(0.041)	(0.044)	(0.041)	(0.045)	(0.040)	(0.041)
Foreign exchange reserves/GDP, t-1	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
US real GDP growth		-0.238	-0.204	-0.289	-0.280	0.302	0.107
		(0.208)	(0.301)	(0.230)	(0.219)	(0.285)	(0.234)
US shadow rate		0.183	0.307*	0.177	0.205	0.101	0.006
		(0.118)	(0.170)	(0.119)	(0.127)	(0.121)	(0.129)
Oil price growth (USD)		-0.028***	-0.004	-0.030***	-0.023**	-0.016	-0.027***
		(0.009)	(0.013)	(0.009)	(0.010)	(0.011)	(0.010)
GFC squared				-0.044			
				(0.086)			
GFC¿1					0.222		
					(0.182)		
GFC*dummy for 2008-2009						1.017***	
						(0.377)	
GFC*dummy for 2010-2020							-0.924***
							(0.267)
Observations	1,025	1,025	494	1,025	973	1,025	1,025
Pseudo-R2	0.0828	0.125	0.104	0.126	0.133	0.135	0.142

Notes: Results from logit regressions with sudden stop episode as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis.

Table 20: USD effect on the probability of a currency crisis.

	(1) Baseline	(2) Adding global controls	(3) Emerging and developing economies	(4) Linear relationship I?	(5) Linear relationship II?	(6) Driven by crisis?	(7) Different post crisis?
USD NEER	0.071	-0.342	-0.108	-0.239	-0.393	-0.400	-0.762**
	(0.188)	(0.284)	(0.337)	(0.275)	(0.281)	(0.279)	(0.368)
Chinn-Ito index, t-4	0.008	0.039	0.023	0.040	0.046	0.066	0.056
	(0.149)	(0.154)	(0.193)	(0.154)	(0.154)	(0.156)	(0.155)
External vulnerability index, t-4	-0.744	-2.118	-4.817*	-2.387	-1.827	-1.519	-1.813
	(2.092)	(2.216)	(2.458)	(2.243)	(2.280)	(2.251)	(2.237)
Peg (Klein and Shambaugh), t-4	-0.567	-0.470	-2.064*	-0.460	-0.465	-0.515	-0.505
	(0.460)	(0.467)	(1.122)	(0.468)	(0.468)	(0.466)	(0.466)
Composite risk rating, t-1	-0.084***	-0.102***	-0.160***	-0.102***	-0.094***	-0.103***	-0.101***
	(0.027)	(0.027)	(0.039)	(0.027)	(0.027)	(0.027)	(0.027)
Current account/GDP, t-1	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Foreign currency debt/GDP, t-1	-0.000	0.000	-0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation, 3-quarter average, t-1	-0.189	-0.183	-0.293	-0.171	-0.121	-0.180	-0.157
	(0.391)	(0.380)	(0.540)	(0.354)	(0.403)	(0.396)	(0.361)
IMF Access, t-4	-0.237***	-0.306***	-0.264***	-0.299***	-0.296***	-0.321***	-0.305***
	(0.086)	(0.090)	(0.098)	(0.090)	(0.091)	(0.092)	(0.090)
Foreign exchange reserves/GDP, t-1	-0.008**	-0.007*	-0.005	-0.007*	-0.007*	-0.007*	-0.007*
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
US real GDP growth		-0.344	-0.278	-0.128	-0.271	-0.944*	-0.659
		(0.401)	(0.505)	(0.437)	(0.387)	(0.564)	(0.448)
US shadow rate		0.439*	0.498*	0.491**	0.472**	0.550**	0.618**
		(0.232)	(0.283)	(0.239)	(0.237)	(0.245)	(0.263)
Oil price growth (USD)		-0.022	-0.017	-0.013	-0.011	-0.036*	-0.027
		(0.017)	(0.020)	(0.018)	(0.018)	(0.019)	(0.017)
GFC squared				0.197			
				(0.142)			
GFC¿1					0.509		
					(0.322)		
GFC*dummy for 2008-2009						-1.102	
						(0.690)	
GFC*dummy for 2010-2020							0.847*
							(0.499)
Observations	1,576	1,576	992	1,576	1,498	1,576	1,576
Pseudo-R2	0.103	0.138	0.220	0.145	0.147	0.147	0.148

Notes: Results from logit regressions with currency crisis as the dependent variable, including country fixed effects. Each column corresponds to the specific GFC measure listed. Quarterly data from 1990 to 2020. Robust standard errors are in parenthesis.

Appendix A: Details on the construction of the external vulnerability index

The vulnerability index used in this paper is similar to the approach described in Chamon and Crowe (2013), which is also used by the IMF. This approach takes the occurrence of a set of crises and evaluates a set of indicators regarding their signalling qualities for these crises. We use the set of crises defined in Laeven and Valencia (2012) to evaluate the ability of several indicators in signalling them.

Specifically, we evaluate the signalling qualities of a set of several indicator variables k for identifying currency crises, sovereign debt crises and banking crises (in the following referred to as 'episode'). We focus on those variables which have good signalling qualities for currency crises and combine them into an "external vulnerability index".

More specifically, we define a threshold value δ for each variable k that minimizes the loss function L:

$$\min_{\delta} L = \left(\theta \frac{C(\delta)}{A(\delta) + C(\delta)} + (1 - \theta) \frac{B(\delta)}{B(\delta) + D(\delta)} \right) \tag{A.1}$$

where A denotes how many times an indicator k above threshold δ signals a episode when there is truly an episode (right positive), B denotes how many times the indicator k signals an episode when there is in fact none (false positive, type II error), C denotes how many times the indicator k does not signal an episode when there is truly an episode (false negative, type I error) and D denotes how many times the indicator k signals no episode when there indeed none (right negative). In other words, $A + B$ denote the number of correct signals, $C + D$ denote the number of false signals. $A + C$ denotes the true number of episodes and $B + D$ denotes the true number of non-episodes. The loss function L trades off type I and type II errors, and θ describes the relative weight put on these errors. We set $\theta = 0.5$ so that each error type is equally weighted in the loss function.

We compare the the number of false signals $(B + C)$ as the share of total observations for each indicator and two permutations, namely the deviation from its long-term trend (computed using an HP filter) and the difference between year t and year $t - 1$. We choose the version of each indicator which scores lowest in terms of false signals. We then combine the indicators or their preferred permutation to four different vulnerability indicators as indicated in Table A.3 : a general one, an indicator for external vulnerability, an indicator for financial sector vulnerability and an indicator for sovereign/macroeconomic vulnerability.

Variable descriptions and sources can be found in Table A.3 .

Thresholds δ_k cannot be calculated for each type of crisis separately due to limited sample size. We therefore we calculate signalling quality thresholds based on a sample pooling currency, sovereign and banking crises. We focus on the years 1995-2006, as before 1995 data availability is too poor to yield meaningful results, and we exclude the global crisis years. While the years considered essentially cover the great moderation, the resulting index performs well in signalling crises in out-of-sample testing. Moreover, we also compare results when using only 1995-2006 to using 1995-2006 and 2010-2017, and to using 2010-2017. The resulting thresholds did not differ significantly.

Table A.1 : List of variables/permutations included in the three vulnerability indices

General	**External Sector**	**Macro and Fiscal**	**Banking / Financial Sector**
Deviation from trend			
CatoGDP	StructuralBalance	CaptoAssets	CAtoGDP
BasicBalance	ShortDebttoFXDebt	BasicBalance	ReservesinmonthsofM
StructuralBalance		LendingRate	RiskPremiumonLending
ShortDebttoFXDebt		AverageCreditGrowth	DomesticCredittoGDP
DebttoX			ShortDetbtoFXDebt
LendingRate			REERyoy
			AverageCreditGrowth
			DeviationGDPGrowth
Change compared to previous period			
CaptoAsstes	CaptoAssets	StructuralBalance	CaptoAssets
ReservesinmonthsofM	DomesticCredittoGDP	ReservesinmonthsofM	BasicBalance: change
DomesticCredittoGDP	FXdebttoX	RiskPremiumonLending	FXdebttoX: change
FXdebttoX	DebttoX	DomesticCredittoGDP	GrossDebt: change
XdebttoGNI	XdebttoGNI	ShortDebttoFXDebt	XdebttoGNI
GrossDebt	GrossDebt	DebttoX	PrimaryBalance
		FXdebttoX	
		DeviationGDPGrowth	
		XdebttoGNI	
		GrossDebt	
Contemporaneous version			
RiskPremiumonLending	CAtoGDP	CAtoGDP	StructuralBalance
MoneyGrowth	BasicBalance	MoneyGrowth	MoneyGrowth
REERyoy	ReserversinmonthsofM	REERyoy	DebttoX
AverageInflation	RiskPremiumonLending	AverageInflation	LendingRate
AverageCreditGrowth	MoneyGrowth	PrimaryBalance	AverageInflation
DeviatioNGDPGrowth	LendingRate		
PrimaryBalance	REERyoy		
	AverageInflation		
	AverageCreditGrowth		
	DeviationGDPGrowth		
	PrimaryBalance		

Notes: A detailed description of each variable can be found in Table A.3 .

Indicator	Description	Source	Timeframe

CAtoGDP	Current account balance (% of GDP)	WDI	1960-2015
CaptoAssets	Bank capital to assets ratio (%)	WDI	2000-2015
BasicBalance	Sum of the current account balance and the net FDI flows	Own calculations	1970-2015
StructuralBalance	General government cyclically adjusted balance adjusted for nonstructural elements beyond the economic cycle. These include temporary financial sector and asset price movements as well as one-off, or temporary, revenue or expenditure items.	WEO	1980-2015
ReservesinmonthsofM	Total reserves in months of imports comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is valued at year-end (December 31) London prices.	WDI	1960-2015
RiskPremiumonLending	Risk premium on lending is the interest rate charged by banks on loans to private sector customers minus the "risk free" treasury bill interest rate at which short-term government securities are issued or traded in the market. In some countries this spread may be negative, indicating that the market considers its best corporate clients to be lower risk than the government.	WDI	1960-2015
DomesticCredittoGDP	Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net.	WDI	1960-2015

ShortDebttoFXDebt	Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Total external debt is debt owed to nonresidents repayable in currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt.	WDI	1970-2014
MoneyGrowth	Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper.	WDI	1961-2015
DebttoX	Total debt service is the sum of principal repayments and interest actually paid in currency, goods, or services on long-term debt, interest paid on short-term debt and repayments (repurchases and charges) to the IMF.	WDI	1970-2014
FXdebttoX	External debt stocks (% of exports of goods, services and primary income)	WDI	1970-2014
LendingRate	Lending rate is the bank rate that usually meets the short- and medium-term financing needs of the private sector.	WDI	1960-2015
REERyoy	Real effective exchange rate index, year-on-year	WDI, own calculations	1962-2015
AverageInflation	Inflation, consumer prices (three year moving average)	WDI, own calculations	1963-2015
AverageCreditGrowth	Three year moving average of year-on-year domestic credit growth	WDI, own calculations	1963-2015

DeviationGDPGrowth	Three year moving average from the real GDP trend growth rate	WEO, own calculations	1990-2015
GrossDebt	General government gross debt includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable.	WEO	1980-2015
XdebttoGNI	External debt stocks (% of GNI). Total external debt is debt owed to nonresidents repayable in currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt.	WDI	1970-2015
PrimaryBalance	General government primary net lending/borrowing	WEO	1980-2015

Table A.2 : List of variables and sources

Notes: WEO = IMF World Economic Outlook, WDI = World Bank World Development Indices.

Once the threshold for each indicator as well as its goodness of fit measure is calculated, the indicators are grouped into (i) external sector, (ii) macroeconomic and fiscal performance, and (iii) banking/financial sector indicators. A indicator's weight in the composite external, macroeconomic and banking indices is equal to its goodness of fit.