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The Global Financial Cycle and Capital Flow Episodes: A Wobbly Link?

Abstract

We add to the literature on the influence of the global financial cycle (GFC) and gyrations in capital flows. First, we build a new measure of the GFC based on a structural factor approach, which incorporates theoretical priors in its definition. This measure can also be decomposed in a price-based and quantity-based version of the GFC, which is novel in the literature. Second, we compare our measure to other common existing indicators of the GFC. Third, we estimate the influence of the fluctuations in the GFC on capital flow episodes (sudden stops, flights, retrenchments, surges) and currency crises, also testing for its stability and linearity. We find that the nexus between the GFC and capital flow episodes is generally consistent and not very wobbly. In line with theoretical priors, we find some evidence that the GFC is more important for sudden stops when it is more negative, i.e. the relationship is (mildly) convex, in keeping with a role for occasionally binding constraints, but the evidence for this feature is not strong.

JEL-Codes: F320, F330, F360, F420, F440.

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

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1 Introduction

Following the seminal contributions by Rey (2013) and Passari and Rey (2015), academics and policy-makers have focused in recent years on the question of whether global financial conditions influence capital flows, in particular to emerging market (EME) borrowers; among others, Koepke (2015) provides a survey of the literature on the role of push factors in driving capital flows. However, no consensus exists on the definition of the global financial cycle (GFC) and on the quantitative role that it plays for emerging markets, as emphasised by more recent contributions. For example, Cerutti et al. (2017) find that the quantitative importance of the global financial cycle in driving capital flows to emerging markets is not large.

In this paper, we revisit the question of the nexus between the global financial cycle (henceforth GFC) and capital flows to emerging markets by offering a novel perspective along three lines. First, we propose a new measure of the GFC obtained from a structural factor approach, which builds on theoretical considerations.[1] Second, we compare our measure with existing estimates of the GFC, for example by looking at correlations between the different indicators, with the aim of understanding how robust and consistent the available estimates are. Last and most central to the paper, we provide an analysis of the influence of the GFC on different types of capital flows *episodes* (sudden stops, currency crises, surges, retrenchments and flights), looking at *extreme* rather than *normal* shifts 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 four key questions: (i) how consistent and reliable is the measurement of the GFC, in particular comparing quantity and price-related indicators (which to our knowledge is novel in the literature)?, (ii) are our GFC measures as well as other existing measures an important driver of capital flow episodes?; (iii) is the effect consistent between different measures of the GFC?, and finally (iv) is the relationship stable over time and linear?

Our main results are threefold. First, we find that our measures of the GFC are positively correlated with other existing measures and negatively correlated with the excess bond premium of Gilchrist and Zakrajsek (2012) and the VIX, although the correlations tend to be lower for the latter variable. Price and quantity-based indicators tend to give consistent sig-

[1] We follow Eickmeier et al. (2014) on the econometric approach but the restrictions imposed are very different from theirs.

nals, but the quantity-based version appears to be more correlated with EME crisis episodes, in particular in the 1990s.

Second, we find that the GFC has a statistically and economically significant effect on the probability of experiencing currency crises and all capital flow episodes apart from retrenchments where results are mixed, in keeping with previous literature claiming that these episodes have an important global component (Forbes and Warnock (2012)). In order to give an idea of the economic significance, for most episodes a one standard deviation deterioration in the GFC more or less doubles the frequency of capital flow episodes. Although other measures of the GFC previously proposed are also significant in most regressions, we find that our baseline measure is consistently significant of all those considered, and that results are similar for the price- and quantity-based versions of our GFC indicators. Third, in our robustness analysis we find that the effect of the GFC is remarkably consistent for sudden stops and currency crises time-wise, i.e. it does not appear to be overly influenced by the global financial crisis or to be substantially different post crisis, although we find that the impact of the GFC on the frequency of sudden stops fell somewhat in the post crisis period. Moreover, we find some evidence that the relationship between the gFC and sudden stops is mildly convex, implying that the influence of the GFC is larger for lower levels of the indicator (tighter financing conditions). This is consistent at least qualitatively with the idea of occasionally binding constraints, but we should also note that the evidence for convexity is not very strong.

The paper is organized as follows. Section 2 provides a background on the existing literature. In Section 3 we describe the methodology and the data. Section 4 compares our measures of the global financial cycle to other existing measures and to US variables. Section 5 turns to the role of the global financial cycle in driving capital flow episodes. Section 6 concludes.

2 Literature review

Our work is connected to five recent strands of literature, and we will now provide a brief overview for each of them.

Drivers of capital flows. A first important strand is the literature on the drivers of capital flows. The era of financial globalization since the mid-1990's has led to a sharp increase in cross border capital 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 (2015) provides a very useful survey on this literature.

Sharp movements in capital flows. Second, the literature has focused in particular on episodes of sharp movements in capital flows. So-called sudden stops in net inflows have been of particular interest, as they led to sharp downturns in the affected economies. Recent contributions 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. Blanchard et al. (2017) present a model explaining why capital inflows are expansionary, rather than contractionary as in the basic Mundell Fleming model. Whereas capital inflows reduce exports through appreciation, they may also reduce the cost of financial intermediation, boosting activity. Related, 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.

In recent years the literature has moved beyond a focus on sudden stops towards a broader perspective of capital flow episodes. A first direction of research 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.

Push vs. pull factors driving capital flows. A significant amount of recent research has focused on the question whether episodes are driven by global "push" factors, such as the level of interest rates in centre countries (Koepke (2015)). 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, 2012). 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. Of special interest for our paper, in particular as regards our analysis of stability over time in the relationship between capital flows and the GFC, Avdjiev et al. (2017) 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.

The volatility of capital flows in the recent crisis has been most pronounced for banking flows, leading to an emphasis of research on this particular category. 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.

The optimal policy reaction. The volatility of capital flows has fueled a growing literature assessing whether they lead to inefficient patterns and how policy should react to them. In

the presence of collateral constraints individual agents can engage in borrowing that, while privately efficient, is excessive from a societal point of view as it does not internalize the impact on the price of collateral (Bianchi et al., 2012; Korinek and Mendoza, 2013). With such a pecuniary externality, a social planner would want to limit borrowing. The optimal allocation can be achieved by imposing taxes on borrowing, although the optimal tax pattern shows a specific dynamic pattern (Mendoza, 2010b) that could be difficult to implement. Brunnermeier and Sannikov (2015) point out that capital flows can display an externality leading to inefficient borrowing even in the absence of borrowing constraints, as individual investors do not take account of their impact on the degree of risk-sharing when financial markets are incomplete. Empirical studies have found that policy makers actively react to episodes of large capital flows, relying on a broad range of macroeconomic and prudential instruments (Ghosh et al., 2017). While the prominent role of conditions in core economies seems to call for more coordination of monetary policies, Banerjee et al. (2016) show that this is not necessary the case. Blanchard (2017) argues that capital controls may be the most natural instrument to deal with capital flow volatility, although he falls short of a blanket endorsement of capital controls and recognizes the potential downsides to these measures. Bauer et al. (2016) discuss how a small open economy (SOE) can defend itself against the vagaries of the global financial cycle, concluding that macro-prudential policies are preferable compared to "leaning against the wind" (namely, use monetary policy for that purpose). Ben Zeev (2017) looks at the role of capital controls in protecting emerging markets from shocks in global credit shocks. He finds that output in countries with stricter capital inflow controls responds significantly less to these shocks, while there is no noticeable effect for outflow controls. Basu et al. (2018) propose a model to analyse the optimal FX intervention in the face of capital outflow shocks in a managed float regime. One of their insights is that a central bank with full commitment and limited reserves optimally uses a combination of intervention and market communication, in particular by promising to intervene aggressively in the future but not using the full stock of reserves immediately. They also find that the optimal response depends on the persistence of the capital outflow shock.

The global financial cycle. Finally, our work is also connected to the growing literature on the GFC itself. Passari and Rey (2015) and Rey (e.g. 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)).

The theory of the global financial cycle is still at its infancy, but global banks and intermediaries play a key role in existing contributions. Indeed, international financial intermediaries can 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) point to the central role of financial intermediaries. They 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 EME.

Measuring a financial cycle is challenging in view of the large range of different price and quantity indicators. 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 (2015) and Habib and Venditti (2019) measure the financial cycle by using the global component of equity prices.

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.

3 A structural measure of the global financial cycle: Price versus quantities

3.1 Methodology and data

Our first step is to construct a measure of the GFC that is closely related to capital flows to, and financial stress in, emerging markets. A novel and key feature of our measure is that it is based on theoretical considerations building on the small but growing theoretical literature on the GFC. Moreover, we build a price-based and a quantity-based version of the GFC and compare them, which to our knowledge is novel in the literature. Price and quantities could, of course, 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.

From an econometric point of view, we build on the methodology of Eickmeier et al. (2014) and construct a GFC measure from a principal component approach that imposes theoretically-motivated restrictions on a set of global variables, although the variables we use, the restrictions we impose and the main research question are all different from theirs. Specifically, we denote the vector of N_x variables (de-trended and standardised) by x_t. We estimate a factor model:

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

where F_t is a set of N_F factors, with $N_F < N_x$.

The N_x variables cover several measures of prices and quantities pertaining to financial integration. Specifically, we consider measures of leverage by global banks and broker-dealers, of world stock market returns, of risk perceptions (including the VIX), of the strength of the USD, of emerging markets bond spreads, of credit volumes and of capital flows. Table 3 provides a detailed presentation of the data, while Figure 1 reports all the variables that we use in the construction of the GFC, appropriately de-trended and standardised.[2] Our GFC measures are defined on quarterly data from 1990 to 2017.

We impose a set of restrictions shown in Table A in constructing our GFC measure. We base the sign restrictions as much as possible on existing literature, especially the more theoretically oriented contributions, as also detailed in the table. We impose that the global

[2]We de-trend the variables using a one-side HP filter.

financial factor has a negative loading for the VIX, the Exchange Market Pressure for emerging economies, and the EMBI spread. While we do not assume a positive loading on portfolio flows to emerging markets in the baseline measure, we do so for the quantity-based measure because it appears necessary to obtain reasonable estimates.[3]

Moreover, we assume that our estimate of the global financial cycle has a positive loading on a number of "centre" or global variables, notably world equity prices, the relative equity price of banks, and the global credit to GDP ratio (proxied by the G7).[4] Following Bruno and Shin (2015), Hofmann et al. (2016) and Avdjiev et al. (2019), we include a restriction for the US dollar nominal effective exchange rate (de-trended and standardized), in order to capture the financial channel of the USD (USD appreciation hurts USD borrowers' balance sheets and lenders' risk-taking capacity). Last but not least, following Bruno and Shin (2015), we assume that the global financial cycle is positively correlated with the leverage of broker/dealers.

Two observations are in order here. First, 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.[5] We instead treat the GFC as a latent state of the world which we aim to uncover applying our restrictions.

Second, while the restriction on portfolio flows to emerging markets is well grounded in the literature, it may raise concerns of circularity, as we later connect episodes of extreme capital flow to our resulting GFC measure. This may be a problem because we will also find later that our measure appears to capture capital flow episodes (mostly in EME) particularly well, and it seems to detect the wave of EME crises in the 1990s (Mexican and Asian crises). While this is a caveat to be kept in mind, we will show later that removing the corresponding sign restrictions leads to a GFC estimate that is very close to the baseline, and with the same characteristics in terms of correlation with EME events.

[3]Notably, the global financial crisis would hardly be visible in the quantity-based measure if we did not impose a restriction on portfolio flows to EME.

[4]Note that the credit to GDP variable tends to be negatively correlated, in the same quarter, with other variables that would normally point to easier financing conditions. Part of the reason may be that credit responds to shocks with significant lags, which our contemporaneous restrictions do not capture. In future versions of the paper, we plan to experiment with restrictions on lagged loadings. For the time being, we have experimented with removing the sign restriction on credit, and found that it makes little difference to the estimated GFC.

[5]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 Habib and Venditti (2019) 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.

Table A: Note: the sign restrictions are imposed on the factor loadings corresponding to each variable.

Sign restrictions imposed on the GFC factors.

	Baseline	Price-based	Quantity-based	Main theoretical reference or supporting evidence for motivating the restriction
Exchange Market Pressure for EME	-			Banerjee et al. (2016), Bruno and Shin (2015)
Portfolio flows to EME			+	Bruno and Shin (2015), Cesa-Bianchi et al. (2018)
Global credit/GDP	+		+	Cesa-Bianchi et al. (2018)
Leverage of broker-dealers	+		+	Cesa-Bianchi et al. (2018), Bruno and Shin (2015), Passari and Rey (2015)
USD NEER	-	-		Bruno and Shin (2015), Hofmann et al. (2016) Avdjiev et al. (2019)
World equity price	+	+		Miranda-Agrippino and Rey (2015)
Relative world equity price banks	+	+		
EMBI spread	-	-		Cesa-Bianchi et al. (2018), Banerjee et al. (2016)
VIX	-	-		Rey (2013), Miranda-Agrippino and Rey (2015)

From a methodological point of view, we build the GFC measure by computing 100,000 rotations of the factors by multiplying it by a orthonormal matrix. For each rotation, we check if the sign restrictions, contained in Table A, are satisfied, and keep the factor only if they are. Note that this procedure leads to a multiplicity of GFC measures, as many different rotations may satisfy the restrictions; for illustrative purposes, we will show the median values across different factors (all satisfying the restrictions) and, at each point in time, the cross-sectional standard deviation around them.

3.2 Measures of the GFC: Some stylised facts

In this section we show some illustrative evidence on our measures of the GFC as well as compare our measures with other existing ones, in order to give a sense of the robustness of the GFC estimates and also their relation with EME stress and capital flows.

Table 4 gives a sense of how restrictions shape the estimated GFC factors, with the general message that correlations tend to be similar also when the factor loadings are unrestricted. For example, the quantity-based GFC loads on equity prices, EMBI spreads and VIX in a similar way as the price-based measure where the sign restrictions are imposed. Vice versa, the price-based factor loads positively on broker-dealer leverage as well as portfolio flows to EME. However, there are some exceptions to the rule, in particular for the credit to GDP ratio, which loads positively (by construction) for the baseline and quantity-based measure but *negatively* for the price-based measure.

Figure 3 compares the quantity and price-based indicators (together with the baseline that combines restrictions on both quantity and price variables), which to our knowledge is novel in the literature. We find that the price and quantity based indicators are strongly positively correlated, but there are some interesting deviations in particular in the mid to late 1990s (Mexican and Asian crises), when the price-based measure does not appear to capture EME stress adequately, while the measures with restrictions on quantity variables do.[6]

In order to further look into how restrictions shape the GFC factors - in particular the risk of circularity as these structural factors are built on restrictions to EME variables that are then used to explain EME capital flow episodes - Figure 3 compares the baseline measure with two variables where (i) all restrictions on EME variables and (ii) the restriction on the

[6]Note that this is the case also for the baseline measure, which does not impose any restriction on EME portfolio flows.

USD are lifted. Perhaps surprisingly, relaxing the restrictions on EME variables does not appear to have material implications for the estimated factor, in particular it still appears to capture the EME crises in the 1990s (the Mexican and Asian crisis in particular). Relaxing the restriction on the USD likewise has little impact on the estimates.

Figures 4 and 5 compare our baseline GFC estimate with other existing estimates. First, our GFC measure is strongly correlated with the measure of Miranda-Agrippino and Rey (2015) and negatively correlated with the VIX, though not very strongly.[7] Moreover, it is also strongly correlated with the excess bond premium of Gilchrist and Zakrajsek (2012), shown with a minus sign, although it is noteworthy that even this latter measure does not appear to capture the EME crises in the 1990s.[8]

Table 5 shows correlations between different GFC measures, pointing to generally positive and relatively strong correlations between our GFC measures and other existing estimates (note that again the excess bond premium and the VIX are shown with a negative sign, for ease of comparability). However, it is interesting that the quantity-based GFC is uncorrelated with the VIX, and, more generally, that the VIX is not very strongly correlated with other measures, including (perhaps surprisingly) the one of Miranda-Agrippino and Rey (2015). This in turn sheds some doubt on the idea that the VIX is a good catch-all measure of the global financial cycle.

Table 6 shows correlations between our baseline GFC measure and selected macroeconomic variables of global significance (without of course making any causality claim here). The GFC is shown to be positively correlated with US real GDP growth, oil price growth (which is however uncorrelated with the VIX) as well as US interest rates, in particular the long term rate, with the expected negative sign. (The positive sign for oil prices might also reflect, beyond the correlation with global business cycle conditions, also a role for financing conditions in oil exporters, although we do not test this explicitly.)

[Include Tables 3-5 and Figures 2-5 here]

Overall, we find that our measures of the GFC are positively correlated with other existing measures and negatively with the excess bond premium and the VIX, although the correlations tend to be lower for the latter variable. Price and quantity-based indicators tend to give consistent signals, but the quantity-based version appears to be more correlated with EME crisis episodes, in particular in the 1990s.

[7] We do not (yet) compare our GFC to the one of Habib and Venditti (2019) because it has been developed in parallel.

[8] See Ben Zeev (2019) for a use of this indicator of GFC for, inter alia, capital flows to EME.

Table 2: 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.

4 Capital flow episodes and global financial cycle

4.1 Country sample

We largely draw from the database of Scheubel and Stracca (2016), which provides annual data from 1990 to 2017 and covers in principle 189 countries, but we use the data at *quarterly* frequency.[9] Later we will also consider emerging and developing countries separately, which constitute the bulk of our sample of countries anyway. 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.[10] Moreover, the data availability is further reduced by the availability of the co-variates, so that we end up with sample sizes between 5,000 and 18,000 quarterly observations, depending on the specification. Table 2 contains a description of how the quarterly data are constructed and which of our data are originally at that frequency or interpolated.

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

[9]Note that the database is available online at https://www.nber.org/data/international-finance/.

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

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 Scheubel et al. (2019), giving only a short description here.[11]

In short, 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. $\Delta c_t^x = c_t^x - c_{t-1}^x$ denotes the quarterly year-over-year change in flows. In addition, we denote the four-quarter moving average of the change in flows by $m_4^{\Delta c_t^x} = \left(\sum_{h=1}^{4} \Delta c_{t-h}^x\right)/4$ and the standard deviation of flows during those four quarters???? by $sd_4^{\Delta c_t^x} = \left(\sum_{h=1}^{4} sd(\Delta c_{t-h}^x)\right)/4$. We define capital flow episodes as times where the change in flows in a year differs from the previous moving average by at least two standard deviations for at least a year (and by one standard deviation subsequently). Importantly, our approach focuses on *private* capital flows, different for example from Forbes and Warnock (2012).[12]

We define currency crises as in Laeven and Valencia (2012) but apply the methodology to quarterly data. We compute the year-on-year exchange rate depreciation and then we define a crisis event as a quarter where the depreciation is larger than the thresholds in Laeven and Valencia. 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 7 reports the frequency of each capital flow episode in our sample, split between advanced economies and EME. Notably, currency crises are much more common in EME, but other capital flow episodes are more common in advanced countries, due to higher volatility in their capital flows (probably in turn reflecting higher capital account openness). While we will show most of our results for all countries, later on we will also report results for EME separately.

Figure 6 shows the time clustering of one key capital flow episode, sudden stops, and of currency crises, together with our baseline GFC measure. We find that the number of sudden stops peaked during the global financial crisis and in the late 1990s, while currency crises show a trend towards diminishing over time, which pertains in particular to EME.

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

[12] 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 flows is provided in Appendix B of Scheubel and Stracca (2016).

4.3 How important is the Global Financial Cycle for capital flow episodes?

Baseline regressions. After identifying capital flow episodes and currency crises, our next question is the role of the global financial cycle in driving them. To this aim, we run the following logit regression with country fixed effects,

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

where $X_{i,t-1}$ is a vector of country-specific controls, which includes (i) de iure financial openness (the Chinn-Ito index), (ii) an external vulnerability index which is defined in Appendix A, (iii) the composite risk rating from the International Country Risk Guide (ICRG), a measure of 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, (viii) IMF access (availability based on the country's IMF quota) and (ix) the ratio between foreign exchange reserves and GDP.[13] Because including controls implies a significant loss of available observations, we also estimate the same equation *without* the X vector, with results that are generally consistent with the baseline regression. Standard errors are robust for heteroscedasticity and serial correlation.

Note that we include variables in the X vector that have originally a quarterly frequency (see Table 2) with lag $t-1$, but those with 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 X 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 parameter for this analysis is β, which we expect to be *negative* for all episodes (say, an upswing in the global financial cycle reduces the probability of a crisis in emerging markets) except surges. In the regression tables we show coefficients associated with each measure of the GFC moving up *by one standard deviation.* Observe that, for ease of comparability, all possible measures of the GFC (including, for example, the VIX) are defined such

[13]For more information on the variables please refer to the original paper, Scheubel and Stracca (2016) as well as to Scheubel et al. (2019).

that a positive value indicates an easing.

Robustness over time and asymmetry. A central question addressed in this paper is whether the relationship between the global financial cycle and capital flow episodes is robust to different definitions of the cycle and in different periods. Therefore, we run this regression using several different definitions and time periods by estimating the following equation:

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

where Z_t is a vector of variables including (i) the GFC itself, hence testing whether a quadratic term is significant; (ii) a dummy for the global financial crisis (2008-09); (iii) a dummy for the post-2007 sample. In this way, we test for the functional form of the relationship as well as possible variation over time. Observe, however, that for reasons of sample size we add each component of the Z vector one by one, and not simultaneously which would be the ideal choice if we had more degrees of freedom available.

A short discussion on the functional form is worthwhile. It is indeed possible that the effects of the GFC are asymmetric between tighter and looser conditions. If there are occasionally binding constraints, for example, a worsening of the GFC may 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, because the GFC is expected to have a negative sign by construction (a higher GFC indicates a loosening of conditions). We also cross check this specification in another variant where we include separately a variable equal to the GFC measure when this is below minus one standard deviation, i.e. when it is particularly 'tight'.[14]

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 on top of them. The estimated

[14]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 (2010a). 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.

regression is therefore

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

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

5 Results

5.1 Baseline results

Tables 8 to 12 report the baseline results for equation (2) for different measures of the GFC, where each table reports results for one type of episode (note that again the excess bond premium and the VIX and included with a negative sign, for ease of comparability). Results for the GFC are generally robust to excluding country specific controls in order to increase the sample size, as noted in the previous section.

Results for *sudden stops* (Table 8) show a negative and statistically significant effect of the GFC in all its measures apart from the MAR one. Also note that the effects are economically significant, as the coefficient is of the same order of magnitude as the sample frequency of sudden stops; in other words, a one standard deviation increase in the GFC lowers the probability of experiencing a sudden stop by a magnitude similar to the sample prevalence of this episode.[15] Among the controls, we find that only the composite risk rating and the ratio of the current account to GDP are statistically significant, with the expected signs.

Results for *currency crises* (Table 9) also show a statistically significant and negative coefficient for the GFC; again, the effect for our GFC measures is economically significant using the metric applied to sudden stops. Among the controls, we find that a number of domestic variables influence the probability of experiencing a currency crisis, including financial openness, being a peg, the composite risk rating and IMF access with a negative sign, as expected; foreign currency debt to GDP with a positive sign, again in line with the priors. The Pseudo-R2 also suggest that currency crises are to a significant extent predictable events but also that domestic factors matter more than the GFC, judging to the R2 contributions.

[15]Note, however, that our perspective is different from that of Cerutti et al. (2017), namely we do not investigate the question of how much of the incidence of capital flow episodes is due to the GFC, which is instead their main focus.

The GFC enters also *positively* and significantly in the regressions for capital flow *surges* (Table 10). In other words, a loosening of the GFC leads to more frequent surges in capital inflows, with an effect that in the same ballpark as the other episodes (a standard deviation in the GFC leading to a doubling of the frequency of episodes). Among the controls, we find that higher IMF access increases the likelihood of surges, whereas other domestic controls are insignificant.

Our GFC measures are statistically significant and negative for *flights* (Table 11), but the MAR and the excess bond premium are insignificant. The influence of the GFC is quantitatively smaller than for other episodes, however. Moreover, for this capital flow episode no control variable turned out to be statistically significant.

Finally, there is no consistent evidence that the GFC matters for *retrenchments* (Table 12). The price-based GFC is negative and significant, as are the excess bond premium and the VIX, while the MAR measure is even positive, although statistically insignificant. Among the domestic control variables, the external vulnerability index, the current account to GDP ratio and the availability of foreign exchange reserves all reduce the likelihood of experiencing retrenchments. The inconsistency of the results for the GFC is not unexpected because these capital flow episodes are, by definition, driven by domestic investors.

[**Include Tables 8-12 here**]

All in all, we find that the GFC has a statistically and economically significant effect on the likelihood of all capital flow episodes apart from retrenchments (and quantitatively small for flights), as well as of currency crises, in line with previous literature (Forbes and Warnock (2012)). For most episodes, a one standard deviation deterioration in the GFC leads to more or less a doubling of the frequency of episodes (the sign is opposite for surges). Domestic controls matter differently for each episode, and they appear to be particularly important for currency crises and less for capital flow episodes. In other words, there does not seem to be a consistent set of domestic variables that are robustly related to the probability of experiencing capital flow episodes or currency crises.

5.2 Robustness

We now turn to evaluate the stability and functional form of the nexus between the GFC and capital flow episodes in Tables 13 (for sudden stops) and 14 (for currency crises), hence estimating equations (3) and (4).[16] These tables report the baseline regression in column 1

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

and a number of variants in subsequent columns.

Results for sudden stops (Table 13) show that the coefficient for the GFC becomes smaller when global controls are added, and US real GDP growth and the US interest rate are all statistically and economically significant predictors of sudden stop episodes (see column 2Results for emerging markets only, excluding episodes in advanced countries, are similar to the baseline results (column 3), but (as expected) the coefficient of the GFC is larger. The squared term of the GFC is statistically significant (only at 10 per cent) and positive, indicating that the relationship is mildly convex (column 4); however, the variable capturing the very low levels of the GFC is insignificant (column 5). Finally, there is some evidence of a small reduction in the effect of the GFC in the post crisis environment, consistent with other recent studies (column 7).[17] We conclude, therefore, that (i) the relationship between the incidence of sudden stops and the GFC is mildly asymmetric (convex) and relatively stable over time but that some of the effect of the GFC is captured by US macro variables, , i.e. it is not only in the "financial" component of the GFC.

Results for currency crises (Table 14) suggest that, instead, the baseline results are robust when including global controls (column 2), as US real GDP growth and oil prices are statistically insignificant. Results for emerging markets only (column 3) are again almost identical to the baseline ones. Furthermore, there is no evidence that the relationship is either non-linear or time-varying during or after the global financial crisis, as visible in the insignificant variables from columns 4 to 7.

Overall, in this robustness analysis we find that the effect of the GFC is remarkably consistent for sudden stops and currency crises time-wise, with a slight reduction of the effect for sudden stops in the post crisis environment. The relationship between the GFC and sudden stop is mildly convex, which is in keeping with the idea that occasionally binding constraints matter, but the non-linearity is statistically and economically relatively weak.

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 specifically make two

[17] Avdjiev et al. (2017) and Habib and Venditti (2019) 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.

contributions to the existing literature. First, we construct a new measure of the GFC based on a structural factor approach, which allows us to construct price-based and a quantity-based estimates and compare them, as well as compare our measures to other existing measures in the literature - hence also allowing us to take a view on how robust and consistent existing measures of the GFC are. Second, and most central, we study the links between different types of large capital flow *episodes* (sudden stops, currency crises, surges, retrenchments and flights) 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.

With our analysis we reach three main conclusions. First, we find that our measures of the GFC are significantly correlated with other existing measures of the GFC, with the expected signs. Importantly, price and quantity-based indicators tend to give consistent signals, but the quantity-based version appears to be more correlated with EME crisis episodes, in particular in the 1990s. Second, we find that the GFC has a statistically significant effect on the frequency of all capital flow episodes (apart from retrenchments, that are driven by domestic investors) and currency crises, broadly consistent with previous literature claiming that these episodes have an important global component (Forbes and Warnock (2012)). The effect is also economically significant: indeed, a one standard deviation deterioration in the GFC more or less doubles the frequency of capital flow episodes (with the opposite sign for surges). Although other measures of the GFC previously proposed are also significant in some regressions, we find that our baseline measure is the consistently significant of all those considered (implying that our measure can be seen as a benchmark in the literature, at least as far as EME stress and capital flow episodes are concerned), and again that results are generally the same between the price- and quantity-based versions of our GFC indicators. Finally, we find that the effect of the GFC is remarkably consistent for sudden stops and currency crises time-wise as it does not appear to be overly influenced by the global financial crisis or to be substantially different post crisis than before it (although with a slight weakening of the effect of the GFC on sudden stops after the global financial crisis). However, we find that (i) the coefficient for the GFC becomes smaller for sudden stops once global macro variables (US growth and interest rates and oil prices) are included, suggesting that the transmission channel is not necessarily, or at least not only, "financial" in nature; and (ii) the relationship between the GFC and the probability of sudden stops is mildly convex, in line with the idea that occasionally binding constraints matter, but the evidence for this feature is not particularly strong, neither statistically nor economically.

Overall, we conclude that the nexus between the GFC and capital flow episodes is strong, well established and not a very wobbly one, although 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 3: Data used for the structural measure of the GFC

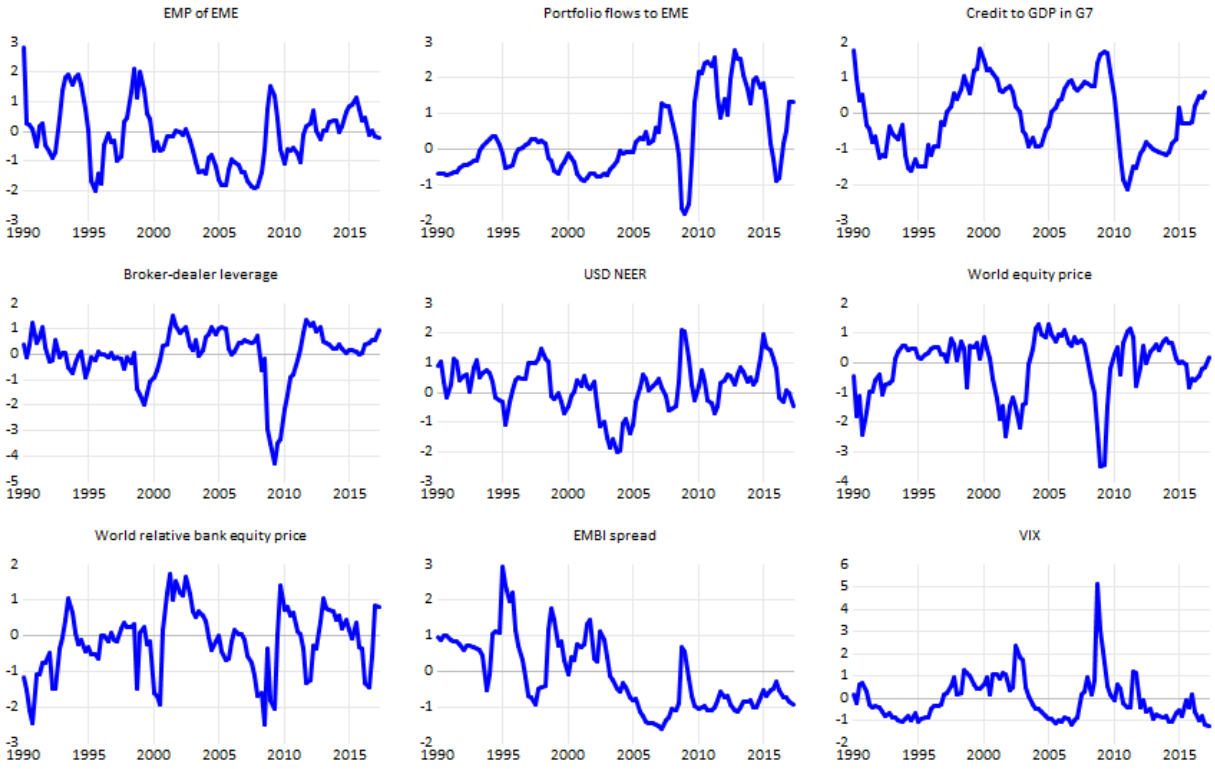
Indicator	*Availability at quarterly frequency*	*Details on calculation*
Leverage of Global Banks (own calculations)	1980:Q1-2017:Q4	Own calculation based on Datastream data.
Exchange Market Pressure for EME	1980:Q1-2016:Q4	Exchange Market Pressure Index, average for 25 EME. The average is weighted with the shares of 2010 GDP in PPP (data from WB WDI), therefore the weights are fixed within a year and before 1990. The index is computed as the difference between the growth rate of exchange rate and the growth rate of reserves minus gold (both qoq).
Total Credit to Non Financial Sector over GDP (BIS, End of Period), G7 countries (EA, Canada, Japan, UK, US)	1980:Q1-2016: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	1980:Q1-2017:Q2	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:Q3-2016:Q4	Source: Bloomberg.
VIX/VXO	1990:Q1-2017:Q4	VIX Level.
Datastream World Total Shares Price	1980:Q1-2017:Q4	Level
Datastream Bank Total Share Price	1995:Q1-2017:Q4	Level.

Table 4: Note: the sign restrictions imposed to the structural factors are shown in parentheses. The GFC factor is the median across all estimated factors satisfying the sign restrictions in Table A. Sample period 1990 to 2017, quarterly data.

Correlation of the estimated Global Financial Cycle factor with the constituent components.

	Baseline	Price-based	Quantity-based
Exchange Market Pressure for EME	-0.55 (-)	-0.53	-0.31
Portfolio flows to EME	0.30	0.71	0.48 (+)
Global credit/GDP	0.18 (+)	-0.51	0.32 (+)
Leverage of broker-dealers	0.42 (+)	0.44	0.40 (+)
USD NEER	-0.43 (-)	-0.45 (-)	0.03
World equity price	0.56 (+)	0.77 (+)	0.40
Relative world equity price banks	0.33 (+)	0.42 (+)	0.07
EMBI spread	-0.58 (-)	-0.57 (-)	-0.79
VIX	-0.38 (-)	-0.62 (-)	-0.23

Figure 1: Underlying components of the global financial cycle.



Notes: Underlying components of the global financial cycle. The data are de-trended where appropriate and standardised for all variables.

Figure 2: The blue solid line indicates the median baseline measure of the GFC, the green line with circles the quantity-based measure, and the dashed purple line the price-based measure.

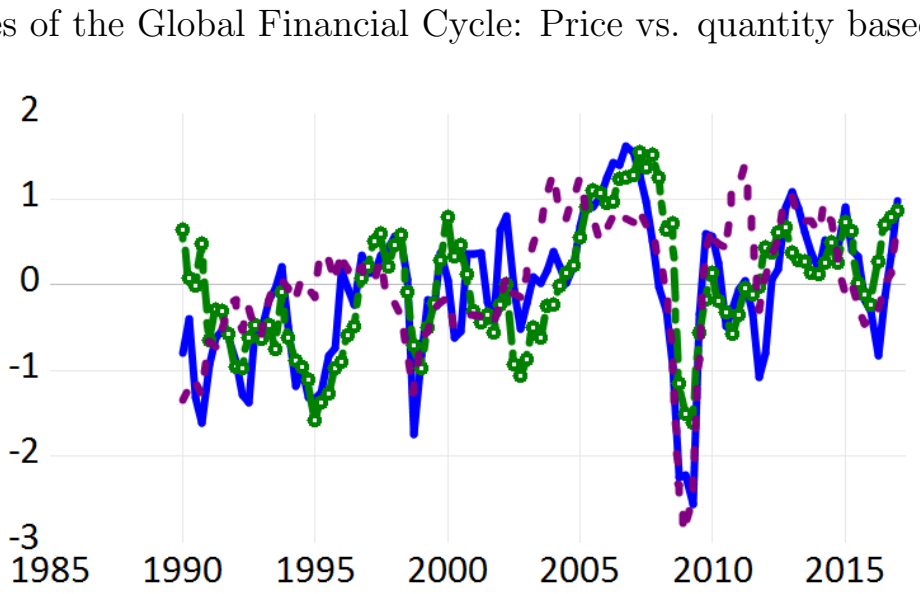


Figure 3: The blue solid line indicates the median baseline measure of the GFC, the green line with circles relax all the sign restrictions related to EME variables and the purple dashed line relaxes the sign restriction on the USD NEER.

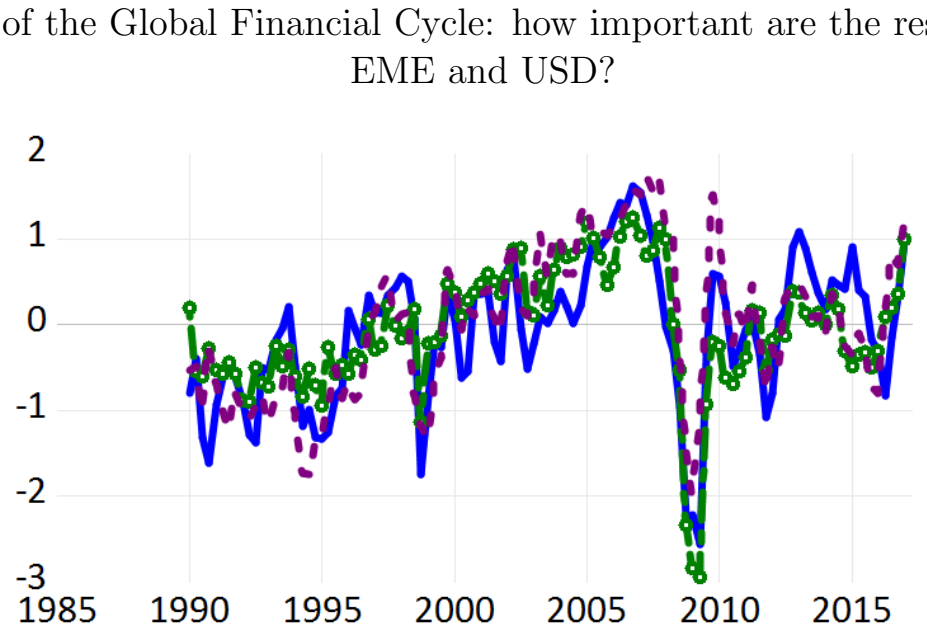


Figure 4: The blue solid line indicates the median baseline measure of the GFC, the green line with circles the Miranda Agrippino and Rey measure, and the dashed purple line the VIX.

Comparing different estimates of the Global Financial Cycle I.

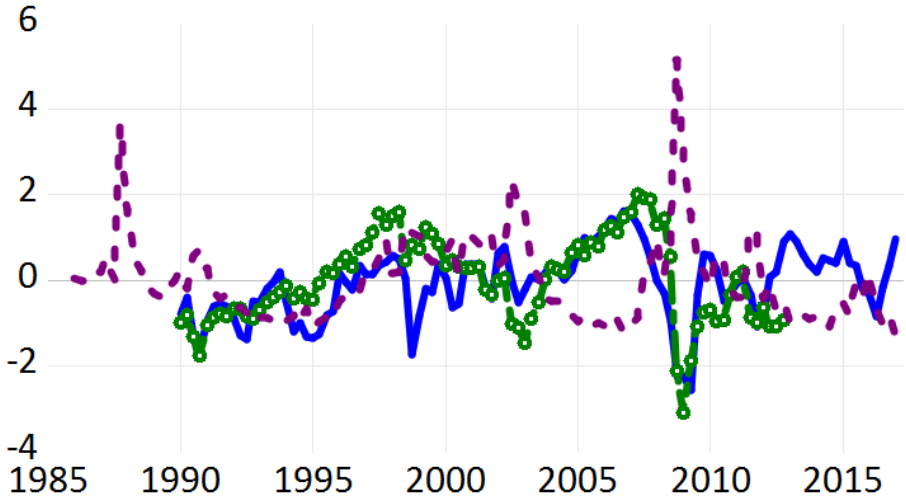


Figure 5: The blue solid line indicates the median baseline measure of the GFC and the green line with circles the excess bond premium, with the minus sign for ease of comparability.

Comparing different estimates of the Global Financial Cycle II.

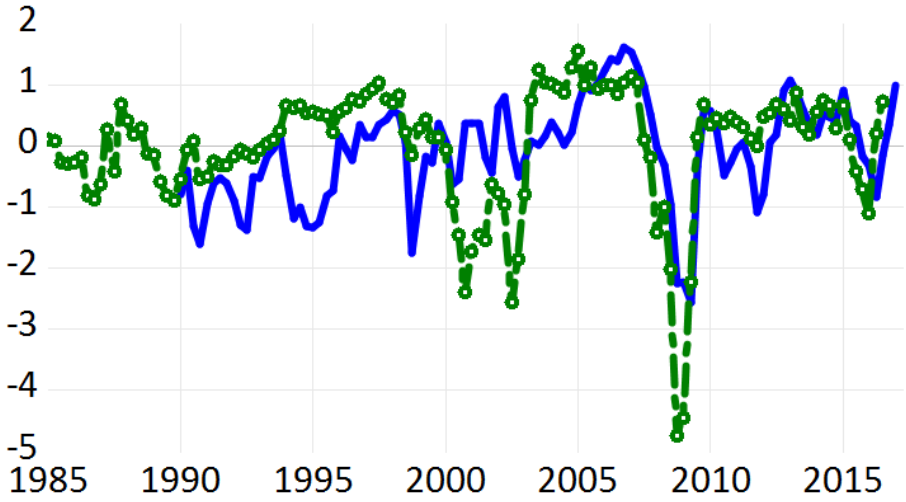


Table 5: Sample period 1990 to 2017.

Correlations between different GFC measures (common sample)

	(1)					
	GFC baseline	GFC quantity-based	GFC price-based	MAR	Excess bond premium	VIX
GFC baseline	1					
GFC quantity-based	0.79***	1				
	(0.000)					
GFC price-based	0.73***	0.49***	1			
	(0.000)	(0.000)				
MAR	0.68***	0.53***	0.48***	1		
	(0.000)	(0.000)	(0.000)			
Excess bond premium	0.53***	0.24***	0.67***	0.46***	1	
	(0.000)	(0.000)	(0.000)	(0.000)		
VIX	0.47***	0.16***	0.54***	0.34***	0.78***	1
	(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: Sample period 1990 to 2017.

Correlations between the GFC and selected macroeconomic variables

	(1)					
	GFC baseline	VIX	US real GDP growth	Oil price growth	US short term rate	US long term rate
GFC baseline	1					
VIX	0.48***	1				
	(0.000)					
US real GDP growth	0.30***	0.42***	1			
	(0.000)	(0.000)				
Oil price growth	0.34***	0.24***	0.25***	1		
	(0.000)	(0.000)	(0.000)			
US short term rate	-0.046***	-0.054***	0.076***	0.040***	1	
	(0.000)	(0.000)	(0.000)	(0.000)		
US long term rate	-0.21***	0.035***	0.17***	0.090***	0.86***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

p-values in parentheses

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

Figure 6

Global prevalence of capital flow episodes and the global financial cycle

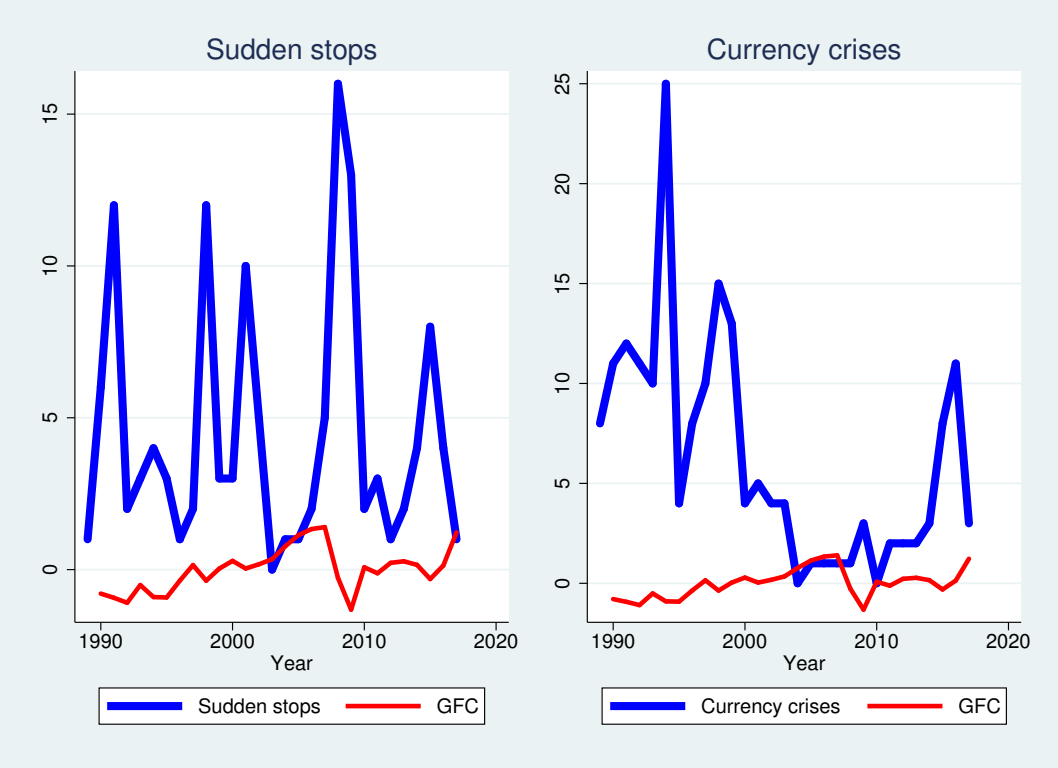


Table 7: Sample period 1990 to 2017, quarterly data for 189 countries. For more information on the data see Scheubel and Stracca (2016).

Frequency of each capital flow episode

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%

Table 8: The table reports results from a logit regression with country fixed effects. Dependent variable: Sudden stop episode. Sample period 1990 to 2017, quarterly data. MAR is the Miranda Agrippino and Rey measure of the global financial cycle; GFC is the measure of the global financial cycle, changing in each column. Robust standard errors are in parenthesis.

Probability of a sudden stop and the global financial cycle

	(1) GFC baseline	(2) GFC baseline no controls	(3) GFC price-only	(4) GFC quantity-only	(5) MAR	(6) Excess bond premium	(7) VIX
GFC	-0.490***	-0.501***	-0.888***	-0.638***	-0.064	-0.449***	-0.419***
	(0.076)	(0.073)	(0.111)	(0.128)	(0.080)	(0.051)	(0.052)
Composite risk rating, t-1	0.022**		0.019*	0.021*	0.019*	0.021*	0.019*
	(0.011)		(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Current account/GDP, t-1	-0.027**		-0.021*	-0.027**	-0.021*	-0.022*	-0.023*
	(0.013)		(0.012)	(0.013)	(0.013)	(0.012)	(0.012)
Observations	4,773	5,480	4,773	4,773	3,764	4,653	4,773
Pseudo-R2	0.0309	0.0254	0.0448	0.0213	0.00377	0.0510	0.0419

Table 9: The table reports results from a logit regression with country fixed effects. Dependent variable: currency crisis. Sample period 1990 to 2017, quarterly data. MAR is the Miranda Agrippino and Rey measure of the global financial cycle; GFC is the measure of the global financial cycle, changing in each column. Robust standard errors are in parenthesis.

Probability of a currency crisis and the global financial cycle

	(1) GFC baseline	(2) GFC baseline no controls	(3) GFC price-only	(4) GFC quantity-only	(5) MAR	(6) Excess bond premium	(7) VIX
GFC	-1.034***	-0.541***	-1.384***	-1.465***	-1.341***	-0.700***	-0.568***
	(0.130)	(0.048)	(0.186)	(0.214)	(0.202)	(0.088)	(0.088)
Chinn-Ito index, t-4	-1.394**		-1.359**	-1.384**	-1.606**	-1.271**	-1.123**
	(0.569)		(0.569)	(0.567)	(0.754)	(0.573)	(0.568)
Peg (Klein and Shambaugh), t-4	-1.682**		-1.610**	-1.567**		-1.575**	-1.575**
	(0.738)		(0.738)	(0.736)		(0.740)	(0.738)
Composite risk rating, t-1	-0.119***		-0.109***	-0.107***	-0.072**	-0.122***	-0.114***
	(0.026)		(0.024)	(0.025)	(0.035)	(0.025)	(0.024)
Foreign currency debt/GDP, t-1	0.001***		0.001***	0.001***	0.001**	0.001***	0.001***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IMF Access, t-4	-0.278**		-0.255**	-0.274**	-0.179	-0.286**	-0.295***
	(0.116)		(0.113)	(0.111)	(0.145)	(0.115)	(0.112)
Peg (Klein and Shambaugh), t-4 = o,					-		
Observations	2,683	17,849	2,683	2,683	1,507	2,683	2,683
Pseudo-R2	0.302	0.0254	0.282	0.259	0.306	0.289	0.240

Table 10: The table reports results from a logit regression with country fixed effects. Dependent variable: surge episode. Sample period 1990 to 2017, quarterly data. MAR is the Miranda Agrippino and Rey measure of the global financial cycle; GFC is the measure of the global financial cycle, changing in each column. Robust standard errors are in parenthesis.

Probability of a surge and the global financial cycle

	(1) GFC baseline	(2) GFC baseline no controls	(3) GFC price-only	(4) GFC quantity-only	(5) MAR	(6) Excess bond premium	(7) VIX
GFC	0.412***	0.428***	0.535***	0.237*	0.332***	0.484***	0.359***
	(0.097)	(0.096)	(0.145)	(0.139)	(0.080)	(0.105)	(0.094)
IMF Access, t-4	0.046**		0.050***	0.048***	0.029	0.052***	0.060***
	(0.018)		(0.018)	(0.018)	(0.019)	(0.018)	(0.018)
Observations	5,413	5,479	5,413	5,413	4,345	5,286	5,413
Pseudo-R2	0.0154	0.0127	0.0128	0.00573	0.0144	0.0205	0.0143

Table 11: The table reports results from a logit regression with country fixed effects. Dependent variable: flight episode. Sample period 1990 to 2017, quarterly data. MAR is the Miranda Agrippino and Rey measure of the global financial cycle; GFC is the measure of the global financial cycle, changing in each column. Robust standard errors are in parenthesis.

Probability of a flight and the global financial cycle

	(1) GFC baseline	(2) GFC baseline no controls	(3) GFC price-only	(4) GFC quantity-only	(5) MAR	(6) Excess bond premium	(7) VIX
GFC	-0.137*	-0.137*	-0.341***	-0.398***	-0.007	-0.042	-0.087
	(0.083)	(0.083)	(0.117)	(0.125)	(0.076)	(0.068)	(0.066)
Observations	5,513	5,513	5,513	5,513	4,419	5,383	5,513
Pseudo-R2	0.00159	0.00159	0.00485	0.00580	6.08e-06	0.000227	0.000980

Table 12: The table reports results from a logit regression with country fixed effects. Dependent variable: retrenchment episode. Sample period 1990 to 2017, quarterly data. MAR is the Miranda Agrippino and Rey measure of the global financial cycle; GFC is the measure of the global financial cycle, changing in each column. Robust standard errors are in parenthesis.

Probability of a retrenchment and the global financial cycle

	(1) GFC baseline	(2) GFC baseline no controls	(3) GFC price-only	(4) GFC quantity-only	(5) MAR	(6) Excess bond premium	(7) VIX
GFC	-0.056	-0.050	-0.272*	-0.010	0.164	-0.184**	-0.191**
	(0.106)	(0.087)	(0.156)	(0.179)	(0.106)	(0.075)	(0.076)
External vulnerability index, t-4	-1.011**		-0.975**	-1.009**	-0.625	-0.895**	-0.980**
	(0.415)		(0.413)	(0.415)	(0.490)	(0.422)	(0.414)
Current account/GDP, t-1	-0.036**		-0.033**	-0.036**	-0.036**	-0.033**	-0.031**
	(0.015)		(0.015)	(0.015)	(0.017)	(0.016)	(0.015)
Foreign exchange reserves/GDP, t-1	-0.005**		-0.005*	-0.005**	-0.008*	-0.005**	-0.004*
	(0.002)		(0.002)	(0.002)	(0.004)	(0.003)	(0.002)
Observations	3,118	5,511	3,118	3,118	2,140	2,996	3,118
Pseudo-R2	0.0201	0.000201	0.0230	0.0198	0.0229	0.0266	0.0261

Table 13: The table reports results from a logit regression with country fixed effects. Dependent variable: sudden stop episode. Sample period 1990 to 2017, quarterly data. GFC is the baseline measure of the global financial cycle. Robust standard errors are in parenthesis.

Probability of a sudden stop and the global financial cycle: Stability over time, global controls and asymmetry

	(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 baseline	-0.490***	-0.260**	-0.734***	-0.343***	-0.323**	-0.386***	-0.625***
	(0.076)	(0.102)	(0.115)	(0.110)	(0.151)	(0.125)	(0.100)
Composite risk rating, t-1	0.022**	0.014	0.019	0.021*	0.022**	0.021*	0.021**
	(0.011)	(0.011)	(0.021)	(0.011)	(0.011)	(0.011)	(0.011)
Current account/GDP, t-1	-0.027**	-0.016	-0.010	-0.025**	-0.026**	-0.025**	-0.027**
	(0.013)	(0.012)	(0.020)	(0.012)	(0.012)	(0.012)	(0.013)
US real GDP growth		-0.355***					
		(0.129)					
US short term interest rate		0.147***					
		(0.035)					
Oil price growth (USD)		-0.007					
		(0.005)					
GFC squared				0.086*			
				(0.049)			
GFC¡-1					-0.227		
					(0.180)		
GFC*dummy for 2008-2009						-0.157	
						(0.151)	
GFC*dummy for 2010-2017							0.280*
							(0.145)
Observations	4,773	4,753	1,854	4,773	4,773	4,773	4,773
Pseudo-R2	0.0309	0.0531	0.0643	0.0329	0.0320	0.0316	0.0335

Table 14: The table reports results from a logit regression with country fixed effects. Dependent variable: currency crisis. Sample period 1990 to 2017, quarterly data. GFC is the baseline measure of the global financial cycle. Robust standard errors are in parenthesis.

Probability of a currency crisis and the global financial cycle: Stability over time, global controls and asymmetry

	(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 baseline	-1.034***	-0.881***	-1.073***	-1.040***	-1.564***	-1.056***	-0.957***
	(0.130)	(0.210)	(0.161)	(0.311)	(0.431)	(0.304)	(0.195)
Chinn-Ito index, t-4	-1.394**	-1.374**	-1.486**	-1.394**	-1.365**	-1.393**	-1.422**
	(0.569)	(0.567)	(0.701)	(0.570)	(0.566)	(0.569)	(0.573)
Peg (Klein and Shambaugh), t-4	-1.682**	-1.768**	-1.500**	-1.682**	-1.714**	-1.684**	-1.678**
	(0.738)	(0.740)	(0.760)	(0.739)	(0.738)	(0.739)	(0.738)
Composite risk rating, t-1	-0.119***	-0.127***	-0.150***	-0.119***	-0.117***	-0.119***	-0.118***
	(0.026)	(0.027)	(0.032)	(0.026)	(0.025)	(0.026)	(0.026)
Foreign currency debt/GDP, t-1	0.001***	0.001***	0.004***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
IMF Access, t-4	-0.278**	-0.290**	-0.384***	-0.278**	-0.270**	-0.278**	-0.276**
	(0.116)	(0.118)	(0.136)	(0.116)	(0.115)	(0.116)	(0.116)
US real GDP growth		-0.193					
		(0.341)					
US short term interest rate		-0.206					
		(0.150)					
Oil price growth (USD)		-0.009					
		(0.009)					
GFC squared				-0.003			
				(0.116)			
GFC_i-1					0.574		
					(0.431)		
GFC*dummy for 2008-2009						0.025	
						(0.307)	
GFC*dummy for 2010-2017							-0.116
							(0.215)
Observations	2,683	2,683	1,657	2,683	2,683	2,683	2,683
Pseudo-R2	0.302	0.310	0.321	0.302	0.306	0.302	0.303

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 these crises.

In particular, 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'). However, for the analyses in the paper we only use those variables which have good signalling qualities for currency crises and combined them into what we call external vulnerability index.

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

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

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, while $C + D$ denote the number of false signals. while $A + C$ denotes the true number of episodes and $B + D$ denotes the true number of non-episodes. Therefore, 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.1 : 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.1 .

Thresholds δ_k cannot be calculated for each type of crisis separately due to limited sample size, which is why we calculate signalling quality thresholds based on a sample pooling currency, sovereign and banking crises. The thresholds δ_k are moreover computed based on 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.0 : 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.1 .

Table A.0 : List of variables and sources

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

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.