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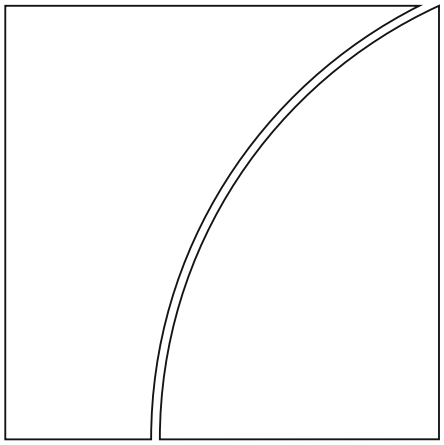

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by Iñaki Aldasoro, Stefan Avdjiev, Claudio Borio and Piti Disyatat

Monetary and Economic Department

May 2020

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Global and domestic financial cycles: variations on a theme*

Iñaki Aldasoro, Stefan Avdjiev, Claudio Borio and Piti Disyatat†

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Abstract

We compare and contrast two prominent notions of financial cycles: a domestic variant, which focuses on how financial conditions within individual economies lead to boom-bust cycles there; and a global variant, which highlights how global financial conditions affect individual economies. The two notions share a common analytical basis – the "procyclicality" of the financial system. Yet a number of distinguishing features stand out. These include differences in: (i) the underlying components – financial asset prices and capital flows for the global financial cycle (GFCy) versus credit and property prices for the domestic financial cycle (DFC); (ii) their empirical properties – the GFCy has a shorter duration and is primarily linked with traditional business cycles, while the DFC has a longer duration and is predominantly linked with medium-term business cycles; and (iii) the policy focus – "dilemma versus trilemma" for the GFCy, "lean versus clean" for the DFC. Despite these differences, the two cycles tend to come together around crises. Finally, we show that traditional GFCy measures mainly reflect developments in advanced economies and that a simple alternative measure is much more relevant for emerging market economies.

JEL classification: F30, F40, E32, E50.

Keywords: global financial cycle, financial cycle, business cycle, capital flows.

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Introduction

Interest in financial cycles has increased sharply in recent years. This reflects an intellectual shift towards viewing financial developments as an integral part of business cycle fluctuations. Despite the ubiquitous use of the term, there remains a degree of ambiguity. This pertains, above all, to the variables that characterise the cycle and the degree to which internal and external developments play a role. It is particularly useful to distinguish between two notions of the financial cycle prominent in the burgeoning literature: the "domestic financial cycle" (DFC) and the "global financial cycle" (GFCy). Both notions have a long lineage.

The DFC focuses on how financial conditions within individual economies lead to boom-bust cycles there. The notion dates back to at least the 19th century (eg Overstone (1857)), was popularised by Fisher (1933), articulated most prominently in the works of von Mises (1912) and Hayek (1933), and revived in the postwar era by Minsky (1982) and Kindleberger (2000).[1] These ideas have regained prominence more recently in the "lean versus clean" debate with respect to monetary policy (Borio and Lowe (2002), Borio and White (2004)) and again in the aftermath of the Great Financial Crisis (GFC) of 2007–09, as reflected in efforts to incorporate the role of financial factors into macro models.[2]

The GFCy focuses on how global financial conditions affect individual economies. The notion is of more recent vintage. In the 1990s, the analysis of "push" versus "pull" factors behind cross-border capital flows recognised the importance of external financial conditions (Calvo et al (1993, 1996), Fratzscher (2012)). The role of global financial conditions was subsequently highlighted by the literature on "sudden stops" (Calvo and Reinhart (2000), Forbes and Warnock (2012)). These ideas regained prominence in the "dilemma versus trilemma" debate sparked by Rey (2015) and Passari and Rey (2015). The authors stressed the existence of an important common component in global risky asset prices driven by risk appetite and US monetary policy. A subsequent complementary literature strand has focused on the tendency of banking systems and cross-border banking flows to expand balance sheets in good times and contract them in bad times, giving rise to cycles in global liquidity (Avdjiev et al (2020), Bruno and Shin (2015a,b), Cesa-Bianchi et al (2018)).[3]

Against this backdrop, our aim is to explore how the two types of financial cycle are related analytically and empirically. Given their prominence, we will take as benchmarks two particular characterisations that are representative of the broader literature. For the DFC, we take as our starting point the measure proposed by Drehmann et al (2012), which builds on previous BIS work; for the GFCy, we focus on the measure put forward by Rey (2015) and updated in Miranda-Agrippino et al (2020).

The key takeaways from our investigation along the two dimensions examined are as follows (summarised in Table 1).

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[1] See Besomi (2006) for a historical survey of the notion. For a review of the more recent literature, see Claessens and Kose (2018).

[2] Gertler and Gilchrist (2018) and Brunnermeier et al (2013) provide a review of the recent literature. The self-reinforcing relationship between leverage, asset prices, net worth and collateral constraints loosely referred to as the "leverage cycle" has also been studied in Geanakoplos (2009) and Adrian and Shin (2014) and draws on the vast literature on the financial accelerator (Bernanke et al (1999)). Beaudry et al (2019) provide a particularly interesting attempt to generate endogenous cycles within a standard New Keynesian framework.

[3] Cerutti et al (2019b), Koepke (2019) and Kaminsky (2019) provide comprehensive reviews of the literature.

First, from an analytical perspective, the two concepts have a common basis – the ebbs and flows of financial risk-taking and risk avoidance as reflected in funding conditions and asset prices. In this sense, they are variations on a theme. But there are also substantial differences. Naturally, in terms of geography: the DFC describes conditions in individual countries; the GFCy captures co-movements of external conditions across countries. And there are differences in the quantities and asset classes involved. The DFC stresses credit and property prices; the GFC, cross-border debt and equity flows and financial asset prices. These features are mirrored in the main focus of the respective policy debates: "lean versus clean" for the domestic cycle and "dilemma versus trilemma" for its global counterpart.

Second, from an empirical perspective, three features stand out. The GFCy has a duration similar to that of the business cycle *as traditionally measured* in economic analysis (two to eight years being the typical range) and co-moves strongly with output fluctuations in this frequency range; the DFC is much longer, sometimes twice as long, and is closely related to the pronounced, but typically neglected, medium-term fluctuations in output. Moreover, while DFCs do co-move in some instances, they can also be highly asynchronous; the GFCy is, by definition, global, although it is explained mainly by developments in advanced economies (AEs). That said, the GFCy and DFCs come together around crises, when output declines are largest – a kind of turbocharging effect. The twin cycles can thus be quite damaging, putting a premium on policy to reign them in.

The global and domestic financial cycles compared — Table 1

	Global	Domestic
Common analytical basis	Nexus risk-taking/funding conditions/asset prices (procyclicality)	
Original analytical focus	US monetary policy transmission	Banking crises
Policy focus	Dilemma vs trilemma	Lean vs clean
Components		
Asset prices	Financial	Property
Quantities	Capital flows	Credit
Cross-country synchronicity	Full by construction	Partial
Duration	Short	Long
Link between the two	Peaks around crises	
Relationship with GDP	Traditional business cycle	Medium-term business cycle

The structure of the paper is as follows. Section 1 sets out the analytical relationship between the two financial cycles. Section 2 highlights their main empirical features, notably examining the relationship between the two and their link with output. The last section concludes with some policy reflections.

1. Global and domestic financial cycles: the analytical relationship

The DFC and the GFCy are fundamentally related concepts. In particular, they share the same analytical basis drawing on the notion of "procyclicality" – defined as the proclivity of financial markets, or the financial system more broadly, to amplify, rather than dampen, economic fluctuations (eg Borio et al (2001), Brunnermeier et al (2009)). This proclivity reflects those mechanisms that lead to a self-reinforcing interaction between funding conditions, risk-taking, asset prices and the accumulation of stock imbalances, mainly in the form of debt.

This interaction has an inherently cyclical character. The contraction phase is a consequence of the expansion phase that precedes it, and vice versa. The busts are linked to the prior booms.

Underlying this perspective is a notion of risk that has a distinct intertemporal dimension. This is a clear departure from the notion of risk in the literature on efficient asset pricing – the idea of a "random walk" – or embedded in typical macroeconomic models – the "shock plus propagation and return to steady state" paradigm.[4] According to this cycle notion, risk is not *low* during expansions and *high* during contractions; rather, risk *builds up* in expansions and *materialises* in contractions. This explains why, before serious financial stress, risk spreads are unusually narrow, volatilities unusually low, asset prices unusually high and credit unusually buoyant – and why they adjust sharply in the opposite direction once risk materialises.

The analyses of both the DFC and GFCy attribute a prominent role to monetary policy. Monetary policy is seen to exert a powerful influence on financial conditions, both within and across borders. In a sense, monetary policy sets the universal price of leverage, which has a pervasive effect on credit, asset prices and risk-taking.

The two cycles differ in terms of the quantities and asset prices on which they focus. In the case of the DFC, the main focus is on credit and property prices; in that of the GFCy, on international capital flows and prices of risky financial assets. The reason for this difference is the original focus of the analysis: for the DFC, banking crises – consistent with numerous studies that have found strong credit and/or asset price increases, beyond historical norms, to be useful leading indicators of crises (eg Aldasoro et al (2018), Schularick and Taylor (2012), Jordà et al (2016)); for the GFC, capital flows – in line with the literature on "sudden stops", which highlights the disruptive role of capital flow surges and reversals in the context of emerging market economies (EMEs) (eg Calvo and Reinhart (2000)).

More subtly, the balance of the analysis differs. That of the DFC focuses on the accumulation of vulnerabilities and the underlying imbalances; that of the GFCy on the propagation of financial conditions across countries and, more specifically, from the United States to the rest of the world. To a large extent, this difference carries over to the policy discussion. That for the DFC centres primarily on ways of restraining expansions and the associated risks. Think of the "lean versus clean" debate: should monetary policy seek to restrain financial booms or just soften the blow after the bust? Can macroprudential measures do the whole job during the boom or do they need a helping hand from monetary policy?[5]

[4] For the notion of efficient markets, see eg Fama (1991); for the shock-plus-propagation approach to the business cycle, see eg Woodford (2003), who lays out the benchmark New Keynesian model, built on a real business cycle core by adding nominal rigidities, such as sluggish price adjustments.

[5] See eg Bernanke and Gertler (1999), Borio and White (2004), Borio (2014a), Bean (2009), IMF (2015), Svensson (2017), Aikman et al (2015). Smets (2013) includes a literature review.

With respect to the GFCy, the policy discussion deals primarily with ways in which countries on the receiving end can cope with the cycle's impact. This is the "dilemma versus trilemma" debate and that on cross-border financial spillovers. In particular, if capital flows are unrestricted, can flexible exchange rates allow monetary policy to sufficiently influence domestic financial conditions?[6] If not, what other policies can help (eg FX intervention, capital flow management measures, etc)?

2. Global and domestic financial cycles: the empirical relationship

How can the DFC and the GFCy best be characterised empirically? How are the two related? We analyse these issues along three dimensions: (i) the cycles' degree of synchronicity across countries; (ii) their duration; and (iii) their relationship with output fluctuations. The last question is important because it connects most directly to the policy discussion.

Depending on the variable of interest, we focus on two specific frequency bands that have been widely employed in the literature. A short-term band, spanning five to 32 quarters, typical of traditional business cycle analysis; and a medium-term band, in the range of 32 to 120 quarters, emphasised in the analysis of DFCs. To isolate the frequencies, we utilise the Christiano and Fitzgerald (2003) bandpass filter.

The data for our analysis come from several sources. Those on DFCs and their components (credit-to-GDP, real credit and house prices) are from the respective BIS databases, which are in turn compiled from national sources. For the estimation of the GFCy, we use data on gross capital flows from the IMF Balance of Payments (BoP) database as well as the GFCy measure of Miranda-Agrippino and Rey (2018) and Miranda-Agrippino et al (2020). Finally, seasonally adjusted real GDP growth comes from national sources.

Our *benchmark* ("long") sample covers the period between Q1 1981 and Q4 2018. In some of our empirical exercises, we also employ an alternative ("short") sample. It starts in Q1 1996, but covers a larger number of countries for all the key variables we examine. For example, the long (short) sample contains capital flow data for 31 (49) countries and real credit data for 30 (40) countries. Annex A provides more details on the data.

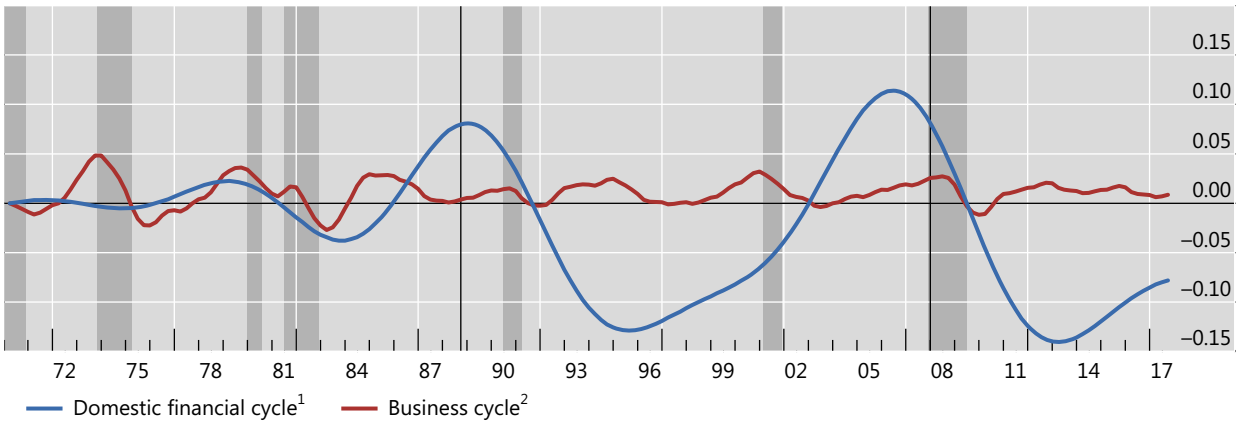
2.1 Measurement

The empirical characterisation of the DFC has largely focused on indices that combine credit and asset prices, often from a medium-term perspective. Prominent examples are Drehmann et al (2012) and Claessens et al (2012). A sizeable literature has explored the empirical properties of the cycle. The approaches vary, including turning-point analysis using the dating algorithms of Bry and Boschan (1971) and Harding and Pagan (2002) (eg Claessens et al (2011), Drehmann et al (2012)), frequency-based filters (Drehmann et al (2012), Aikman et al (2015)), model-based filters (eg de Winter et al (2017), Galati et al (2016)), and spectral or wavelet analysis (Verona (2016), Strohsal et al (2019)). This body of work indicates that, distinctively, DFCs have a longer duration and larger amplitude than "traditional" business cycles, ie the notion commonly used by economists and policymakers who view these cycles as having a duration of up to eight years.

[6] See eg Obstfeld (2015). Far less attention has been paid to what the country or countries at the source of the GFCy can do; see also Rajan (2019).

We follow the above literature and take as benchmark for the DFC a composite index as constructed by Drehmann et al (2012). Specifically, we apply the Christiano and Fitzgerald (2003) bandpass filter to three series: (i) annual growth rates of credit to the non-financial private sector; (ii) the ratio of credit to GDP; and (iii) the annual growth of residential property prices. All series are normalised to ensure that the units are comparable and can be aggregated. Credit and residential property prices are in real terms (deflated by CPI) and in logs. We apply the filter in both the *short-term* and the *medium-term* frequency range, five to 32 and 32 to 120 quarters, respectively. Nevertheless, our analysis considers primarily the medium-term component, which better reflects the slow-moving cumulative build-up and retrenchment of financial imbalances. Graph 1 displays an estimate of the domestic financial cycle for the United States, alongside the respective business cycle estimate.

The domestic financial and business cycles in the United States — Graph 1



The shaded areas indicate recessions; the solid black lines indicate the start of a banking crisis as defined by Laeven and Valencia (2018).

[1] The financial cycle as measured by frequency-based (bandpass) filters capturing medium-term cycles in real credit, the credit-to-GDP ratio and real house prices. [2] The business cycle as measured by a frequency-based (bandpass) filter capturing fluctuations in real GDP over a period from one to eight years.

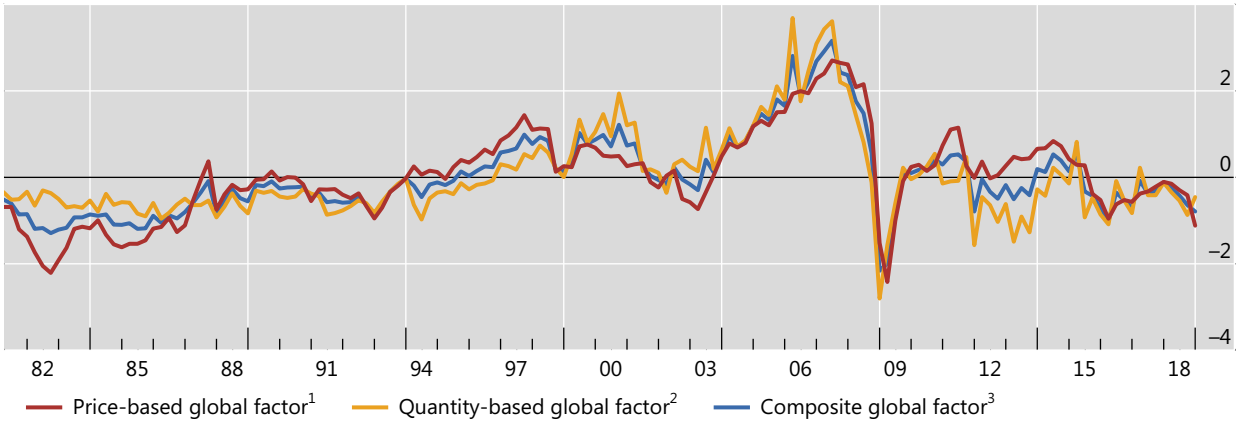
Sources: Drehmann et al (2012); Laeven and Valencia (2018).

For the GFCy, our starting point is the global common factor constructed by Miranda-Agrippino and Rey (2018) and Miranda-Agrippino et al (2020). This is generated through a dynamic factor model using daily data on 858 asset prices (Graph 2, red line). In this paper, we refer to it as the *price-based* measure of the GFCy. In light of the recent recognition of the importance of gross capital flows in driving cross-border financial developments (eg Borio and Disyatat (2011), Forbes and Warnock (2012), Cerutti et al (2019a,b)), we complement the above price-based measure with a *quantity-based* one. We construct the latter by extracting the first principal component of the ratio of gross capital inflows to GDP for each of the 31 countries in our long sample (Graph 2, orange line).[7]

[7] Given that gross capital outflows by construction tend to mirror much of gross capital inflows, the results are very similar if we use gross capital outflows instead of inflows. Furthermore, the first principal component extracted from the shorter data set (covering a broader set of 49 countries between Q1 1996 and Q4 2018) is virtually identical to our benchmark quantity-based GFCy measure (correlation 97%).

The global financial cycle

Graph 2



[1] Miranda-Agrippino et al (2020) global financial factor. [2] First principal component of total external flows/GDP of 31 countries. [3] Average of the price-based global factor and the quantity-based global factor.

Sources: Miranda-Agrippino et al (2020); IMF, *Balance of Payments*; authors' calculations.

Graph 2 reveals that the resulting measure of the GFCy hardly differs depending on whether asset prices or quantities are used: the two plots are remarkably similar, despite being derived from completely different data sets and using different methods.[8] We thus combine them into a single variable by taking their simple average. In what follows, we use this *composite* factor, depicted by the blue line in Graph 2, as our benchmark measure of the GFCy.[9]

Why are the price-based and the quantity-based measures of the GFCy so similar? Presumably, similar forces are at work. The finding suggests that large movements in international capital flows coincide with large movements in risky asset prices, and vice versa. Moreover, by construction, *gross* capital flows should be especially sensitive to shifts in capital reallocations across countries because a given transaction will tend to show up in *both* home and host countries. For example, if US residents invest in Thailand, this will appear as an increase in gross inflows to Thailand *and* a corresponding increase in gross outflows from the United States.[10]

Preliminary inspection suggests that the link between the DFC and GFCy is generally rather weak. Across our sample of 16 countries – those that have data for both variables starting in Q1 1981 – the median correlation is 23%. The same conclusion applies if we restrict our analysis to the first principal component of the DFCs across countries: the correlation with the GFCy remains weak (Graph 3, left-hand panel). There appears to be little association between the two cycles, except perhaps around peaks of the DFC (something to which we turn

[8] Recent studies have confirmed this finding using annual data (Davis et al (2019), Habib and Venditti (2019)).

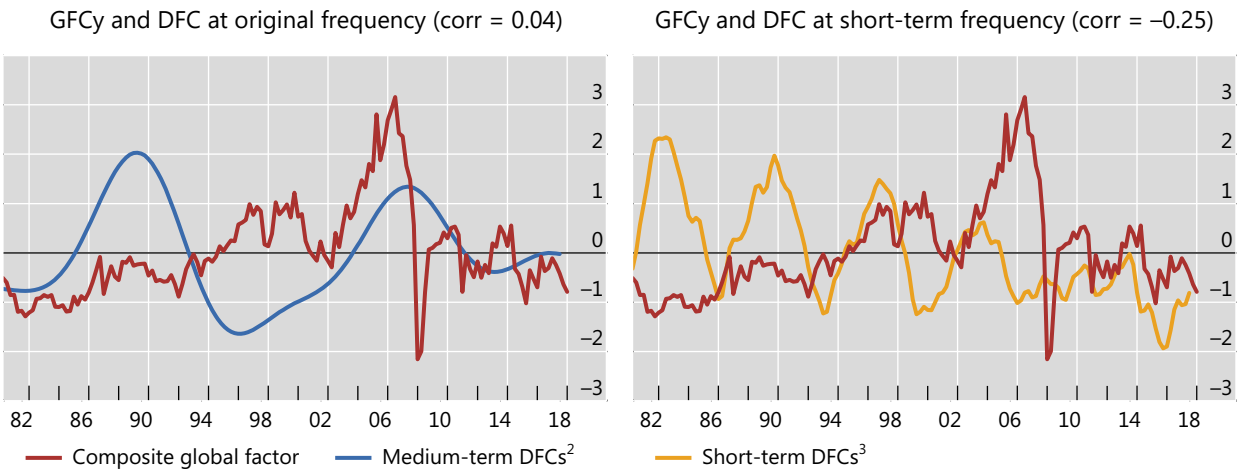
[9] The chosen benchmarks for the financial cycles simply reflect their prominence in recent discussions, but there are others. In the case of DFCs, a large literature focuses on financial conditions indices that encompass a large number of financial variables, including the exchange rate (eg Hatzius et al (2010)). At the same time, GFCys have been analysed in terms of co-movements among domestic financial variables, such as credit, equity prices and property prices (eg Jordà et al (2018)) or co-movements in international banking flows (eg Amiti et al (2018)).

[10] Moreover, financial transactions generally entail "offsetting" gross inflows and outflows for a given country. In the example above, the increase in gross inflow to Thailand would typically be accompanied by an increase in gross outflows out of Thailand (eg as some Thai resident acquires the foreign asset (US dollars) offered by US residents in exchange for Thai assets). Similarly, gross outflows out of the United States would usually occur in tandem with a rise in gross inflows to the country (reflecting the acquisition of US assets by the Thai resident). These correspondences may not hold in the case of foreign exchange intervention or payments for goods and services.

later). This remains true even if we constrain the DFC to lie within the same short-term frequency range (five to 32 quarters) in the right-hand panel of the graph. As we document below, this finding is not surprising in light of the different durations inherent in the two cycle measures.

The correlation between the domestic financial cycle (DFC) and the global financial cycle (GFCy)[1] is weak

Graph 3



[1] Measured as first principal component of fluctuations in real credit, the credit-to-GDP ratio and real house prices, captured by a frequency-based (bandpass) filter, for AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, HK, IE, IT, JP, KR, NL, NO, SE, US and ZA. [2] Filtered over a period from 32 to 120 quarters. [3] Filtered over a period from five to 32 quarters.

Sources: Miranda-Agrippino et al (2020); IMF, *Balance of Payments*; national data; authors' calculations.

2.2 Cross-country synchronicity

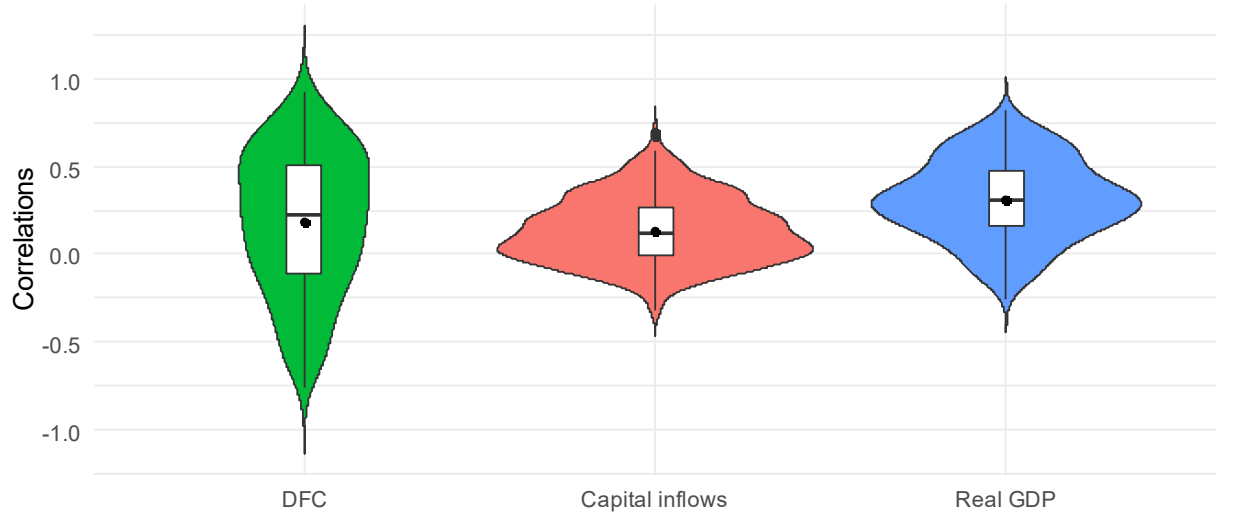
How does each type of cycle co-move across countries? In this subsection, we will focus on the quantity-based measure of the GFCy for two main reasons. First, because it is constructed using a country-specific variable (ie the ratio of gross capital inflows to GDP), the quantity-based measure allows us to examine the individual country perspective. This is not possible in the case of the price-based GFCy measure since it is a function of an asset-specific (rather than a country-specific) variable. Second, the quantity-based measure delivers a very close approximation of the GFCy due to the close association between price-based and quantity-based measures of the GFCy we documented above.

We start by looking at cross-country pairwise correlations. These tend to be positive, although not very high, for both the DFCs and gross capital inflows (Graph 4). For the DFCs the median pairwise correlation is 0.23, while for capital flows it is 0.12 (left-hand panel). Importantly, DFC correlations are notably more dispersed. With respect to capital flows, the correlations tend to be stronger among AEs: the median correlation for this group is 0.25 compared with 0.16 for EMEs. This suggests that EMEs may be subject to more idiosyncratic capital flow shifts, something we confirm below.

As a comparison, the pairwise correlations for GDP tend to be higher and considerably less dispersed (Graph 4, right-hand panel).[11] Their median in the benchmark (long) sample is 0.31. Moreover, most of these correlations have increased sharply over the past couple of decades – their median in the sample starting in 1996 is close to 0.40. Graph 5 confirms this feature: summary statistics for 10-year rolling window pairwise GDP correlations indicate that output co-movements increased markedly after 2000.

Financial and business cycles are positively correlated across countries

Graph 4



DFC sample: AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, HK, IE, IT, JP, KR, NL, NO, SE, US and ZA. Capital inflows sample: AR, AU, BD, BR, CA, DE, DK, ES, FI, FR, GB, GR, ID, IE, IL, IN, IS, IT, JP, KR, MX, NL, NO, NZ, PH, PK, PT, SE, TH, US and ZA. Real GDP sample: AU, BE, BR, CA, CH, DE, DK, ES, FI, FR, GB, HK, ID, IS, IT, JP, KR, MX, NL, NO, NZ, PE, PT, SE, SG, US and ZA.

Sources: IMF, *Balance of Payments*; national data; authors' calculations.

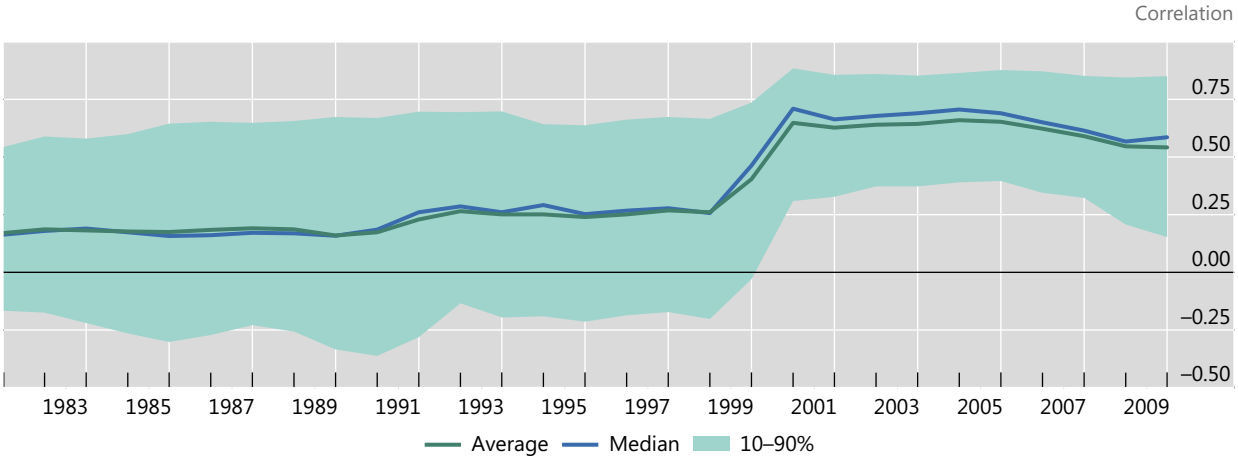
Turning to common variations, DFCs and capital flows both have sizeable first principal components. Table 2 shows the share of variance explained by the first principal component of each of the two variables for our benchmark (post-1981) country sample. For capital flows, the first principal component explains around 22% of the overall movement. This is in line with that of the price-based GFCy measure of Miranda-Agrippino and Rey (2018), which accounts for roughly 20% of all asset price movements.[12] Interestingly, AEs display a *higher* degree of cohesion than EMEs – the first principal component captures around 32% of the total variation for AEs, compared with 23% for EMEs. The results using the shorter, but broader, sample are very similar. In the case of DFCs, the share explained by the first principal component is even higher (36%). Nevertheless, this share is obtained using a smaller sample of countries, consisting mostly of AEs, and has a higher dispersion (Graph 4). The common variation is highest for output, especially among AEs.

[11] This is consistent with Oman (2019), who finds, using frequency-based filters, that financial cycles in euro area countries are less synchronised than business cycles, although the degree of synchronisation of financial cycles increases during crisis times.

[12] Cerutti et al (2019b) also find similar results.

Business cycle correlation has increased markedly in recent years

Summary statistics of 27 countries' pairwise 10-year rolling correlations of real GDP growth — Graph 5



Country sample: AU, BE, BR, CA, CH, DE, DK, ES, FI, FR, GB, HK, ID, IS, IT, JP, KR, MX, NL, NO, NZ, PE, PT, SE, SG, US and ZA.

Sources: National data; authors' calculations.

Pairwise correlations and percentage of variance explained

Table 2

	1st principal component analysis, percentage of variance explained		
Variable	All	AEs[1]	EMEs[2]
Capital flows/GDP	22.6	32.5	23.4
Domestic financial cycle	36.0	40.2	-
Real GDP growth	37.7	48.8	36.6

[1] For capital flows: AU, CA, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, JP, NL, NO, NZ, PT, SE and US. For DFC: AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, IE, IT, JP, NL, NO, SE and US. For real GDP growth: AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, IS, IT, JP, NL, NO, NZ, PT, SE and US. [2] For capital flows: AR, BD, BR, ID, IL, IN, KR, MX, PH, PK, TH and ZA. For real GDP growth: BR, HK, ID, KR, MX, PE, SG and ZA. The principal component analysis of the domestic financial cycle for EMEs is not shown, as data are available only for three countries.

Source: Authors' calculations.

How global is the global financial cycle?

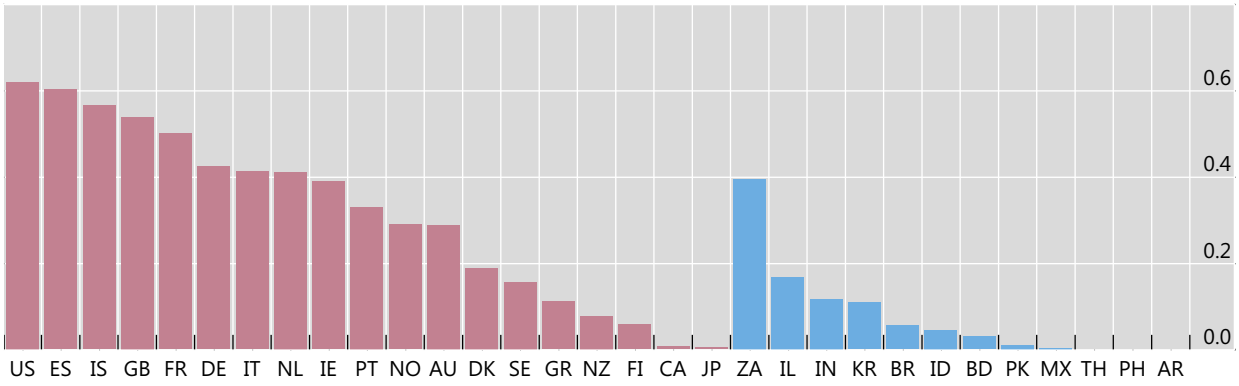
Policy focuses on the GFCy to the extent that global factors make it more difficult for authorities to manage local financial conditions. The importance of the issue depends on the degree to which the GFCy drives capital flows across countries and on how local financial and economic conditions respond to them. As noted earlier, AEs seem to display a higher degree of cohesion than EMEs as measured by the share of variance explained by the first principal component of capital flows. We thus "look under the hood" of the GFCy to see for which countries it matters most.

This deeper examination confirms that the GFCy is most relevant for AEs. In fact, it appears to be largely an AE phenomenon. Graph 6 shows the fraction of the variance of capital flows in a given country that is explained by the quantity-based GFCy (the first principal component of capital flows to each country in the sample). Capital flows to AEs are generally much more

closely associated with the GFCy than those to EMEs.[13] Indeed, the association is closest for the United States, with the GFCy explaining some 60% of the variance. Another way to see this is to compare the first principal component of capital flows for a subsample consisting only of AEs with that based on all countries – our quantity-based GFCy proxy. The left-hand panel of Graph 7 shows that they are indistinguishable (correlation of 99%).

The global financial cycle is more representative of capital flows in advanced economies

Fraction of the variance of a country's capital flows accounted for by the global financial cycle — Graph 6



The chart shows variance decomposition of individual country capital flows. It depicts the percentage of total variability in capital flows in each country that is captured by the quantity-based global factor (first principal component of capital flows in all countries). Red bars = AEs; blue bars = EMEs.

Source: Authors' calculations.

The finding, of course, does not imply that EMEs are insulated from global capital flows; the relationship is more subtle. Capital flows to EMEs turn out to be closely associated with the *second* principal component of global gross capital flows – a component which, by construction, is orthogonal to the first. This second component is still sizeable, as it explains roughly 10% of the total variation in capital flows – about half the size of the first. It lines up very closely with the first principal component extracted from a subsample that consists *exclusively* of EMEs (Graph 7, right-hand panel): the correlation is 91%. Notably, this first principal component is quite important, explaining 23% of all variation in the EME sample.[14]

Our finding that the GFCy is predominantly an AE phenomenon may seem surprising. Much of the policy discussion has been couched in terms of the GFCy's effects on EMEs. We conjecture that understanding this requires a distinction between *exposure* and *impact*. That is, EMEs may be less exposed to the GFCy, but its impact on domestic financial conditions may be larger.

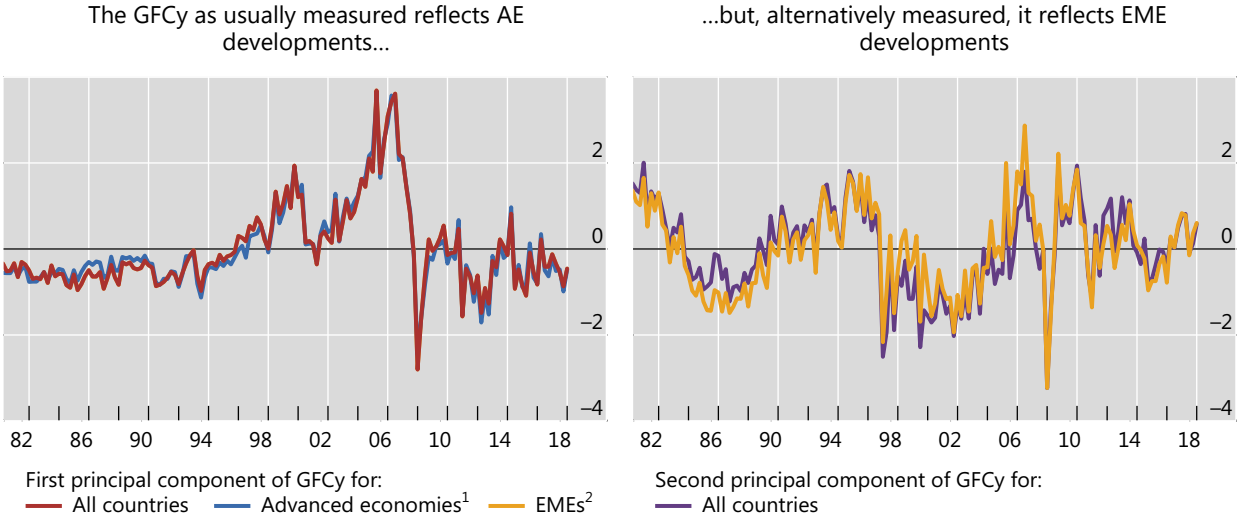
Although a proper test would require much more detailed analysis, a first pass at the data appears to support this hypothesis. More concretely, we estimate the impact of the GFCy on several key country-specific variables (output, real credit, the real exchange rate, equity prices

[13] Disyatat and Rungcharoenkitkul (2017) document similar findings in terms of cross-country term premia.

[14] The results are not due to correlated fundamentals. For each country, we regressed capital inflows/GDP on a number of domestic variables (output, real credit, real exchange rate and equity prices) and extracted principal components from the residuals. The first principal component of all countries again lines up with those of AEs, and the second principal component of all countries with those of EMEs.

and capital inflows). The left-hand panel of Graph 8 reports the medians of the respective (country-specific) regression coefficients. Confirming the previous result, capital inflows to AEs are more sensitive to the GFCy. In addition, while the estimated sensitivities of output and credit are quite similar between the two country groups, the response of the exchange rate is higher for EMEs, despite the greater incidence of FX intervention in this group. Equity prices in EMEs are also more strongly affected by the GFCy.

The global financial cycle (GFCy) in advanced and emerging market economies — Graph 7



[1] AU, CA, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, JP, NL, NO, NZ, PT, SE and US. [2] AR, BD, BR, ID, IL, IN, KR, MX, PH, PK, TH and ZA.

Sources: IMF, *Balance of Payments*; authors' calculations.

What about the impact of the second principal component of capital flows, which is much more of an EME affair? As expected, the sensitivities of key variables tend to be considerably higher for EMEs (Graph 8, right-hand panel). This pattern is especially pronounced for the exchange rate, real credit, capital flows and, to a lesser extent, output.

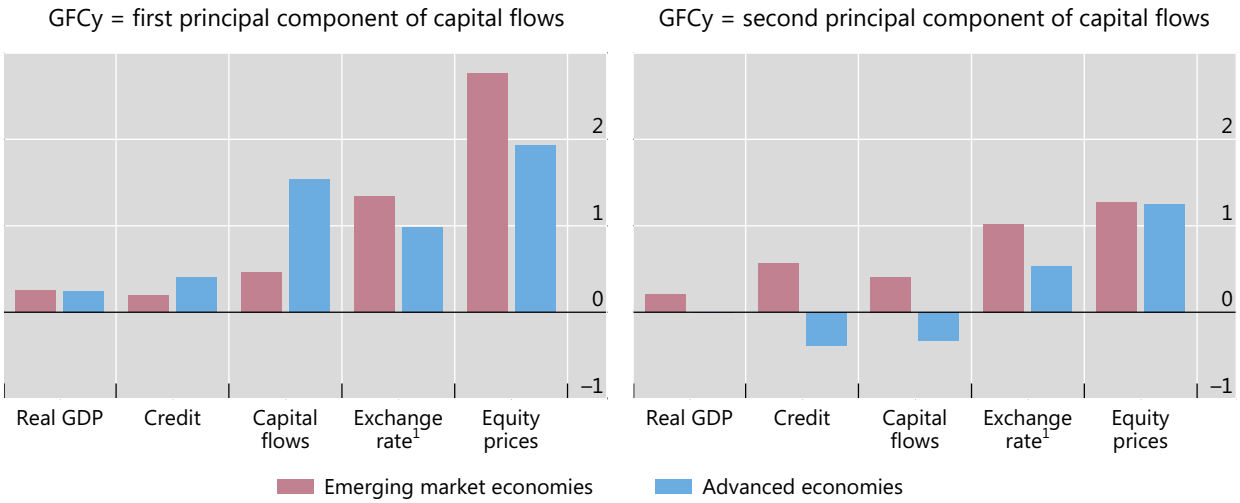
A number of factors could account for the greater sensitivity of EMEs to the GFCy. These include more shallow financial markets, weaker institutions and a more fickle foreign investor base. Cerutti et al (2019a), for example, find that those EMEs that are more dependent on global mutual funds are more sensitive to global push factors. More importantly, the impact of the exchange rate itself on economic activity through financial conditions is generally much higher in EMEs, not least owing to the presence of currency mismatches (BIS (2019), Hofmann et al (2016), Avdjiev et al (2019)).

Overall, idiosyncratic factors tend to play a larger role in capital flows to EMEs than to AEs. As a result, the identified (first) global principal component – which correlates very closely with the price-based measure of Miranda-Agrippino and Rey (2018) – does not fully capture the variation of capital flows to these countries.[15] Even so, the impact of the GFCy and capital flow fluctuations on EMEs' financial conditions may well be larger than for AEs.

[15] Using a factor model on annual data, Barrot and Serven (2018) find that a common global factor dominates capital flows to AEs while EME ones are more subject to idiosyncratic shocks. On the other hand, Cerutti et al (2019a) find strong co-movements among EMEs and relatively weaker ones among AEs. We conjecture that this difference

Impact of the global financial cycle (GFCy) on EMEs can be larger, especially for exchange rates

Coefficients obtained from regressing domestic variables on the GFCy — Graph 8



[1] A positive estimated coefficient on the exchange rate indicates an appreciation of the local currency against the US dollar.

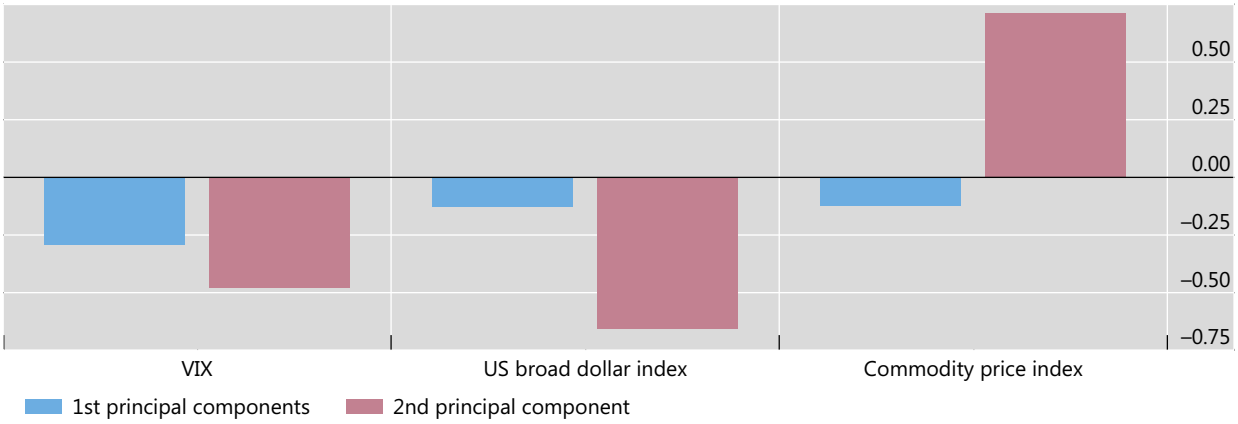
Source: Authors' calculations.

The importance of the second principal component of gross capital flows as the most relevant measure for EMEs is also highlighted by its co-movement with the typical drivers of the GFCy (Graph 9). Specifically, while both the first and the second principal components of capital flows have a negative and statistically significant relationship with the VIX – the standard measure of risk appetite – the correlation is considerably higher for the second principal component. Furthermore, two of the other key GFCy drivers identified in the literature – the US dollar exchange rate and commodity prices – are also much more strongly correlated with the second principal component.

may be related to the shorter sample size (Q1 2001 to Q1 2015) as well as the broader set of countries (21 AEs and 33 EMs) used in the latter paper.

Drivers of the global financial cycle

Correlation coefficients with the first and second principal components of gross capital inflows — Graph 9



Sources: IMF, *Balance of Payments* and *Primary Commodity Prices*; Bloomberg; BIS effective exchange rate statistics; authors' calculations.

How global is the domestic financial cycle?

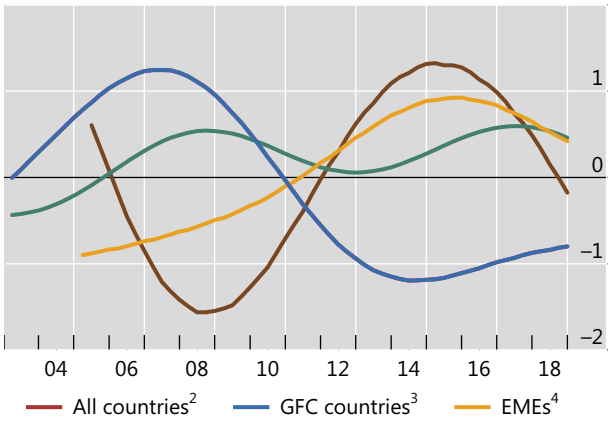
Turning to the DFC, while there exists a sizeable common component – the first principal component of country-specific DFCs explains 36% of total variation – interpreting this as a kind of "global" cycle warrants caution. The common component is dominated by countries that suffered from the GFC. Indeed, the first principal component extracted from just the "GFC" countries is virtually identical to that based on all countries (Graph 10, right-hand panel).

Individual country DFCs can and do evolve distinctly from one another. The post-crisis experience highlights this point very clearly. Countries that suffered from the GFC have seen the private sector as a whole deleverage over the past decade. Examples are the United States, the United Kingdom, Spain and France (Graph 10, left-hand panel). By contrast, the DFCs of many other countries (eg a number of EMEs, including China, and several advanced small open economies) dance to different tunes. To the extent that DFCs are asynchronous, the impact of the GFCy on individual countries and the associated policy trade-offs will differ.

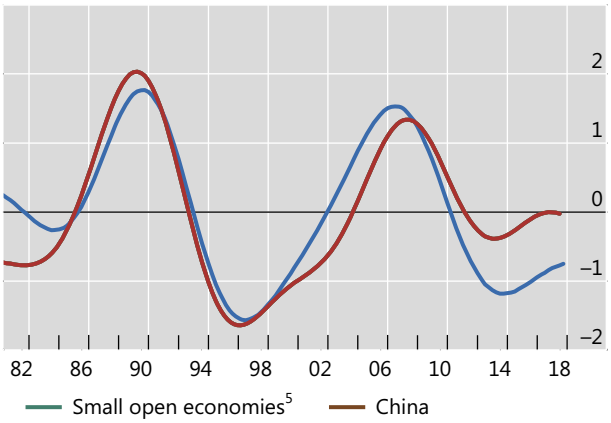
Domestic financial cycles (DFCs) and importance of the Great Financial Crisis (GFC) across countries

Graph 10

DFCs across country groups[1]



First principal component



[1] Financial cycles are measured by frequency-based (bandpass) filters capturing medium-term cycles in real credit, the credit-to-GDP ratio and real house prices. Financial cycles are normalised by country-specific means and standard deviations before simple averages are taken for country groupings. [2] BE, DE, DK, HK, IE, IT, JP, KR, NL and ZA plus GFC and small open economies. [3] ES, FR, GB and US. [4] BR, CL, CO, HK, ID, KR, MX, MY, SG and TH. [5] AU, CA, CH, FI, NO and SE.

Sources: IMF, *Balance of Payments*; authors' calculations.

2.3 Duration

The duration of cycles is one of their key defining features. It has important implications not only for their empirical characterisation, but also for the design of the most appropriate policy response. What, then, is the duration of the GFCy relative to DFCs, and how does this relate to business cycles? We investigate this property first through the analysis of their respective spectral densities and then by comparing the volatility of their short- and medium-term components.

Spectral analysis allows us to investigate the periodicities underlying any given time series. In particular, the spectral density is an alternative way to represent the autocovariance function of a time series – in the frequency domain instead of the time domain. The density is estimated by a smoothed periodogram taking a fast Fourier transform of the sample autocovariances.[16] The frequency band with the greatest contribution to the autocovariance of the series is considered to be the dominant cycle length, and corresponds to a peak in the spectral density. Some spectral densities can be multimodal, indicating that more than one frequency is important in driving the periodicity of the series.

We calculate the peak frequency of spectral densities on the pre-filtered series using the short-term (five to 32 quarters) and medium-term (32 to 120 quarters) frequency bands highlighted above. Applying the same pre-filtering procedure to all variables facilitates the comparison. We are essentially asking the following question: if the peak frequency was restricted to lie within each of the above frequency ranges, what would be the length of the dominant cycle for each variable? For the GFCy, we use the composite index described in Section 2.1. For the DFC, we cannot use the composite measure directly given that it is

[16] A periodogram is defined as the squared correlation between the time series of interest and the sine/cosine waves at different frequencies spanned by the series (Venables and Ripley (2002)). The series are detrended and demeaned.

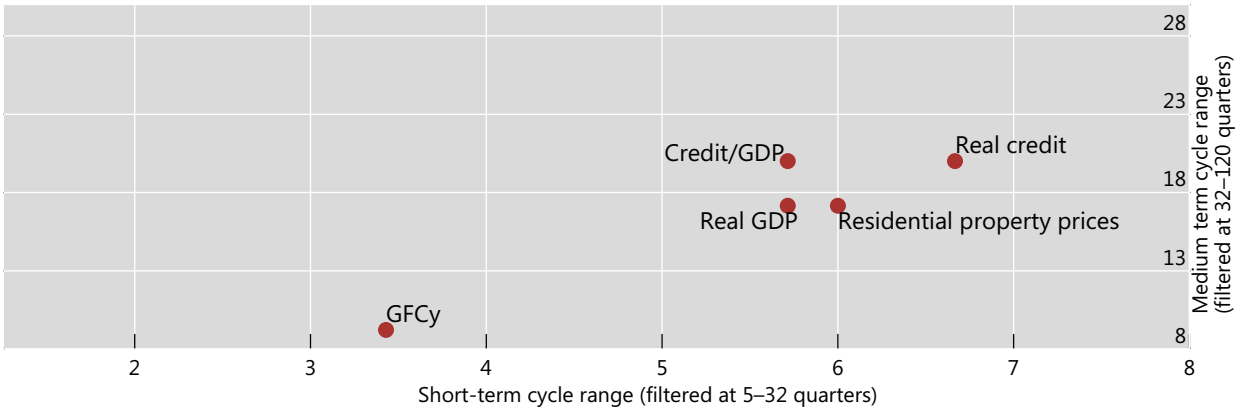
constructed based on specific frequency bands. Instead we examine the DFC's underlying components – real credit, the credit-to-GDP ratio and real property prices.

Our analysis indicates that the cyclicality of the GFCy is considerably shorter than that of the main DFC components (Graph 11). When restricted to the short-term range, the GFCy spectral density peaks at just under 3.5 years, compared with over 6.5 years for real credit and approximately six years for credit-to-GDP and real property prices. When restricted to the medium-term range, the GFCy peaks near the bottom of the permissible range (at around nine years), while the peaks of the DFC components are close to 20 years.

Median peak in power spectra[1]

In years

Graph 11



[1] Median across CA, DE, DK, ES, FI, FR, GB, IT, KR, NL, SE, US and ZA.

Source: Authors' calculations.

Interestingly, *output displays a duration similar to that of the DFC component variables*. This indicates that it has a significant medium-term component, even though the bulk of the economic analysis focuses on the shorter one. In fact, in most countries, the spectral density of GDP is bimodal: it displays a second distinct, albeit typically lower, peak at the short-term frequency, the one consistent with more traditional business cycle analysis.[17]

As an additional gauge, we compare the relative volatilities of the medium-term and short-term cyclical components (following Comin and Gertler (2006) and Drehmann et al (2012)). In this exercise, a ratio higher than 1 implies that medium-term cycles are relatively more important in shaping the behaviour of the underlying variable.

We calculate the above ratio for each country and report the mean values in Table 3. The results confirm the previous findings. For the GFCy, short-term cycles dominate. By contrast, medium-term cycles are more important for the DFC *and* output.

[17] For the G7 countries, and consistently with our results, de Winter et al (2017) find that the spectral density of GDP has a clear peak at medium-term frequencies of roughly 25–30 years as well as one in the shorter frequency range of two to six years. For GDP and the financial variables, we also tried a broad frequency range of two to 120 quarters. In all cases, the power spectra peak at the same frequency as when using the 32-to-120 quarter range, confirming that medium-term cycles are dominant for these variables.

Relative volatilities

Average across countries

Table 3

	K flows	Real GDP	DFC
Start in 1996 (29 countries)[1]	0.7	2.2	3.3
Start in 1981 (13 countries)[2]	0.7	2.3	4.5

[1] The 13 countries starting in 1981 plus AU, BR, CL, CZ, GR, HU, ID, IL, JP, LT, LV, MX, PT, SG, TH and TR. [2] CA, DE, DK, ES, FI, FR, GB, IT, KR, NL, SE, US and ZA.

Source: Authors' calculations.

The degree of attention paid to the importance of the medium-term component for DFCs and output has been quite different. That for the DFC has been amply documented and recognised as a key feature of this phenomenon. For instance, Claessens et al (2012) and Drehmann et al (2012) find that credit and house price cycles are longer and more volatile than business cycles. Aikman et al (2015) similarly observe an important medium-term component in credit cycles, distinct from business cycles. These conclusions are also reached by Schüler et al (2020), Strohsal et al (2019) and de Winter et al (2017) using different methods. By contrast, while the dominant medium-term component in GDP has been documented in Comin and Gertler (2006), it has not attracted the attention it deserves until much more recently (eg Beaudry et al (2019)).[18] The dominance of this component has important policy implications (see below).

2.4 Link with output

Having explored the properties of the financial cycles separately, we now turn to their link with GDP fluctuations. The relationship is quite close, but at different frequencies.

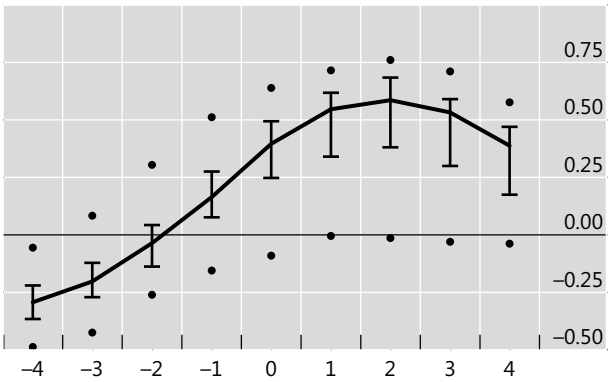
The link between the GFCy and the *traditional* business cycle is quite tight. This is not surprising, given the GFCy's relatively short duration. The left-hand panel of Graph 12 displays the distribution and the median of the correlation between the GFCy and the business cycle at the standard business cycle frequency range (five to 32 quarters), taking into account possible leads and lags. The correlation is quite strong, peaking at around 0.6 when the GFCy is lagged by two quarters. This remarkably close association is depicted visually in the right-hand panel, where the red line represents the GFCy and the blue lines plot individual countries' business cycles. A likely explanation for this strong relationship is that the risky asset prices underlying the price-based GFCy measure (eg equity prices and credit spreads) naturally co-move with traditional measures of the business cycle.

[18] Canova (2019) shows that traditional output gap measures have important low-frequency variations and argues that greater attention should be paid to medium-term fluctuations in GDP. Kulish and Pagan (2019) argue that the presence of medium-term cycles is indicative of the degree of persistence in the underlying series.

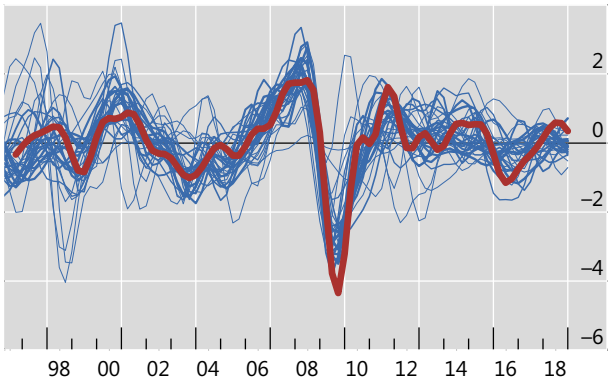
Correlation between the global financial cycle (GFCy) and business cycles

Graph 12

Cross-correlogram between $GFCy_t$ and real GDP_{t+j}[1]



GFCy co-moves with traditional business cycles[2]



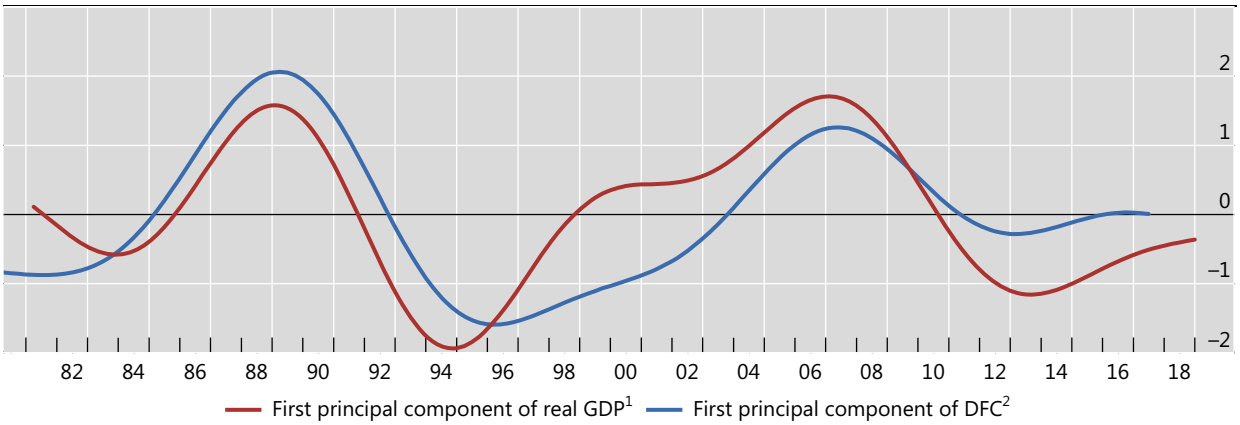
[1] The horizontal axis equals *j*, the lags and leads of log of real GDP. [2] The red line is the composite global financial factor (measured by a frequency-based (bandpass) filter capturing fluctuations over a period from five to 32 quarters and lagged by two quarters) while the blue lines are individual business cycles of 29 countries.

Sources: National data; authors' calculations.

In the case of the DFC, there is a remarkably tight link with the *medium-term* business cycle. Starting with the first principal components of the two cycles across countries, Graph 13 shows the strong association between the two, especially when GDP is lagged by four quarters. The fact that the DFC lags output has been noted before (eg Juselius and Drehmann (2015)) and mostly reflects the fact that credit tends to move slowly and flatten (rather than contract) during the first few quarters of recessions, before eventually declining. A key driver is that borrowers tend to draw on their credit lines. So, output slows down before debt does, pushing the credit-to-GDP ratio up as the economy slows down.

Strong correlation between domestic financial cycle (DFC) and business cycle at medium-term frequencies

Graph 13



[1] Frequency-based (bandpass) filters capturing medium-term cycles in log of real GDP. [2] Domestic financial cycles are measured by frequency-based (bandpass) filters capturing medium-term cycles in real credit, the credit-to-GDP ratio and real house prices, plotted with a four-period lead.

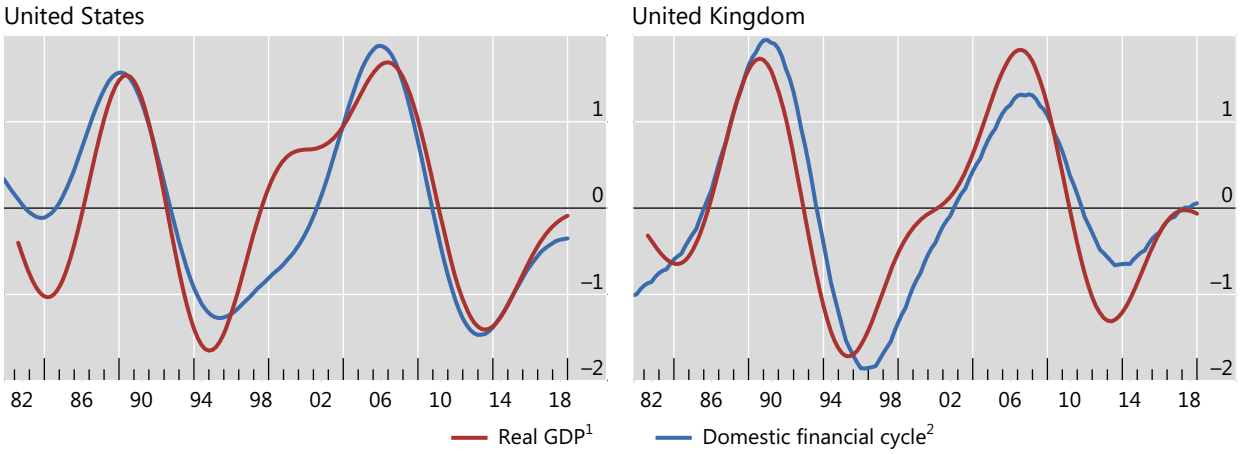
Sources: National data; authors' calculations.

At the individual country level, the association is particularly strong in a number of cases. Graph 14 shows the examples of the United States and the United Kingdom, again with GDP leading the financial cycle by a year. Remarkably, for both of those countries, the correlation is as high as around 0.9. For the sample of 19 countries (which have data for both variables starting in Q1 1981), the median correlation is 43%.

The close connection between financial factors and medium-term GDP has been noted in previous studies. For the United States and a small sample of advanced European countries, Rünstler and Vlekke (2017) find that credit and house price cycles are closely related to a medium-term component of GDP cycles, with credit cycles tending to lag GDP cycles by one to three years. Using a multivariate unobserved components model, de Winter et al (2017) find that the co-movement between financial cycles and macroeconomic variables shows up mainly in the medium term. Most recently, Beaudry et al (2019) have found that hours worked, a key indicator of business cycles, is most correlated with the credit risk premium (spread of BAA bonds and federal funds rate), a financial cycle indicator, at a medium-term frequency of around 10 years.

The domestic financial cycle and the medium-term business cycle are highly synchronised

Graph 14



[1] Frequency-based (bandpass) filters capturing medium-term cycles in log of real GDP, plotted with a four-period lag. [2] Domestic financial cycles are measured by frequency-based (bandpass) filters capturing medium-term cycles in real credit, the credit-to-GDP ratio and real house prices.

Sources: National data; authors' calculations.

These results support the notion that macro-financial linkages constitute an important element of medium-term economic fluctuations and confirm more general evidence and theoretical analyses.[19] This contrasts with Comin and Gertler (2006), who focus on endogenous technological innovation. The mechanisms underlying these linkages deserve further scrutiny. Importantly, fluctuations at this frequency appear to be more important in explaining the overall variation in GDP than those at the standard, shorter frequency. And by focusing on shorter cycles, traditional business cycle analysis neglects these larger and more important movements where the domestic financial cycle appears to be particularly relevant.

[19] See eg Rungcharoenkitkul et al (2019), Juselius et al (2017), Borio (2014a), Schularick and Taylor (2012) and Claessens et al (2012).

2.5 The two cycles come together around crises

Even though the GFCy and DFC do not display a strong and obvious association, their relationship tightens around crises. We have already seen earlier some very suggestive evidence that peaks in the DFC appear to coincide with those in the GFCy. As DFC peaks tend to occur around banking crises (eg Borio (2014a)), their link around crises should be tight.

This is indeed what more specific analysis confirms (Graph 15).[20] The beginning of (banking) crises is marked by the vertical lines at zero. Conditional on a crisis episode, we compute the average of the relevant indicator in the quarters preceding and following it.[21] We see that both the GFCy and the DFC are on the upswing in the run-up to crises, although the DFC's expansion is more pronounced and takes place earlier. Capital flows also rise before crises, with the effects more clearly visible for AEs. For EMEs, the run-up in the second principal component of capital flows – as noted, a more relevant measure for external conditions for these economies – is more prominent.

Following strong expansions, the DFC, the GFCy and capital flows all turn downwards before crises. Interestingly, for AEs, there is not much difference between the first and second principal components. This suggests that, during boom-busts in AEs, capital flows expand and contract for *all* countries – spillovers are especially strong. The main difference between AEs and EMEs is that the initial appreciation and the subsequent sharp depreciation of the domestic currency are much more pronounced for EMEs. This is consistent with more formal empirical evidence, which indicates that the combination of strong credit growth and exchange rate appreciation is a useful leading indicator of banking stress in EMEs, but not in AEs (Borio and Lowe (2002), Gourinchas and Obstfeld (2012)).

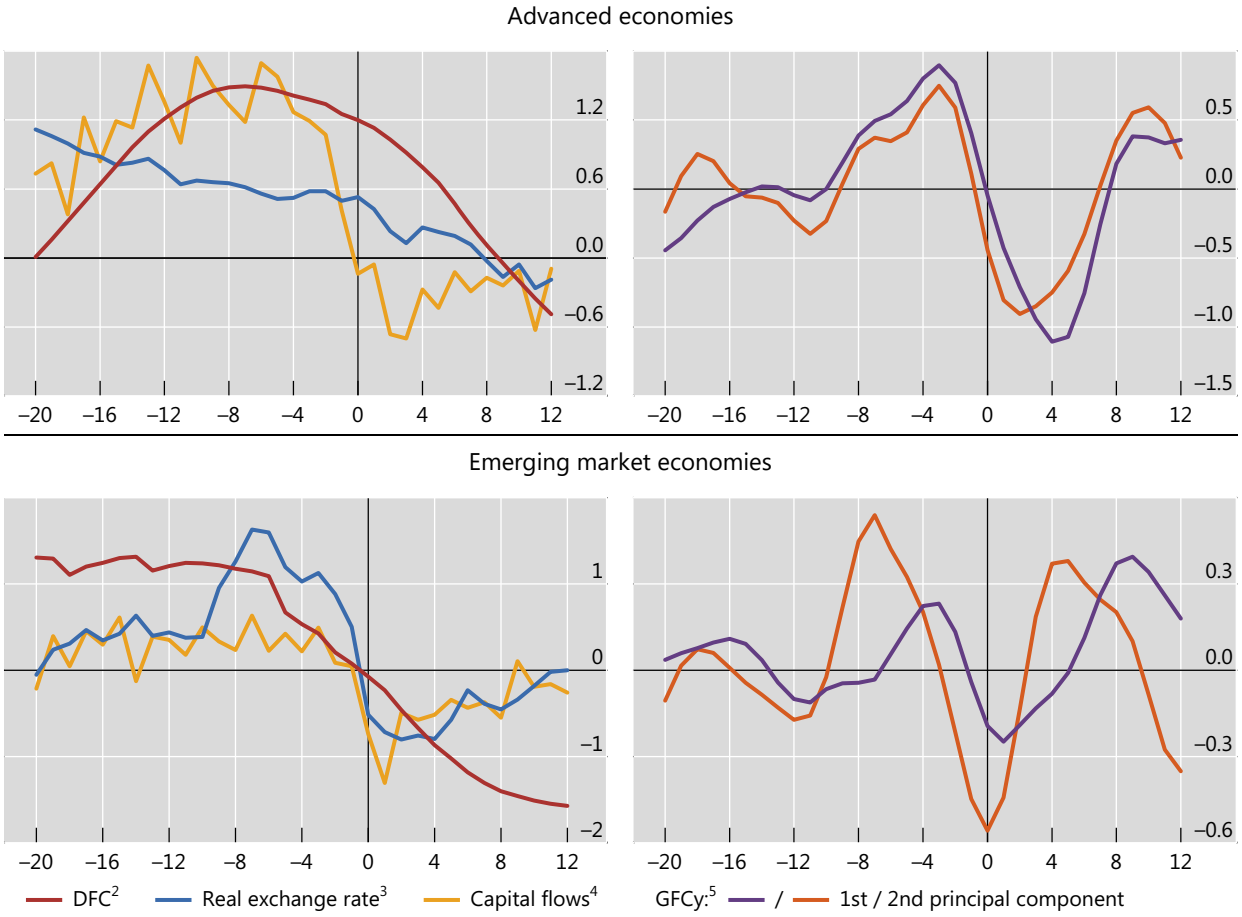
The fact that, in the lead-up to crises, capital flows and the GFCy increase later than the DFC suggests that unsustainable booms are driven predominantly by the DFC, with capital flows turbocharging them in the later stages. A similar picture holds in the aftermath of crises. This reflects the shorter duration of the GFCy, and of capital flow cycles more generally, relative to DFCs. The finding cautions against narratives that mechanically designate capital flows and global "push" factors as the *main* drivers of underlying vulnerabilities. These external forces no doubt tend to exacerbate domestic imbalances, but need not cause them. This interpretation is also consistent with the findings of Ghosh et al (2016): EMEs that (i) allow the build-up of macroeconomic imbalances and financial vulnerabilities (credit expansion, currency overvaluation and economic overheating), and (ii) receive most of their capital inflows in the form of debt, are significantly more likely to experience a crash after episodes of capital inflow surges.

[20] Financial cycle peaks tend to usher in recessions and to coincide with banking distress. Borio et al (2018, 2019) find that, since 1985, DFC proxies have tended to outperform the term spread, for both advanced and emerging market economies, as indicators of recession risk, especially beyond a two-year horizon.

[21] For the purposes of analysing the behaviour around crises, the series are normalised by country-specific means and standard deviations in order to make them comparable across countries. For crisis dating, we rely on the European Systemic Risk Board crisis data set of Lo Duca et al (2017) for European countries and on Drehmann et al (2010) for non-European ones.

The domestic financial cycle (DFC) and the global financial cycle (GFCy) come together around banking crises[1]

In standard deviations — Graph 15



[1] The horizontal axis denotes quarters around crises, with the start date set at zero (vertical lines). The average of the relevant variable is taken at the specific quarter across all crisis episodes available for the respective indicator. [2] Composite domestic financial cycle proxy calculated from frequency-based (bandpass) filters capturing medium-term cycles in real credit, the credit-to-GDP ratio and real house prices, normalised by country-specific mean and standard deviation. [3] Geometric trade-weighted averages of bilateral exchange rates adjusted by consumer prices, normalised by country-specific mean and standard deviation. [4] Gross capital inflows, scaled by GDP, normalised by country-specific mean and standard deviation. [5] Frequency-based (bandpass) filter of the composite global factor, at business cycle frequencies (between five and 32 quarters). The composite global factor combines the price-based global financial factor of Miranda-Agrippino et al (2020) with a quantity-based factor as measured by the first (purple line) and second (orange line) principal component of total external flows to 31 countries.

Sources: Miranda-Agrippino et al (2020); IMF, *Balance of Payments*; national data; BIS exchange rate statistics; authors' calculations.

Conclusion

Financial cycles, in various guises, have become a key feature of macroeconomic analysis. The GFCy and DFC are two particularly prominent variations on the theme. They share some important similarities, but are quite distinct in other equally important dimensions. In particular, their interaction with business cycles differs in one key respect: the GFCy is closely tied with the traditional short-term output fluctuations, whereas the DFC exerts more sway over the medium-term, and quantitatively more important, swings in economic activity. And while the two financial cycles largely dance to different tunes, they do come together around financial crises. One way of thinking of this is that the GFCy can turbocharge DFCs.

Our analysis has important policy implications. Two deserve special attention.

First, it is essential to design policies capable of taming the two financial cycles. As argued in detail elsewhere, this calls for more effective anchors in domestic policy regimes and in their interaction through the international monetary and financial system. At the domestic level, the most promising ones involve a combination of monetary, prudential and fiscal policies in what can be referred to as a macro-financial stability framework (eg Borio et al (2018), BIS (2019)). While stronger anchors domestically will already contribute to limiting the incidence of unwelcome spillovers, stronger anchors internationally would help better internalise such spillovers (Rajan (2019)). The more ambitious possibilities in this respect range from coordinated action in specific circumstances – not just at times of crisis, but also in good times – all the way to new rules of the game (BIS (2015)). Given that the GFCy is predominantly driven by conditions in advanced economies, the onus to act would be greater among these countries.

Second, regardless of the specifics of the arrangements, it is critical to focus on the medium term. It is there, in fact, where most of the relevant action is – a critical and yet underappreciated fact. We saw that the larger component of GDP fluctuations is at medium-term frequencies, not at the standard ones employed in macroeconomic analysis and stabilisation policies. It is at this horizon that the DFC also plays a key role in close sync with the business cycle. It surely makes sense to adjust the policy lens and its focus accordingly. For monetary policy, in particular, a more medium-term orientation may not only better anchor the DFC and hence the economy at large, but it could also mitigate the spillovers associated with the global financial cycle – killing two birds with one stone, as it were. More generally, it is important to recognise the different horizons over which different policy tools work. Prudential policies, for example, are typically geared towards the medium-term horizon. Foreign exchange interventions work primarily in the short term. The impact of monetary and fiscal policies straddles both short- and medium-term horizons. Tensions between stabilisation goals at various horizons could give rise to important policy trade-offs.

Annex A: Data sources

As discussed in Section 2, we construct and use two data sets. The first covers a longer time period (from Q1 1981 to Q4 2018) than the second (from Q1 1995 to Q4 2018). However, the second covers a larger number of countries for each of the main variables under study.

Throughout the analysis, we seek to maximise cross-sectional (country) coverage by applying the following sample selection rules. When we analyse the cross-country relationships *within* a given measure (eg the DFC), we use the maximum set of countries for which we can construct a balanced panel (either between Q1 1981 and Q4 2018 or between Q1 1995 and Q4 2018). When we analyse empirical relationships *between* variables (eg between the DFC and the GFCy), we use a super-balanced panel – that is, a panel for which the set of countries and time periods covered for all variables is the same. Table A1 contains the full list of countries and data sources for each variable in each of the two time periods we examine.

Full lists of countries

ISO2 codes, bold countries indicate **advanced economies** (EMEs otherwise) Table A1

Sample	Sample starting in 1981		Additional countries included as of 1996	
K flows	31	**AU, CA, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, JP, NL, NO, NZ, PT, SE, US**, AR, BD, BR, ID, IL, IN, KR, MX, PH, PK, TH, ZA	18	**EE, LT, LV, SI, SK**, BG, CL, CO, CZ, HU, KZ, PE, RO, RU, SG, TR, UA, VN
Real GDP	27	**AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, IS, IT, JP, NL, NO, NZ, PT, SE, US**, BR, HK, ID, KR, MX, PE, SG, ZA	17	**EE, GR, IE, LT, LV, SI, SK**, AR, CN, CO, HU, IL, MY, PL, RO, TH, TR
DFC	20	**AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, IE, IT, JP, NL, NO, SE, US**, HK, KR, ZA	2	**NZ**, TH
Real credit	30	**AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, JP, NL, NO, NZ, PT, SE, US**, HK, HU, ID, IN, KR, MX, MY, SG, TH, ZA	10	**LT, LV**, BR, CL, CN, CZ, IL, PL, RU, TR
Balanced panel of: K flows, real GDP, DFC	16	**AU, CA, DE, DK, ES, FI, FR, GB, IT, JP, NL, NO, SE, US**, KR, ZA	3	**IE, NZ**, TH
Balanced panel of: K flows, real GDP, real credit	20	**AU, CA, DE, DK, ES, FI, FR, GB, IT, JP, NL, NO, NZ, PT, SE, US**, ID, KR, MX, ZA	10	**GR, IE, LT, LV**, BR, HU, IL, SG, TH, TR

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