

# Committee on the Global Financial System

## CGFS Papers

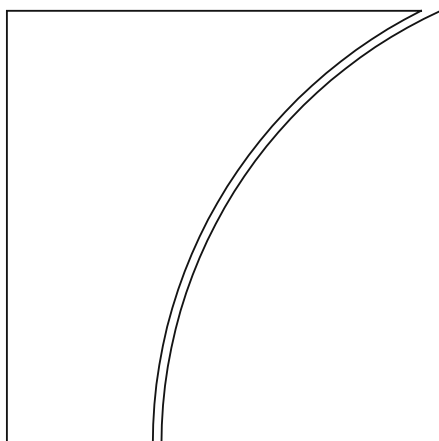
No 65

### US dollar funding: an international perspective

Report prepared by a Working Group chaired by  
Sally Davies (Board of Governors of the Federal Reserve  
System) and Christopher Kent (Reserve Bank of Australia)

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## Preface

The US dollar plays a key role in the international monetary and financial system. Its function as the foremost funding currency is reinforced by its use as a vehicle currency for foreign exchange transactions, invoicing currency for global trade and reserve currency for reserve managers. This widespread use of the US dollar gives rise to a complex and geographically dispersed network of funding relationships. These interconnections generate significant benefits, in terms of lower costs for the international flow of capital and the distribution of risk, but also give rise to vulnerabilities in terms of the transmission and amplification of shocks emanating from the United States or elsewhere, across the globe.

The Committee on the Global Financial System (CGFS) mandated a Working Group co-chaired by Sally Davies (Board of Governors of the Federal Reserve System) and Christopher Kent (Reserve Bank of Australia) to take stock of the structure and evolution the US dollar funding market since the global financial crisis (GFC) and to assess its resilience. The group also identified implications for policy with a focus on non-US entities both inside and outside the United States.

This report presents the Group's findings. The growing share of the US dollar in international borrowing has been accompanied by major changes in the structure of the US dollar funding landscape. After the GFC, geographical weights have shifted and bank intermediation has ceded space to market-based finance and non-banks. Banks have become more resilient, they have lower bilateral credit exposures and access to liquidity swap lines that provide a prudent liquidity backstop. Typically, non-banks are less leveraged than banks, but have access to fewer sources of US dollar funding (including through central bank facilities). As such, they are more likely to act as amplifiers of market volatility if subjected to stresses. Limited visibility of activities of non-banks present obstacles to the assessment of systemic risk. Moreover, cross-border and cross-sector linkages complicate efforts to monitor and manage the risk of a retrenchment in cross-border liquidity. The report suggests that more complete data collection could help reduce vulnerabilities. The report also identifies regulatory and structural policy options that could further reduce certain vulnerabilities.

The bulk of the work was conducted prior to the outbreak of Covid-19. The ensuing crisis validated many of the messages of the report, but it also had an important impact on US dollar funding activity. The report provides some pertinent, albeit necessarily preliminary, observations in this regard.

I hope that policymakers, researchers and market participants will find this report useful as they are looking to learn from the experience of the past decade, and consider ways to better monitor the role of US dollar funding in the global financial system and to improve the resilience of institutions involved in the related activities.

Philip Lowe

Chair, Committee on the Global Financial System  
Governor, Reserve Bank of Australia



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## Executive summary

The US dollar dominates international finance as a funding and investment currency. Although the United States accounts for one quarter of global economic activity, around half of all cross-border bank loans and international debt securities are denominated in US dollars. Deep and liquid US dollar markets are attractive to non-US entities because they provide borrowers and lenders access to a large set of counterparties. The pre-eminence of the US dollar as the global reserve currency and in trade invoicing further motivates its international use.

The widespread use of a dominant currency for funding gives rise to a complex and geographically dispersed network of relationships. This has important implications for the resilience of the global financial system. Specifically, the central role of the US dollar in international finance means that global economic and financial activity is highly dependent on the ability of US dollar funding to flow smoothly and efficiently between users. This broad international use of the US dollar generates significant benefits to the global financial system. These benefits arise from economies of scale and network effects, which reduce the costs of transferring capital and risks around the financial system. But it can also lead to vulnerabilities, as the resulting interconnectedness can transmit and amplify shocks that emanate from the United States or elsewhere in US dollar funding markets, across the globe.

This report seeks to understand better the role of US dollar funding in the global financial system by: (i) taking stock of its structure and evolution since the global financial crisis (GFC); (ii) assessing its resilience and highlighting its potential vulnerabilities; and (iii) identifying implications for policy. The scope of the report is limited to US dollar borrowing, lending and intermediation by non-US entities with each other and with US entities. The bulk of the work reported here was concluded prior to the outbreak of Covid-19. The ensuing crisis validated many of the messages from the analysis, but at the same time had an important impact on US dollar funding activity. The final section of the report provides some pertinent, albeit necessarily preliminary, observations in this regard.

US dollar funding remains below its peak a decade ago relative to the size of the global economy, despite having grown in nominal terms. By contrast, the US dollar's share in international borrowing has reversed its pre-GFC downward trend to again reach levels seen in 2000. It is clearly the dominant international funding currency.

There have been major changes in the structure of the US dollar funding landscape since the GFC. For instance, there is less activity in Europe but more elsewhere, including in emerging market economies (EMEs). Less intermediation is now conducted by banks, and there has been an increase in market-based finance. As a result, non-banks have become more important providers and users of US dollar funding. These trends have been influenced by a number of factors, including (but not limited to) new regulatory reforms, the recovery and recapitalisation of weak banks, and shifting business models of intermediaries in many jurisdictions. Moreover, the robust performance of the United States and some EMEs in recent years and the resulting higher interest rates compared with many advanced economies (AEs) contributed to a shift of global portfolios towards US securities and cross-border lending into EMEs, much of which is in US dollars.

In some respects, vulnerabilities to the global financial system stemming from US dollar funding and the lending activities of non-US banks have declined. Banks

have become more resilient to shocks, as they hold more capital, have larger liquidity buffers, manage risks more carefully and have reduced bilateral credit exposures. In addition, more borrowing is undertaken on a collateralised basis and more transactions are cleared through central counterparties. Bilateral liquidity swap lines between the Federal Reserve and other central banks provide a prudent liquidity backstop. As a result, key markets and institutions are better positioned to withstand shocks. Nevertheless, this does not imply that shocks cannot materialise or that volatility is a thing of the past, as illustrated by the Covid-19 crisis.

Indeed, some of the improvements since the GFC may have been offset, at least in part, by the rise in the US dollar activity of non-banks. On the one hand, institutions such as pension funds and insurers tend to have more stable regular funding sources and operate with less leverage than banks, which by itself would improve the resilience of international US dollar activity. However, certain vulnerabilities may have arisen because these institutions are playing a larger role in US dollar markets while having less recourse to a range of US dollar funding sources (including central bank facilities). The large footprint of non-bank financial institutions in some markets also suggests that should they experience distress, this could trigger fire sales that could amplify any market volatility. Finally, unhedged US dollar borrowers could face the simultaneous adverse realisations of exchange rate risk, interest rate risk and refinancing risk. The systemic-risk implications of these developments are hard to evaluate owing to the limited visibility of activities conducted by these players.

International US dollar funding activity remains large, and economies and sectors remain interconnected. As a result, there is the potential for the transmission of shocks with large effects on the global financial system and the global economy. The cost and availability of US dollar financing can shift as a result of changes in US interest rates, shifts in global risk sentiment or periods of market stress (eg the Covid-19-related stress). Cross-border and cross-sector linkages also often transcend regulatory jurisdictions, which complicates participants' and regulators' efforts to monitor and manage the risk of a retrenchment in cross-border liquidity.

Significant data gaps, in combination with the complexity and interconnectedness of the system, make assessing the evolving risks and vulnerabilities especially challenging. Reflecting this, a key policy message of this report is that authorities should seek to improve the transparency of global US dollar funding activities – for example, through additional data collection, greater data-sharing and improved disclosure. Most prominently, significant gaps remain around the increasingly important role played by some non-bank financial institutions and non-financial corporations, and around key markets such as the repo and FX swap markets. Moreover, the global nature of these markets necessitates taking a global approach to monitoring – no single jurisdiction has the whole picture.

The report identifies regulatory and structural policy options that could further reduce certain vulnerabilities. For example, in time, regulators of non-bank financial institutions could provide guidance on the inclusion of a currency dimension in their liquidity risk management. Some jurisdictions could consider policies aimed at deepening domestic capital markets. Further thought might be given to improving safety nets that can cushion the negative impact when US dollar-related risks crystallise – for example, through increased self-insurance or increased bilateral, regional or global liquidity support mechanisms, although all these options present governance and policy challenges.



## 1. Introduction

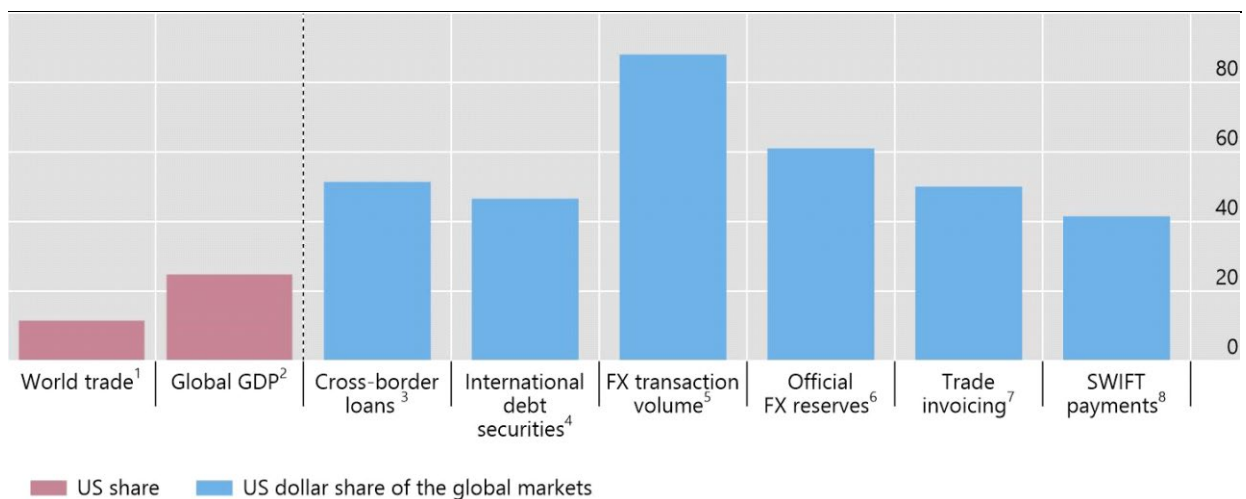
The US dollar plays a central role in the international monetary and financial system. It is the foremost funding currency, with about half of all cross-border loans and international debt securities denominated in US dollars. Around 85% of all foreign exchange transactions occur against the US dollar. It is the world's primary reserve currency, accounting for 61% of official foreign exchange reserves. Around half of international trade is invoiced in US dollars, and around 40% of international payments are made in US dollars (Graph 1).

The focus of this report is the provision, use and intermediation of US dollar funding by non-US entities, both inside and outside the United States. US dollar funding stresses faced by non-US entities during the global financial crisis (GFC) intensified the strains and contributed to their spread across the globe (Annex A). The international nature of the crisis called for extraordinary measures and coordinated efforts by central banks, including the establishment of central bank liquidity swap lines between the Federal Reserve and, ultimately, 14 central banks to provide liquidity in US dollars outside the United States. This report provides a description how the US dollar funding landscape and vulnerabilities therein have evolved and outlines policy options to improve the resilience of institutions and markets. The report also provides preliminary observations with regard to US dollar funding activity during the Covid-19 crisis (Section 6).

### International role of the US dollar

In per cent

Graph 1



<sup>1</sup> Data refer to 2019. <sup>2</sup> Data refer to 2019. <sup>3</sup> US dollar-denominated cross-border loans by banks to counterparties in all countries; data refer to Q4 2019 (excluding interoffice claims but including interbank claims on account of loans and deposits); loans comprise non-negotiable debt instruments that are lent by creditors directly to a debtor or represented by evidence of a deposit. <sup>4</sup> US dollar denominated international debt securities by all issuers; data refer to Q4 2019; these securities are issued outside the local market of the country where the borrower resides, and capture issues conventionally known as eurobonds and foreign bonds and exclude negotiable loans; instruments such as bonds, medium-term notes and money market instruments are included. <sup>5</sup> Data refer to 2019. <sup>6</sup> Data refer to Q4 2019. <sup>7</sup> As estimated in Gopinath (2015). <sup>8</sup> Data refer to February 2020.

Sources: Gopinath (2015); Federal Reserve; IMF; CPB World Trade Monitor; Bloomberg; SWIFT; BIS Triennial Central Bank Survey of Foreign Exchange and Over-the-counter (OTC) Derivatives Markets; BIS locational banking statistics (LBS).

The international US dollar funding network is large, diffuse and interconnected. It consists of a diverse set of borrowers and lenders interacting through a range of intermediaries and a variety of financial instruments. It is geographically dispersed, with a large share of activity occurring outside the United States. It is interconnected, incorporating long and sometimes opaque cross-border and cross-sector linkages transcending regulatory jurisdictions. But it is also partially segmented, with legal, operational and regulatory frictions limiting arbitrage, to some extent, and constraining the ability of some participants to substitute between market segments.

The international US dollar funding landscape has undergone considerable change over the past decade. Funding is increasingly obtained through markets, and banks conduct less US dollar intermediation overall. Also, non-banks have become important providers and users of US dollar funding. Geographical weights have shifted. European banks have reduced their US dollar operations, while non-European banks have expanded theirs. These developments in part reflect the long period of low interest rates in many AEs and the accompanying search for yield, the significant regulatory reforms that have occurred since the GFC and shifts in business models of banks.

Global economic and financial activity depends on the ability of US dollar funding to flow smoothly and efficiently between users. The broad international use of a dominant funding currency generates significant benefits to the global financial system, but also presents risks. Benefits arise from economies of scale and network effects, which reduce the costs of transferring capital and risks around the financial system. At the same time, financial globalisation, coupled with the dominant role of the US dollar in international markets, may have led to a more synchronised behaviour of actors in the global financial system, at least in part because many international investors and borrowers are exposed to the US dollar. As a consequence, it is possible that shocks stemming from US monetary policy, US credit conditions or general spikes in global risk aversion get transmitted across the globe. These dynamics increase the need for participants to manage the risk of a retrenchment in cross-border flows.

The rest of the report is structured in six sections. Section 2 describes the structure and economics of US dollar funding flows. Section 3 analyses recent trends in US dollar funding activity and their drivers, and Section 4 discusses vulnerabilities arising from US dollar funding. Section 5 sets out policy options. Whilst the bulk of the report was completed prior to the Covid-19 pandemic, Section 6 provides an update and a preliminary analysis of the stresses in US funding markets in the first quarter of 2020.

## 2. The structure and economics of global US dollar flows

This section discusses the geographical patterns of international US dollar funding flows, the key participants and their motivations, and the characteristics of global US dollar funding markets.

US dollar funding is special because of its size, the significant role played by non-US entities, including as borrowers from and lenders to the United States, and the large amount of activity that takes place outside the United States. The amount of outstanding international debt securities and cross-border loans that are

denominated in US dollars is \$22.6 trillion as of Q4 2019, or 26% as a share of world GDP, corresponding to about 50% of all outstanding international debt securities and cross-border loans.<sup>1</sup>

A wide array of players across different sectors participate in US dollar funding markets and interact with each other. Banks play a particularly important role, serving as borrowers, lenders and intermediaries that transfer, transform and retain risks. Other players include non-bank financial institutions (NBFIs), non-financial corporations (NFCs) and government entities, which have all increased their footprints in global US dollar funding markets over recent years as borrowers and lenders and also intermediaries.

While the United States is the largest provider and recipient of cross-border US dollar flows, significant activity takes place outside the borders of the United States and without the involvement of any US entity. Most non-US entities do not have access to stable sources of funding, such as retail US dollar deposits, nor can they obtain US dollars through the US interbank market or access Federal Reserve facilities. These entities make extensive use of less stable forms of US dollar funding. In some cases, certain players may only have access to a subset of instruments due to market segmentation, operational constraints or low credit quality. A range of entities with varying access to funding sources contribute to long and complex funding chains, often across borders. Additionally, transactions frequently involve exchange rate risk for non-US entities, creating demand for foreign exchange risk hedging instruments.

## 2.1 The US dollar system is highly dispersed, complex and interconnected

The international US dollar funding network is highly globalised and interconnected. US dollar end users and suppliers are quite dispersed. Although this is true for all types of US dollar funding, it is most easily illustrated for bank-intermediated US dollar funding using data from the BIS locational and consolidated banking statistics. Graph 2 shows the US dollar claims (positive bars) and liabilities (negative bars) of different banking sectors by region of the counterparty. Perhaps unsurprisingly, the US banking sector is the largest lender of US dollars to non-US residents (positive bars for the US, excluding the yellow areas). Also, the United States is the largest receiver of cross-border US dollar bank funding, totalling \$6.1 trillion (sum of the positive yellow areas). Most strikingly, however, much of the non-US activity occurs directly between non-US entities and does not flow through the US banking system, as shown by the collective size of the red, blue, gold and brown bars of non-US banks (see also Aldasoro and Ehlers (2018)). Offshore financial centres (OFCs) are significant borrowers and lenders of US dollars (blue positive and negative bars), although their significance would be diminished had counterparty region been assigned on the basis of the nationality of the customer instead of their location. Many entities located in OFCs have parent companies in other jurisdictions, particularly in the United States and China.<sup>2</sup>

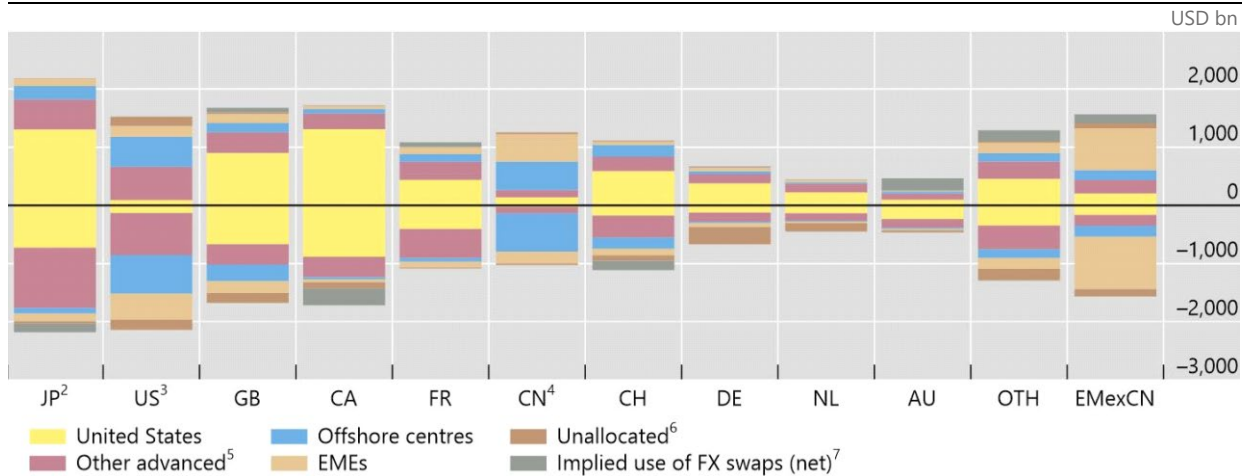
<sup>1</sup> International debt securities are defined as securities that are issued outside the country where the borrower resides. They mainly capture securities conventionally known as eurobonds, or foreign bonds, but exclude negotiable loans.

<sup>2</sup> Coppola et al (2019) and Bertaut et al (2019) highlight the issue for securities holdings. The latter paper puts the nationality-based estimate of US investment in EME corporate debt securities at about \$100 billion, or roughly 30% higher than under the residence-based statistics in 2017.

## US dollar intermediation by banks: a global activity<sup>1</sup>

US dollar positions, by bank nationality and location of counterparty at end Q4 2019

Graph 2



Each bar shows the international dollar book of the banking systems listed below (horizontal axis), where claims (positive) and liabilities (negative) comprise cross-border positions and local positions excluding inter-office positions booked in all BIS reporting countries combined except where noted (see notes 2 and 4). The colours identify the countries and regions where the dollar positions are sourced from (negative) and lent to (positive).

<sup>1</sup> US dollar-denominated positions booked by BIS reporting banks headquartered in: AU = Australia; CA = Canada; CH = Switzerland; CN = China; DE = Germany; GB = United Kingdom; FR = France; JP = Japan; NL = Netherlands; US = United States; OTH = other advanced and offshore; EMexCN = EMEs excl. China <sup>2</sup> Positions of Japanese banks exclude estimated positions of trust banks in Japan. <sup>3</sup> Excludes US banks' domestic dollar positions inside the United States (more than \$10 trillion); implied FX swap position not calculated due to unreported domestic dollar positions. <sup>4</sup> Excludes Chinese banks' domestic dollar positions inside China; implied FX swap position not calculated due to unreported domestic dollar positions. <sup>5</sup> Positions vis-à-vis counterparties in advanced economies other than the United States. <sup>6</sup> Positions lacking a country breakdown (includes positions vis-à-vis international institutions and unallocated debt securities liabilities). <sup>7</sup> Implied use of FX swaps (net) is inferred by assuming that banks use net FX swaps to maintain a currency-matched book of their US dollar assets and liabilities.

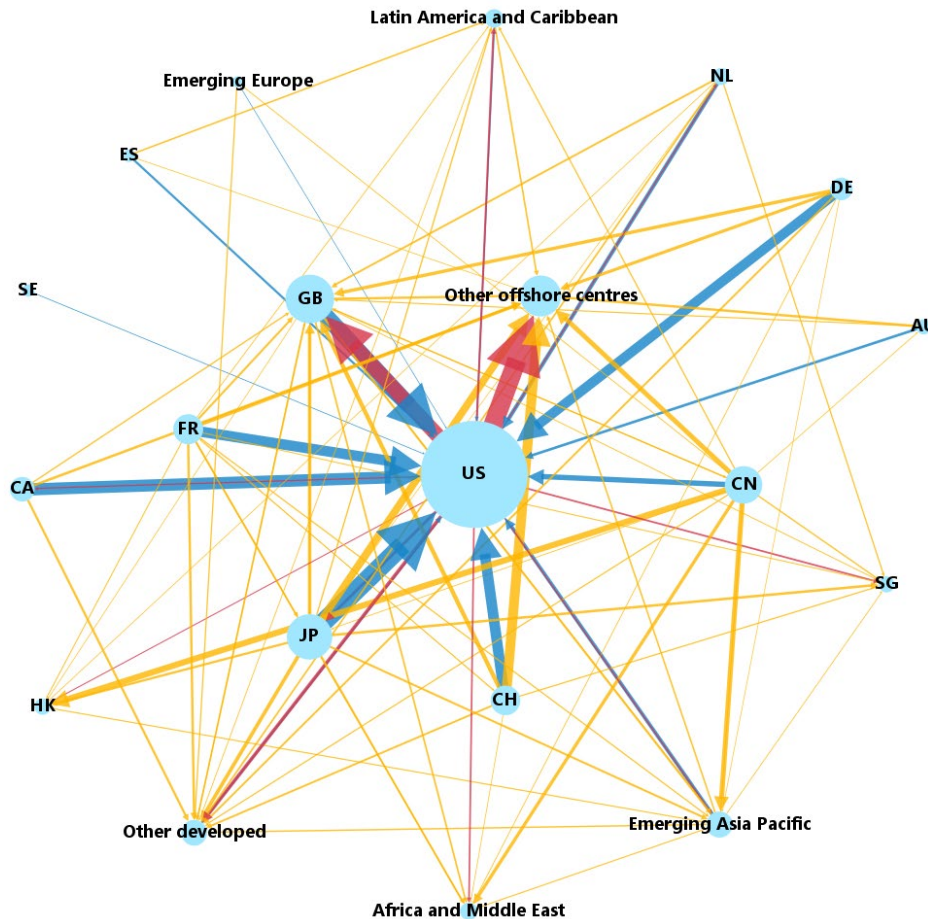
Sources: BIS locational banking statistics by nationality; BIS consolidated banking statistics (immediate counterparty basis); CGFS Working Group calculations.

Further examination of banks' cross-border US dollar claims of one country/region on all sectors in another country/region shows substantial international interlinkages (Graph 3). Nearly half of the claims in the system do not involve a US entity on either side, as shown by all the *yellow arrows*. For example, banks in France, Japan and the United Kingdom engage in significant cross-border activity with other advanced economies (AEs). As seen from the *blue arrows*, banks headquartered in Japan, the United Kingdom, Canada, Switzerland, France and Germany are significant lenders of US dollars to US counterparties. Japanese banks hold the largest claims on US residents, followed by UK banks. As seen from the *red arrows*, which show claims of US banks on foreign counterparties, US banks are significant lenders of US dollars to counterparties in the United Kingdom and OFCs.

# US dollar-denominated cross-border claims of banks on all sectors, by country<sup>1</sup>

Amounts outstanding (more than \$20 billion); as of end-March 2019

Graph 3



AU = Australia; CA = Canada; CH = Switzerland; CN = China; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; HK = Hong Kong SAR; JP = Japan; NL = Netherlands; SE = Sweden; SG = Singapore; US = United States; Other developed = countries or bank nationalities other than AU, CA, CH, DE, ES, FR, GB, JP, NL, SE or US; Other offshore centres = offshore centres or bank nationalities other than HK and SG; Asia-Pacific = countries or bank nationalities other than China. Emerging Europe, Africa and Middle East, Latin America and Caribbean, and Asia Pacific consist of emerging markets and developing economies in the respective regions, excluding those shown in the network nodes.

Blue arrows represent claims of non-US banks on all sectors in the United States. Red arrows represent claims of US banks on all sectors in the counterparty countries. Yellow arrows represent claims of non-US banks on all sectors of the respective non-US counterparty. Blue, red and yellow arrows account for 35%, 18% and 47% of the claims reported in this graph (these shares without the application of the \$20 billion threshold are 31%, 16% and 53%, respectively). The size of a node is proportional to the average value of the claims going from and to the country or region represented by the node.

<sup>1</sup> The network graph shows banks' US dollar-denominated claims of at least \$20 billion, including inter-office claims. Claims of less than \$20 billion are not included in this graph. Cross-border claims of banks of a given country/region on all sectors of the same country are also excluded. Arrows originating from a node represent claims by banks of that nationality on all sectors of the country/region where arrow ends. For example, an arrow going from Japan to the United States means: US dollar-denominated cross-border claims of Japanese banks on all sectors of the United States. The BIS aggregates data by bank nationality from those reported by the home country and other countries hosting the relevant bank nationality. The positions of Japanese banks located in Japan exclude the estimated value of trust accounts; positions of banks located in Saudi Arabia are excluded.

Sources: Bank of Japan; BIS locational banking statistics (by nationality); CGFS Working Group calculations.

## 2.2 Entities provide, seek or intermediate US dollar funding for a variety of reasons

Borrowers, lenders and intermediaries all have different motives for participating in US dollar funding markets, and these motives can also differ between US and non-US entities.

### Why non-US entities borrow US dollars

Non-US entities may want to borrow US dollars for a variety of reasons:

- *Size, liquidity and investor base:* US dollar markets are attractive because they are large and liquid and provide access to a broad and deep investor base, all of which can help reduce transaction costs (Black and Munro (2010)).<sup>3</sup> Borrowers, especially in emerging market economies (EMEs) with high domestic inflation and weaker domestic institutions, might have to issue debt in a foreign currency, and the US dollar in particular, to attract lenders.<sup>4</sup> In addition, non-US borrowers in other AEs might find borrowing in US dollars advantageous because it helps diversify their funding sources.
- *International trade:* Although the US share in world trade is only about 10%, US dollar invoicing is around 50% (Gopinath (2015), Maggiori et al (2019)). During the period between when prices are determined and payments are made, non-US firms (sellers or buyers) face exchange rate risk, which they can hedge in FX forward and swap markets. Alternatively, they can borrow or lend in US dollars to “naturally” hedge exposures.<sup>5</sup>
- *Borrowing cost differentials:* Firms may borrow in foreign currency, in particular the US dollar, to save on borrowing costs, on a hedged or unhedged basis.<sup>6, 7</sup> Since the GFC, there have been persistent deviations from the covered interest rate parity (CIP) that affect the cost of hedging these transactions. In particular, hedged US dollar borrowing costs have fallen at times below borrowing costs in other currencies, thereby generating a cost advantage for borrowing in US dollars (see Liao (2019) and Annex B).

<sup>3</sup> US dollar borrowing is particularly attractive when a country’s exchange rate is closely tied to the US dollar (under a credible regime) because of the reduced exchange rate risk. See Martinez and Werner (2002). According to Ilzetki et al (2019), the dollar is used as an anchor in 59% of countries.

<sup>4</sup> In this context, see the literature on “original sin”, eg Eichengreen et al (2005).

<sup>5</sup> Indeed, firms with foreign income or assets tend to borrow more in foreign currency. See Brown et al (2011), Bleakley and Cowan (2008), Keloharju and Niskanen (2001), Kedia and Mozumdar (2003) and Gelos (2003). For firms’ choices of invoicing currency, see Goldberg and Tille (2008) and Casas et al (2016).

<sup>6</sup> See, among others, Gambacorta et al (2020), Salomao and Varela (2018), Bruno and Shin (2017), Di Giovanni et al (2017), Romo-González (2016) and McBrady and Shill (2007).

<sup>7</sup> It is well known that the US dollar tends to appreciate when global stock prices fall. But this co-movement is different over longer horizons according to Eren and Malamud (2019). They show that the US dollar vis-à-vis other major currencies, such as the euro or the yen, co-moves positively with global stock markets over long horizons that accord with corporate debt maturities, therefore providing a better hedge for firms as opposed to euros or yen in global downturns. This channel could explain why firms might prefer to borrow in US dollars even though nominal US dollar rates are higher than nominal rates on other major currencies.



## Why US entities lend dollars to non-US borrowers

For US investors, lending to non-US borrowers can be attractive for at least two reasons. First, they may obtain higher returns because non-US borrowers may be willing to pay higher rates given more limited access relative to US borrowers. A second reason is portfolio diversification.

In 2019, US banks had between \$1.5 trillion and \$1.9 trillion in US dollar-denominated international claims, mostly in the form of loans (Annex I). In addition, US NBFIs hold more than \$2 trillion of US dollar-denominated debt securities issued by non-US entities (Graph 4, left-hand panel). Mutual funds have the largest holdings.

## Why non-US entities buy US dollar assets

Non-US entities often obtain US dollar funding in order to buy US dollar assets and thereby achieve a better balance of risk and returns. US dollar assets can help diversify their portfolios and may have other favourable liquidity and risk properties.

- Returns:** US dollar assets at times provide higher risk-adjusted returns to non-US entities relative to home currency and other alternative assets in some other AEs, even on an FX-hedged basis (Graph 4, second and third panels). Recently, though, US Treasuries have become less attractive relative to other AE sovereign bonds (second panel). In some cases, US dollar investments carry higher credit risk, such as high-yield corporate bonds or leveraged securities. In 2019, non-US investors held around \$3.8 trillion, or about a quarter, of outstanding US long-term corporate debt.

## US dollar-denominated securities and FX-hedged yields

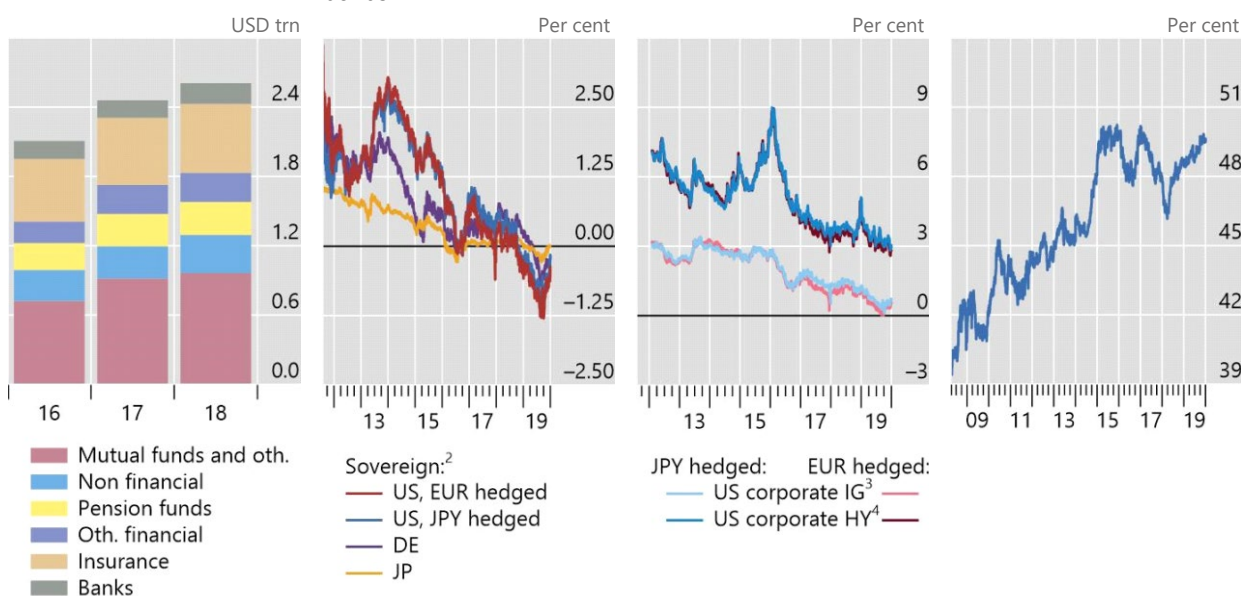
Graph 4

US holdings of foreign US dollar-denominated securities

FX-hedged yields on US sovereign debt compared with other major sovereign bonds<sup>1</sup>

FX-hedged yields on US corporate debt<sup>1</sup>

The US dollar share of highly rated corporate debt<sup>5</sup>



<sup>1</sup> FX-hedged yield is calculated as the yield of the security adjusted by the FX hedge cost. The FX hedge cost is the annualised currency return, using three-month forward exchange rates. <sup>2</sup> US, DE and JP generic 10-year government bond yield. <sup>3</sup> Barclays US Aggregate Corporate Bond Index; yield to worst. <sup>4</sup> Barclays US Corporate HY Bond Index; yield to worst <sup>5</sup> The share is calculated as US High Grade Broad Market Index divided by the Global High Grade Broad Market Index, based on market values.

Sources: Federal Reserve; IMF, *International Financial Statistics*; Bloomberg; ICE BofAML; CGFS Working Group calculations.

- *Preference for safe US dollar assets reflected in convenience yields:* Risk-averse investors, such as reserve managers and *institutional* investors, seek to invest in low-risk and liquid assets such as US sovereign and investment grade (IG) corporate debt. The US Treasury market is the largest and the most liquid sovereign debt market in the world. At the same time, US IG corporate bonds account for about half of all IG corporate debt securities outstanding (Graph 4, fourth panel).<sup>8</sup> In general, investors appear to prefer safe US dollar assets, which tend to appreciate in bad times and therefore serve as a hedge amid an economic downturn or an increase in global financial market volatility (Gourinchas et al (2017)). This preference is reflected, for example, in the so-called convenience yield on US Treasury securities, which tends to be positive, meaning that investors are willing to pay a premium to hold a US Treasury security compared with other FX-hedged risk-free assets (Du et al (2018), Jiang et al (2019)). Non-US entities hold \$6.8 trillion, or 43%, of US Treasuries outstanding (as of August 2019), and \$1.2 trillion, or 17%, of US agency securities outstanding (as of June 2019).<sup>9</sup>
- *Depth of US dollar markets:* Investors may favour US dollar asset markets because of the ability to conduct large-scale transactions with minimal impact on price.
- *Domestic inflation and exchange rate risk:* Market participants, particularly in EMEs, may prefer to hold a significant share of their assets in US dollars (eg bank deposits) as a hedge against the adverse effects of domestic inflation and domestic currency depreciation.

### Why non-US entities have US dollars to invest

A significant amount of dollars are held by non-US entities for a variety of reasons:

- *Official reserves:* Central banks have accumulated large US dollar reserves as a result of current account surpluses in their countries vis-à-vis the United States, operating managed exchange rate regimes or for other policy purposes. As of the fourth quarter of 2019, the nominal stock of US dollar reserves stood at \$6.8 trillion, accounting for 61% of global foreign exchange reserves.<sup>10</sup> Central banks' US dollar reserves are invested in US dollar assets, typically US Treasury securities.
- *International trade:* Because international trade is often invoiced in US dollars, some firms have large US dollar receivables or hold US dollars to pay for goods.

<sup>8</sup> A caveat to constructing the share of US investment grade corporate bonds based on indices is that indices are not comprehensive. That said, the number of constituents is large for the indices used. The ICE BofAML US High Grade Broad Market Index has around 16,000 constituents, and the Global High Grade Broad Market Index has around 28,000 constituents.

<sup>9</sup> Percentages of total outstanding exclude the Federal Reserve's System Open Market Account (SOMA) holdings from the denominator.

<sup>10</sup> See the IMF's COFER database. The nominal stock of US dollar reserves continues to grow, although its share of global reserves has declined in recent years, as central banks have diversified some of their US dollar reserves into other currencies (Velandia-Rubiano and Cabral (2017)).



These amounts can be placed in US dollar deposit accounts or invested in short-term US dollar securities.<sup>11</sup>

- *US dollar intermediation:* Non-US bank or non-bank entities that have obtained US dollars through financial activities, or from retail and corporate deposits, may purchase US dollar assets to hedge the currency exposure of those liabilities.

### 2.3 US dollar funding markets span a variety of instruments offering a range of maturities and transaction sizes

Global US dollar funding markets are complex in terms of both the participants and the instruments. Intermediaries that might provide US dollars through one instrument (eg a loan) also need to fund that asset by borrowing US dollars (eg a US dollar deposit). Intertwined in this process is the need to hedge risks, including those related to the exchange rate, interest rate and maturity, for which certain instruments, such as FX swaps, tend to be used. The type of instrument selected reflects the type of participant, their access to various funding instruments, their specific funding needs, and their size, as well as their operational and regulatory constraints.

Shorter-term funding instruments, which typically have maturities extending from overnight to a few months, include repurchase agreements (repos), commercial paper, eurodollars, certificates of deposit, wholesale or retail deposits, and the FX forward and swap markets. Contract terms and maturities of these instruments vary, and so do the participants that typically use them. While these instruments are predominantly used by financial entities, non-financial firms too participate in some of these markets.

Corporations or institutional investors tend to seek longer-term financing to fund longer-term liabilities or investment. Financing instruments for these entities might include loans, bonds or cross-currency swaps. Additionally, market participants can exchange one currency for another in FX spot markets.

These instruments and their characteristics are listed in Table 1, along with market sizes.

The complexity of global US dollar funding markets as well as certain data gaps prevent the construction of an accurate and complete map of activity. International banking data provide a view into the activities of internationally active banks, but they often lack information on maturity and counterparty type. Data for transactions occurring between non-banks (financial or non-financial), in particular those transactions occurring outside the United States, are among the most opaque.

<sup>11</sup> Gopinath and Stein (2018a,b) provide a potential channel to explain the use of a single currency in multiple parts of the financial system. In their theory, when a larger share of a country's imports are invoiced in dollars, its importers have a greater demand for US dollar-denominated safe claims. This leads the local banking sector to become more dollarised, ie it funds itself more with US dollar-denominated liabilities. This natural consequence of US dollar invoicing, in turn, induces the central bank – in its role as lender of last resort – to hold a larger stockpile of dollar reserves.

## Characteristics of global US dollar funding markets

Table 1

Market	Borrower	Purpose of the borrower	Lender	Purpose of the lender	Typical Maturity	Market size
FX forwards and swaps	Banks outside the United States, corporations, insurance and pension funds, supranationals	Funding, hedging	Banks, hedge funds, supranationals, central banks	Market-making, investment	Mainly <6 months	\$3.8 trillion daily <sup>1</sup>
Repo	US dealers, US and non-US banks, hedge funds	Finance high-quality securities portfolios	Wide participation	Secured short-term return	Mainly overnight	\$1 trillion daily involving a non-US entity; <sup>2</sup> \$2 trillion daily involving only US entities <sup>3</sup>
Commercial paper	Banks, corporations	Short-term funding ease of issuance	Banks, sovereign wealth funds (SWFs), foreign central banks (FCBs), money market funds (MMFs), pension funds, hedge funds, insurance companies and asset managers	Investment in short-term liquid security	<3 months	\$300 billion issued by non-US financial institutions; \$500 billion issued by US entities. \$200 billion asset-backed commercial paper <sup>4</sup>
Eurodollars	Banks outside the US	Capacity to attract/offer deposit services to a broader base	MMFs, SWFs, FCBs, corporations, hedge funds and other asset managers	Short-term investment	Overnight	\$110 billion <sup>3</sup>
Certificates of deposit	Banks outside the US	Medium-term fixed rate funding	Wide participation	Ability to lock in return over a relatively longer period	<1 year	\$600 billion issued by non-US banks <sup>5</sup>
Wholesale deposits	Banks	Secure large-scale funding to finance/expand operations; may not be able to attract retail deposits in size	Banks, investment, mutual and pension funds	Higher return (credit and liquidity risks are higher)	<1 year	Total size unknown; cross-border deposits (including wholesale, retail and corporate) from non-US residents are \$8.8 trillion and from US residents \$2.5 trillion
Retail/Corporate deposits	Banks	Secure, low-cost, smaller form of dollar funding	Retail and corporations	Safety and liquidity	On demand	See entry on wholesale deposits

## Characteristics of global US dollar funding markets (continued)

Market	Borrower	Purpose	Lender	Purpose	Typical maturity	Market size
Private bonds	Banks, corporations, supranationals	Long-term debt for investment, diversification and reduced reliance on short-term funding, match maturity profile of assets	Banks	Long-term investment return	2–10 years	\$5 trillion issued by non-US entities; <sup>6</sup> \$9 trillion issued by US entities <sup>7</sup>
Public bonds	Government entity (foreign and domestic)	Fund fiscal spending, diversify funding	Wide participation	High-quality investment and liquidity, return	>2 years	\$1.2 trillion issued by foreign governments; <sup>6</sup> \$22 trillion issued by US government <sup>4</sup>
Cross-border loans	Banks, corporations	Simplified lending structure, maximise borrowing capacity	Banks, corporations	Return	3 months to 5 years	\$7.6 trillion lent to non-US entities, of which: \$4.5 trillion is interbank. \$2.6 trillion lent to US entities <sup>8</sup>
Of which: Cross-border interbank loans	Banks	Cover regulatory shortfall, manage liquidity	Banks	Excess liquidity, earn higher interest	Generally short-term	\$1.8 trillion (excl. interoffice loans) <sup>8</sup>
Of which: Syndicated loans	Banks, corporations, pension and insurance funds	Spread risk among several lenders, lower cost relative to a bond, diversify funding source, match maturity profile	Banks	Generate deal, fees, spread risk, return	3 months to 5 years	\$460 billion in new lending (originations) to non-US borrowers yearly; \$540 billion in new lending to US borrowers <sup>9</sup>
Cross-currency swaps	Banks and other financial institutions	Hedge FX exposure	Banks and other financial institutions	Return	>1 year	\$102 billion daily <sup>1</sup>
Spot FX	Wide participation	To purchase US dollar assets, investments or operations	Wide participation	Market-making, investment	Spot	\$1.7 trillion daily <sup>1</sup>

Market size shows rough estimates; estimates of total market size (non-US plus US borrowers is more precise than those of the two elements). Data are amounts outstanding expected from daily figures, which represent transaction volumes. Data are latest available, ranging from Q1 2019 to Q3 2019. "Corporations" are non-financial corporations.

Sources: <sup>1</sup> BIS Triennial Survey. <sup>2</sup> US Treasury/TIC. <sup>3</sup> Federal Reserve Bank of New York. <sup>4</sup> Federal Reserve. <sup>5</sup> DTCC. <sup>6</sup> BIS international debt securities statistics. <sup>7</sup> Bloomberg. <sup>8</sup> BIS locational banking statistics. <sup>9</sup> Dealogic.

## Foreign exchange swaps and forward markets

Foreign exchange swaps and forwards, which are generally shorter-maturity instruments, are a significant source of US dollar funding and hedging, helping facilitate trade and investment in US dollar assets. An FX swap is an agreement to exchange currency (eg euros for US dollars) between two parties for a specified period of time. At maturity, the currency exchange is reversed. In a forward transaction, only a single payment is made at maturity.<sup>12</sup> Use of these instruments has increased over the past decade, including as a share of global GDP (Graph 5, left-hand panel). Daily transactions volumes are in the trillions of US dollars.

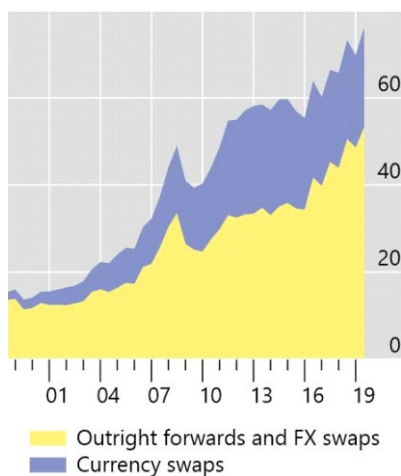
As discussed in Borio et al (2017), FX swaps are economically equivalent to secured debt, but they do not appear on balance sheets. While BIS statistics provide some information about the counterparties to FX derivatives transactions, they do not provide information about the direction of exposures. As a result, it can be difficult to assess which entities are using FX swaps and forwards, their motivations (eg hedging vs speculation) and the linkages that arise from these transactions. This makes it hard to evaluate the financial stability implications from the use of FX swaps and forwards.

### US dollar-denominated FX swaps and forwards

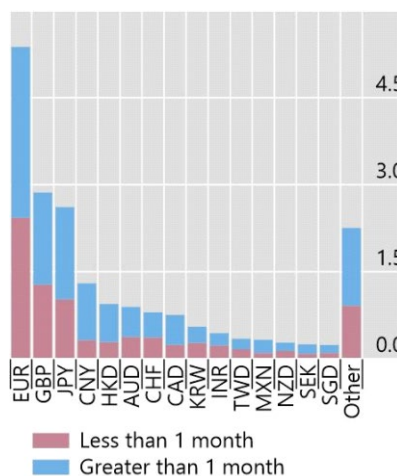
In trillions of US dollars

Graph 5

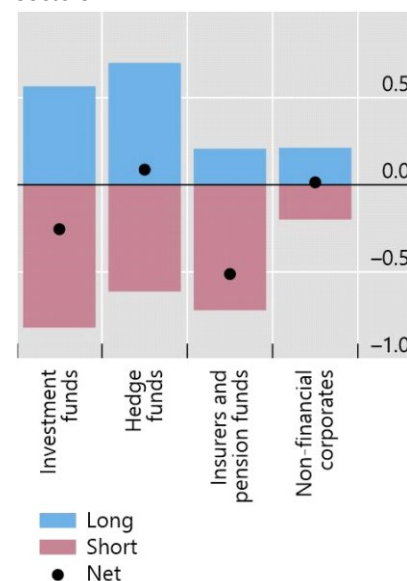
Total gross notional<sup>1</sup>



Total gross notional, by currency<sup>2</sup>



Long, short and net notional positions for main non-US non-bank sectors<sup>2</sup>



<sup>1</sup> Notional, global total amounts outstanding. <sup>2</sup> Outstanding positions at 9 July 2019 based on EMIR trade repository data reported to the Bank of England. Intragroup trades and trades with central counterparties have been removed.

Sources: DTCC; Regis and UnaVista trade repositories; BIS OTC derivatives statistics; CGFS Working Group calculations.

<sup>12</sup> For a primer on FX instruments, see eg Baba et al (2008).

That said, transaction-level data, which are collected by trade repositories, have recently become available to authorities in many jurisdictions following G20 commitments in 2009. A snapshot of positions data reported to the Bank of England provides new insights (Graph 5, centre and right-hand panels). This snapshot covers \$20 trillion of FX forwards (which is a combination of outright forwards and the forward leg of swaps), representing an estimated 40% of the global market. According to calculations by the Bank of England, the currency in the non-US dollar leg of the FX forwards in this sample is mostly EUR, followed by GBP, JPY, CNY and HKD (Graph 5, centre panel). Moreover, around 40% of the FX forwards mature within one month (see also Section 4 for the maturity distribution of FX forwards for some Asian insurers and pension funds).

These transaction-level data can be used to see the direction of participants' FX forward positions (Graph 5, right-hand panel). The main non-US, non-bank users of FX forwards in this sample are investment funds, hedge funds, insurers and pension funds, and NFCs.<sup>13</sup> Of these, insurers and pension funds (combined) and investment funds have net short US dollar forward positions (shown by the black dots below the line), consistent with using FX swaps to hedge US dollar assets. Hedge funds and NFCs in this sample have broadly flat US dollar forward positions. For hedge funds, this reflects individual hedge funds in the sample mostly having long and short positions at different maturities, resulting in broadly flat US dollar forward positions. The individual NFCs in the sample, to a large extent, have either net long or net short positions in US dollars, depending on the currency of their cash flows.

### Other short-term funding markets

Besides the FX swap and forward markets, there are other secured and unsecured money markets available to participants seeking US dollar funding. The repo market is a *secured* market and one of the largest sources of US dollars for non-US entities for shorter-term financing and investment. A repo is a short-term transaction where cash is provided in exchange for a security over a specified period of time.<sup>14</sup> It offers a secured and safe short-term return, which may be of particular benefit to those investors with short-term cash management motives and who may not be permitted to lend unsecured, such as money market funds (MMFs) or foreign central banks.

Although repo markets are more transparent now than before the GFC, data gaps leave them relatively opaque. This is particularly true for activity among non-US entities that takes place outside the United States and activity outside the tri-party repo market in the United States.

There are several other markets that offer short-term financing and investment opportunities. *Unsecured* markets include commercial paper and certificates of deposit. Banks often issue these to diversify their funding sources (eg relative to deposits). Corporations obtain funding in the commercial paper market to secure short-term funding and take advantage of relatively low issuance costs. Eurodollars are US dollar deposits held outside the United States. For non-US institutions, these deposits may not be subject to US regulatory requirements and are an alternative to funding via onshore markets, such as the federal funds market, where these banks

<sup>13</sup> Almost all outstanding positions in this sample involve a bank (either a dealer or a commercial bank), and just over two thirds of positions are interbank. Banks are net long US dollars via forwards (although net position is significantly smaller than gross position).

<sup>14</sup> Through a repo transaction, a borrower of US dollars (lender of securities, which is typically a primary dealer) is able to finance a portfolio of high-quality securities (eg US Treasuries).

may not have access. Wholesale deposits held by both financial and non-financial entities are liabilities of banks. Banks use these to secure larger-scale short-term funding, and they are particularly attractive to banks without a US dollar retail deposit base. Some non-US banks have access to a US dollar retail or corporate deposit base in the United States or elsewhere, which is a more stable source of funding.

### Long-term funding markets

Entities that need longer-term financing and lenders seeking longer-term investments transact in the international US dollar loan and bond markets. Corporate bond issuance allows larger borrowers to obtain financing from a range of investors, but requires significant information disclosure, which can be costly. Smaller borrowers may not have access to global debt markets and will rely on bank loans. These are often large loans provided jointly by a syndicate of several lenders and sold to non-bank investors after origination. Syndicated lending allows borrowers to avoid the costs of bond issuance while obtaining credit in an amount that would generally be too large for a loan from a single bank. Data gaps exist for syndicated loans to non-US borrowers, particularly information post-origination. The portion of those syndicated loans that are retained by banks may be included in total cross-border bank loans, but the portion that is sold on to non-bank investors is not captured.

Other forms of longer-term US dollar funding are cross-currency swaps. A cross-currency swap is similar to an FX swap, but tends to be of much longer maturity and it involves the exchange of floating interest rate payments during the term of the contract. Banks and NBFIs tend to be most active in the cross-currency markets, according to BIS data.

Lastly, the FX spot, while not considered a funding transaction because it is an outright transaction and there is no obligation for future repayment, is an instrument used to obtain US dollars. In a spot transaction, one currency is permanently exchanged for another, which can be used for international trade, investment and/or speculative purposes.<sup>15</sup>

## 3. Recent trends and their drivers

The size and nature of international funding in US dollars have evolved since the GFC in several important respects. This section describes several key trends and highlights some factors that may have influenced them. Changes in the system can portend a shift in vulnerabilities, but this depends upon how entities manage the risks that could arise from their evolving activities. Accordingly, Section 4 investigates the shifting nature of vulnerabilities.

In summary, US dollar funding remains below its peak a decade ago relative to the size of the global economy, despite having grown in nominal terms. However, the share of international funding that is denominated in US dollars has risen compared with other major international currencies, reaching levels last seen in the early 2000s and making it the dominant international funding currency.

<sup>15</sup> Collateral swaps may also enable entities to obtain US dollar funding. For example, a non-US entity may look to swap sovereign bonds in local currency for US Treasuries and then use those Treasuries in the repo market to obtain US dollars.

In addition, since the GFC, the US dollar funding landscape has undergone significant structural changes:

- *Less bank intermediation:* Overall, banks are less leveraged, they manage their liquidity risks better and they are less interconnected. Additionally, banks have adjusted the US dollar portion of their balance sheets, reducing their use of short-term US dollar funding and increasing their holdings of liquid US dollar assets. Cross-border bank loans in US dollars as a share of global GDP have declined to their levels in the early 2000s.
- *Shifting geography:* European banks have scaled back their US dollar operations substantially, while Japanese and Canadian banks have expanded theirs. Since the GFC, the prominence of the United States as a destination for bank lending is little changed, and non-US residents now hold a greater fraction of US corporate bonds.<sup>16</sup> EMEs as a whole, and China in particular, have become both larger borrowers and larger suppliers of US dollars, especially via the bond market.
- *More market-based finance:* In contrast to bank intermediation in US dollars, market-based financing in US dollars has outpaced the growth of the global economy. A consequence of this trend is that some non-banks – eg insurers, pension funds and central counterparties (CCPs) – have become more important providers and intermediaries of US dollar funding. Banks have become more exposed to non-bank intermediaries.
- *Core activities are more resilient but remain subject to volatility:* Regulatory developments have encouraged greater use of collateral and/or central clearing, while intermediary balance sheets are less risky. However, these markets are not immune to bouts of volatility. In part, that is because banks are less willing to absorb liquidity shocks than before, leading to greater price movements.

Each of these trends is likely to have been influenced by an interplay of factors, including but not limited to:

- *Strengthened regulation and supervision:* Post-crisis regulatory reforms and greater supervisory attentiveness – along with banks' own recognition of the need for more capital and improved liquidity – have led banks to increase their capital and improve their liquidity and their risk management practices. Regulators and supervisors have been attentive to the US dollar activities of certain non-banks, particularly in Europe and parts of Asia.
- *Shifting business models:* In response to the GFC and the euro area sovereign debt crisis, some intermediaries have also changed their business models. In some instances, driven by the need to improve their capital positions by reducing the capital intensity of their business, they have scaled back and changed the nature of their US dollar activities. Other intermediaries were less constrained and increased their US dollar activities.
- *Divergences in growth and interest rates among AEs and between AEs and EMEs:* Low growth can reduce domestic demand for loans, and low interest rates and

<sup>16</sup> Based on the BIS consolidated banking statistics, US borrowers continue to account for about one quarter of consolidated foreign claims of reporting banks headquartered outside the United States. Compared with the domestic banking system assets (measured by the BIS long credit series) of the same countries, consolidated foreign claims on US borrowers remain sizeable, although they did decline somewhat, from about one quarter to about one fifth of domestic banking system assets.

accommodative monetary policies reduce the rate of return on domestic lending. For example, this has arguably prompted banks and life insurance companies in some economies to lend abroad in order to improve their returns. This is likely to have resulted in greater investor demand for debt issued in US dollars (including by US entities).

### 3.1 US dollar funding has grown faster than funding in other currencies

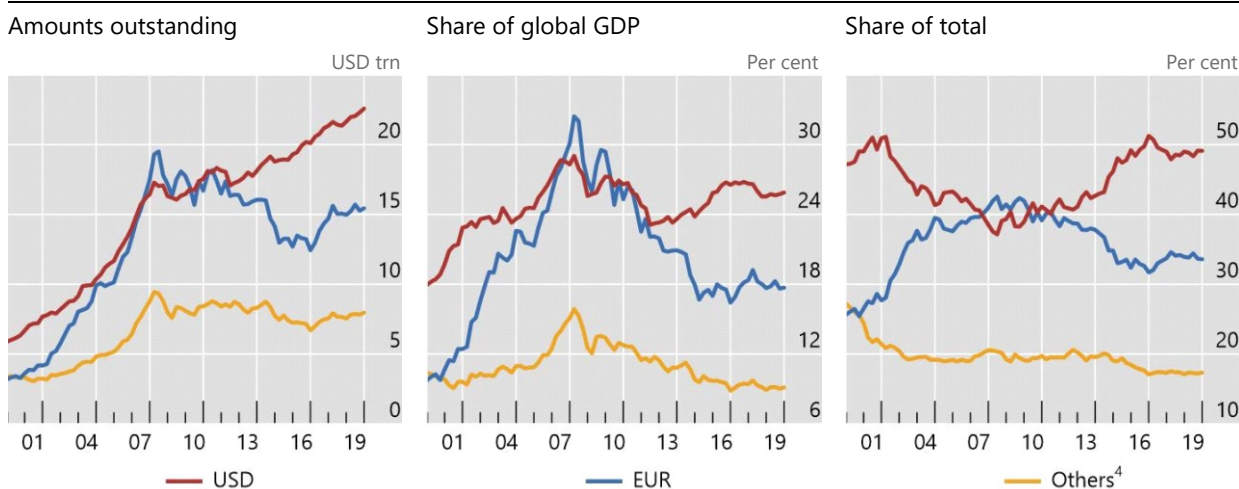
Relative to GDP, international US dollar funding is below its pre-GFC peak. To be sure, international US dollar borrowing has grown since the GFC in absolute terms (Graph 6, left-hand panel). However, it has been fairly stable in recent years at around 25% of global GDP, compared with a peak of nearly 30% prior to the GFC (centre panel).

When compared with other funding currencies, the US dollar has returned to the dominant position it held around the turn of the century (Graph 6, right-hand panel). The use of the euro for international funding briefly surpassed the US dollar around the time of the GFC, but it subsequently reversed those gains in the wake of the euro area sovereign debt crisis.

Cross-border bank loans<sup>1</sup> and international debt securities<sup>2</sup> in all currencies

By currency<sup>3</sup>

Graph 6



<sup>1</sup> Cross-border loans extended by banks in all reporting countries including those in the United States; loans comprise non-negotiable debt instruments that are lent by creditors directly to a debtor or represented by evidence of a deposit (including interoffice claims on account of loans and deposits). The figures include cross-border loans in euros within the euro area – that is, loans that are in the home currency for both parties. <sup>2</sup> International debt securities (IDS) are issued outside the local market of the country where the borrower resides. They capture issues conventionally known as eurobonds and foreign bonds and exclude negotiable loans. Instruments such as bonds, medium term notes and money market instruments are included in international debt securities. IDS include euro-denominated instruments issued inside the euro area but outside of the euro-area borrower's home country. <sup>3</sup> The figure shows the total sum of cross-border bank loans and international debt securities in each currency. <sup>4</sup> The currency denomination of underlying instruments is other than the US dollar and euro.

Sources: World Bank; BIS locational banking statistics (by residence); BIS international debt securities statistics.



### 3.2 Banks have adjusted their balance sheets, partly due to regulation

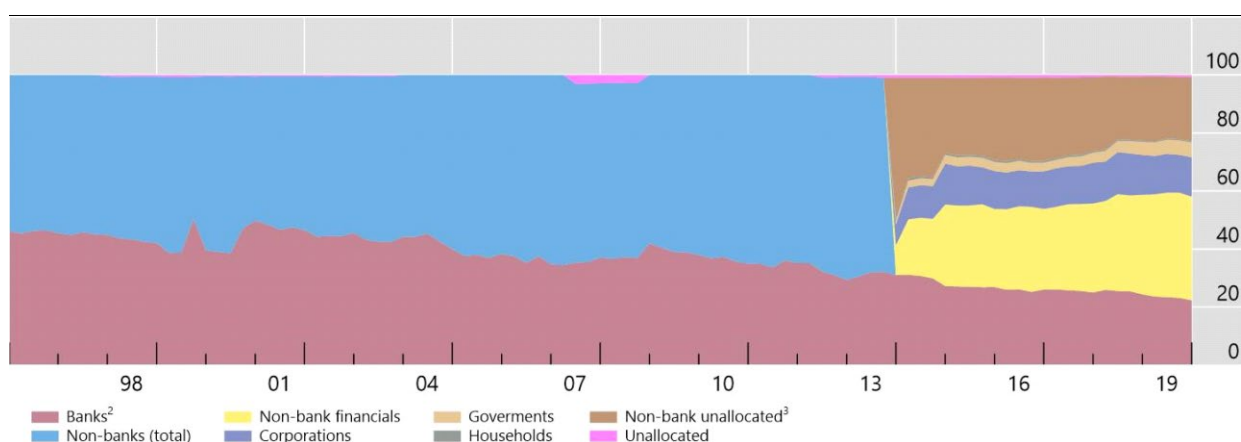
Banks, which have historically played a key role in international US dollar funding, have made large adjustments to their balance sheets since the GFC. These have been driven by new banking regulations and improved risk management practices. In particular, banks have improved their capital positions – in some cases shifting away from capital intensive businesses – in response to Basel III capital requirements (CGFS (2018a)). They have improved their liquidity and liquidity risk management in response to Basel III liquidity requirements, including the Liquidity Coverage Ratio. As part of these reforms, national supervisory authorities require banks to monitor their liquidity risk at the currency level. As a consequence, banks have significantly increased their holdings of liquid US dollar assets and reduced their use of short-term US dollar funding, including by lengthening the maturity of their liabilities. As detailed in Section 4.1, these balance sheet changes have made individual international banks with US dollar activity more resilient than they were a decade ago (see discussion of recent behaviour of US dollar funding markets in Section 6).

As banks have responded to the new regulatory environment, they have also become less interconnected in certain ways. Banks' direct exposures to one another have declined over the past decade, from around 40% to just under 25% of international US dollar loan exposures (the red area in Graph 7). In addition, the introduction of mandatory clearing for many over-the-counter (OTC) derivatives has reduced bilateral connections between banks in both US dollars and other currencies, as discussed in greater detail below. While banks are generally less connected with one another, they have become more connected to NBFIs. For example, lending to NBFIs (the yellow area in Graph 7) has grown to more than one third of banks' total cross-border loans in US dollars.<sup>17</sup> As highlighted in Section 2, overall US dollar activities and markets remain highly interconnected.

#### Sectoral decomposition of US dollar-denominated cross-border bank claims<sup>1</sup>

Amount outstanding, as a percentage of total US dollar-denominated cross-border claims

Graph 7



<sup>1</sup> Cross-border claims in all instruments extended by banks in all reporting countries including those in the United States; excludes interoffice claims. <sup>2</sup> Excluding interoffice claims. <sup>3</sup> Amount of claims/liabilities vis-à-vis non-banks that are not reported with a breakdown by its subsectors (subsectors of non-banks are available partially from Q4 2013).

Source: BIS locational banking statistics (by nationality).

<sup>17</sup> These exposures to NBFIs tend to be concentrated in offshore financial centres (Garcia Luna and Hardy (2019)).

Bank balance sheets are also affected, by banks' efforts, at the margin, to limit the extent to which they are subject to some enhanced supervisory rules. The intermediate holding company (IHC) rule is an example of this that affects US dollar funding. This rule applies the same enhanced supervision and regulation of liquidity, risk management and capital (including stress tests) to non-branch US operations of foreign banks and to US commercial banks of similar size. US branches of foreign banks are exempt from the enhanced supervision and regulation, and following implementation of the rule some non-US banks moved some of their US dollar activities out of their US subsidiaries and into their US branches (Kreicher and McCauley (2018)).

Regulatory changes have also affected the structure of banks' US dollar funding in other ways. For example, non-US banks have increasingly obtained US dollar funding from outside the United States following reforms aimed at increasing the resilience of US money market funds (MMFs). The effect of these reforms on US dollar funding was that non-US banks now obtain less funding from US MMFs (Aldasoro et al (2017b)).

### 3.3 Activity has declined in Europe but risen elsewhere, including in EMEs

#### Declining role of European banks, rising role of others

Non-US banks in different jurisdictions have made diverging choices about their business models pertaining to US dollar activity over the past decade.<sup>18</sup> Since the GFC, European banks have significantly rolled back their foreign banking activities, in contrast to other AE banks. European banks' total US dollar claims have steadily declined after rapid growth before the GFC (Graph 8, left-hand panel; see also CGFS (2018a)). This has occurred primarily via a reduction in cross-border loan exposures, particularly to US residents, as European banks have sought to repair balance sheets and redeploy scarce capital to core markets. While the total US dollar activities of European banks have declined overall, some have become more prominent in specific market segments as their business models have evolved (eg French banks in US dollar repo markets; see Annex D).

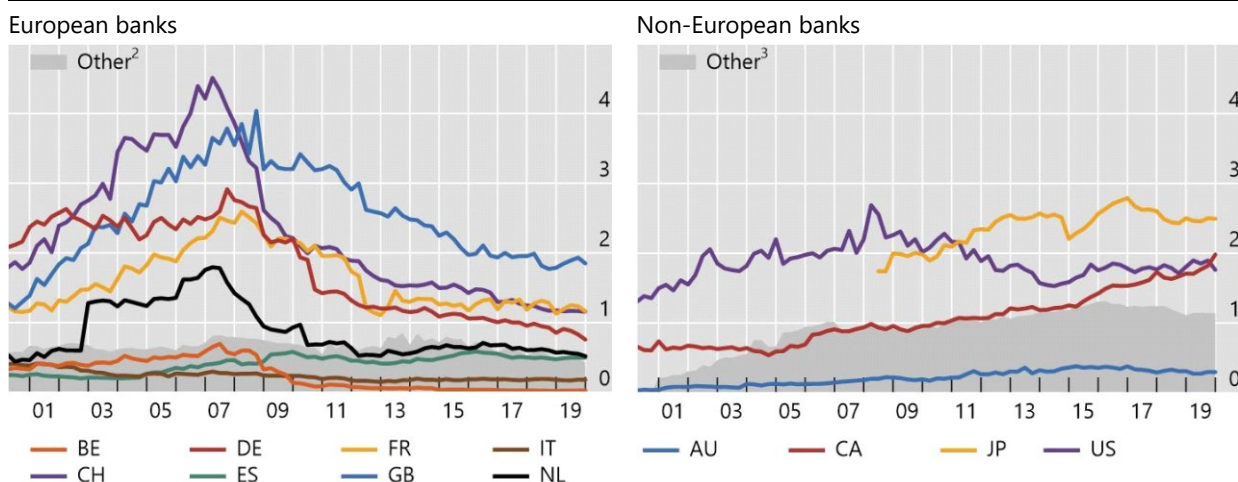
The US dollar claims of other banking systems have risen steadily in recent years, although this has not fully offset the decline of European banks' claims (Graph 8, right-hand panel, and Graph 9, left-hand panel). Japanese banks in particular have expanded their US dollar activities, partly driven by a search for yield in the face of low-yielding domestic investment opportunities. At the same time, banking systems such as Canada's, which emerged from the GFC with fewer losses and higher levels of capital, have been able to pursue strategies that have seen their US dollar activities expand. Bank supervisors in Canada and Japan are attentive to foreign currency funding issues. In particular, they monitor foreign currency funding and have used regulations and supervisory guidance to get banks to improve their positions. (See Annexes C and E.)

<sup>18</sup> Aldasoro et al (2019b) document differences in the business models of banks from different jurisdictions, and analyse the implications in different US dollar funding markets and instruments. CGFS (2018a) describes how many banks reduced their capital-intensive activities (such as trading activities) and reliance on wholesale funding sources and increased focus on retail banking. It also documents how the changes were more profound for European banks and globally active banks and that banks that were healthier post-crisis (had less pressure to change) were more likely to resist these trends.

## European and non-European banks' US dollar foreign claims<sup>1</sup>

Percentage of world GDP

Graph 8



AU = Australia; BE = Belgium; CA = Canada; CH = Switzerland; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; IT = Italy; JP = Japan; NL = Netherlands; US = United States.

<sup>1</sup> Excludes inter-office claims. Positions of Japanese banks exclude estimates of trust account-based positions of banks in Japan. <sup>2</sup> Austria, Denmark, Finland, Greece, Ireland, Luxembourg, Norway, Portugal, Sweden and Turkey. <sup>3</sup> Brazil, Chile, Chinese Taipei, Hong Kong SAR, India, Korea, Mexico, Panama and Singapore.

Sources: Bank of Japan; IMF, *World Economic Outlook*; BIS consolidated banking statistics; BIS locational banking statistics (by nationality); CGFS Working Group calculations.

### Growth of EME activity

While most US dollar funding activity is still within and between AEs, that involving EMEs has increased over the past decade, in part reflecting the relatively rapid growth of these economies.<sup>19</sup> This growth in US dollar activity has been driven by debt security issuance, which has risen strongly for EME sovereigns, banks and NFCs (Graph 9, right-hand panel). In contrast, cross-border US dollar lending by banks headquartered in EMEs remains around its level of a decade ago (Graph 9, left-hand panel). Nevertheless, around 20% of worldwide cross-border bank claims have EME banks either as a borrower or a lender (Graph 9, centre panel; see also Cerutti et al (2018)).

Much of the overall growth in EMEs' US dollar activities in recent years relates to Chinese entities, which have become more prominent as both borrowers and lenders of US dollars internationally (discussed further in Annex G).

<sup>19</sup> EME borrowers now account for 19% of global US dollar funding as measured in this report (cross-border loans and international debt securities in US dollars), up from 10% just before the GFC.

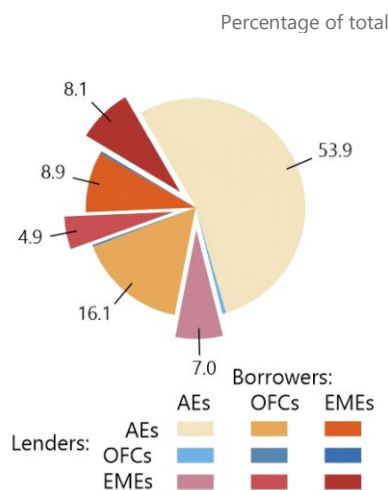
## US dollar-denominated cross-border bank claims, by geography and international debt securities of EMEs, by sector

Graph 9

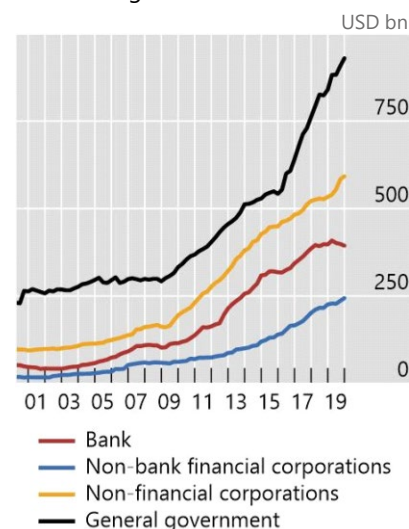
Cross-border bank claims, by country of bank<sup>1</sup>



Lender-borrower relationships in worldwide cross-border bank claims<sup>4</sup>



Sectoral decomposition of EME international debt securities outstanding<sup>5</sup>



<sup>1</sup> Excluding interoffice claims. <sup>2</sup> Includes Chinese Taipei and Korea. United States excluded. <sup>3</sup> Banks headquartered in Brazil, Chile, India, Malaysia, Mexico, South Africa and Turkey. <sup>4</sup> As of end-December 2019; excluding interoffice claims; lender banks by nationality excluding banks located in The Bahamas, Bahrain, Curaçao, Jersey, consortium banks and unallocated by parents; cross-border claims exclude those vis-à-vis unallocated non-residents and international organisations. <sup>5</sup> On immediate issuer basis. Excluding Hong Kong SAR and Singapore. Banks include central banks.

Sources: BIS locational banking statistics (by nationality); BIS international debt securities statistics.

### 3.4 Market-based finance has driven the growth of US dollar funding

The growth of global US dollar funding in recent years has largely been driven by *market-based* financing. Over the past five years, around three fourths of the increase in international US dollar funding has been in the form of marketable debt securities rather than bank lending. In that time, the stock of US dollar international debt securities has risen relative to global GDP, while bank lending has shrunk relative to global GDP to around its levels of the early 2000s (Graph 10, left-hand panel). As a result, international US dollar debt securities now exceed bank loans, having been around 60% as large a decade ago.<sup>20</sup>

The increased prominence of market-based funding has reflected a range of factors, some of which are not unique to US dollar activity. As discussed, banks' asset growth has been limited, as they have focused on improving risk management and repairing balance sheets. While post-crisis banking regulations have improved the safety and soundness of the banking system, the increased cost of intermediation may have also encouraged some activities to migrate outside the banking sector. In addition, there has been strong demand for securities from institutional investors, reflecting rapid growth in their funds under management amid a search for yield in an environment of low global interest rates. NBFIs have also become increasingly important as issuers of debt securities (the dark blue area in the right-hand panel of Graph 10).

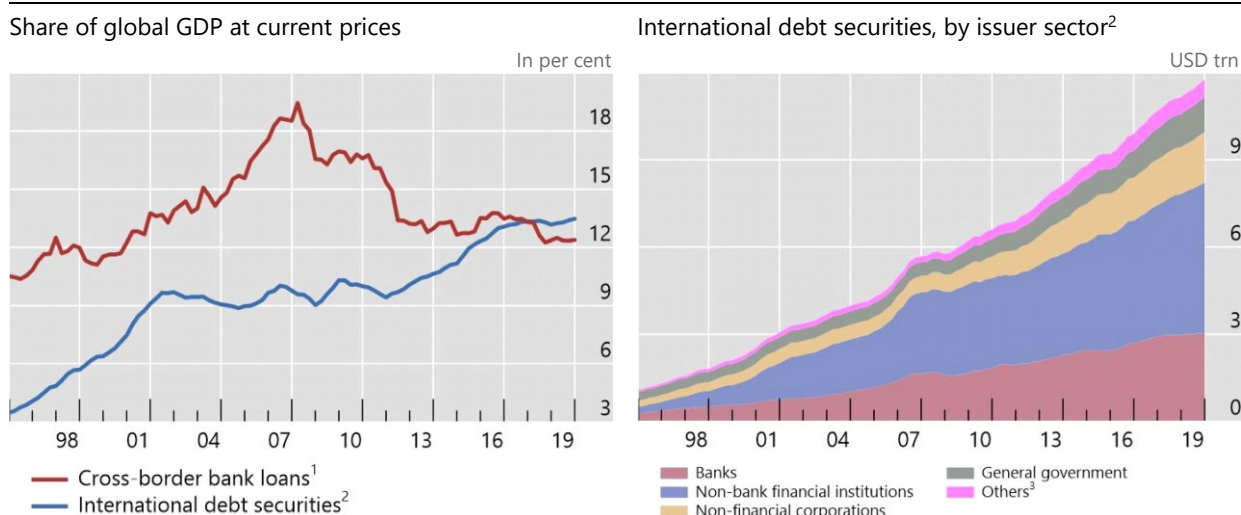
<sup>20</sup> The broader shift (across currencies) from cross-border bank loans to international debt securities has been described as "the second wave of global liquidity"; see Shin (2013).

At the same time, some factors specific to US dollar activity have also partly driven this shift. Market-based finance plays a particularly large role in the US financial system, including for US corporate funding via bond issuance and leveraged loans. In recent years, foreign investors have expanded their holdings of these instruments:

- *Corporate bonds*: the share of US corporate bonds owned by investors outside the United States has risen even though about three quarters of US corporate bonds are still held by US entities (Graph 11, left-hand panel).
- *Syndicated loans and collateralised loan obligations (CLOs)*: Foreign investors have been active in the packaging of syndicated loans, particularly of higher-risk corporate loans. For instance, the creation of CLOs, where banks package loans into a structured financial vehicle for sale to investors, has increased significantly in recent years.<sup>21</sup> While around 90% of US CLOs are held by US investors, non-US investors have increasingly been purchasers of these CLOs (Liu and Schmidt-Eisenlohr (2019)). That has been especially the case for Japanese banks, which have been buying the lowest-risk tranches (Graph 11, centre panel; see also Annex C). A range of other types of foreign institutional investors have reportedly also played a role in the growth of this market, including by investing in riskier tranches. However, there are significant data gaps in this market that hinder a more precise assessment of exposures (Bank of England (2018), FSB (2020)).

## US dollar-denominated cross-border bank loans and international debt securities outstanding

Graph 10



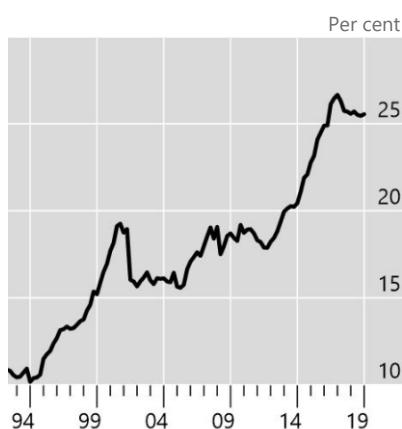
<sup>1</sup> Cross-border loans extended by banks in all reporting countries including those in the United States; include interoffice loans. <sup>2</sup> International debt securities (IDS) are issued outside the local market of the country where the borrower resides. They capture issues conventionally known as eurobonds and foreign bonds and exclude negotiable loans. Instruments such as bonds, medium-term notes and money market instruments are included; includes issuances by entities in the United States. <sup>3</sup> Include central banks and international organisations.

Sources: World Bank; BIS locational banking statistics (by residence); BIS international debt securities statistics.

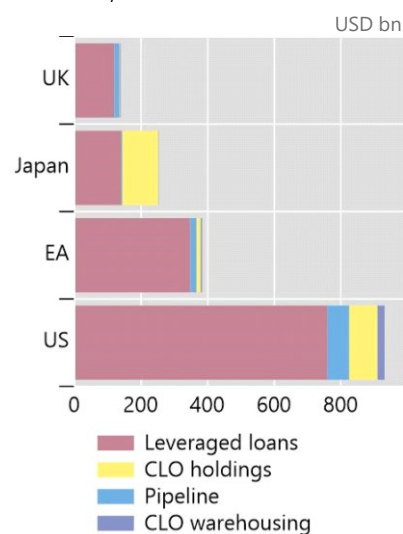
<sup>21</sup> Evidence suggests that banks' syndicating leveraged loans quickly pass these loans, particularly those with riskier characteristics, to non-bank investors; see Lee et al (2019).



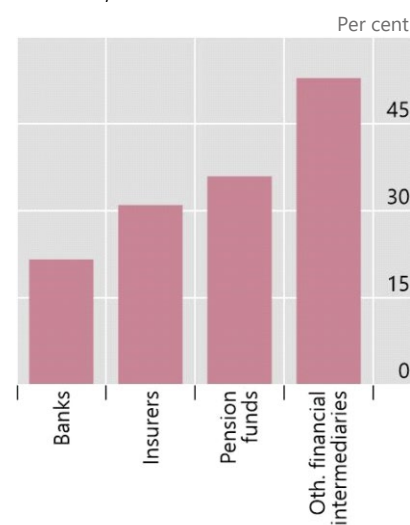
Non-US holdings of US corporate debt<sup>1</sup>



Bank holdings of leveraged loans and CLOs, all currencies<sup>2</sup>



Total assets growth by sector in 2012–17, all currencies<sup>3</sup>



<sup>1</sup> Excluding private asset-backed securities where possible. <sup>2</sup> Direct exposure, global and all currencies, based on supervisory data covering US, EA, UK and JP banks. CLO = collateralised loan obligation. <sup>3</sup> Twenty-nine jurisdictions: Argentina, Australia, Belgium, Brazil, Canada, Cayman Islands, Chile, China, France, Germany, Hong Kong SAR, India, Indonesia, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Switzerland, Turkey, the United Kingdom and the United States. Some exchange rate effects have been netted out by using a constant exchange rate (from 2017).

Sources: Federal Reserve; Financial Stability Board, *Global Monitoring Report on Non-Bank Financial Intermediation 2018*; Treasury International Capital; CGFS Working Group calculations.

### 3.5 Certain non-banks have become more important

As market-based finance has grown over the past decade, the activities of certain non-banks have become more important. Non-banks have become more significant investors and borrowers, mirroring a broader trend across currencies; the growth of pension funds, insurers and other NBFIs has far outpaced that of banks in recent years (Graph 11, right-hand panel).

Institutional investors in East Asian economies – notably insurance companies and pension funds – appear to have been particularly active buyers of international securities in recent years, including US dollar securities. For example, insurers in Japan (the blue bars in Graph 12, left-hand panel; see also Annex C) have made large purchases of international securities in recent years, comparable in size to those of banks (the yellow bars in Graph 12, left-hand panel). More generally across the region, holdings of international securities by such non-bank entities are estimated to be as much as \$2.6 trillion (across currencies, much of which is in US dollars) (Graph 12 right-hand panel).<sup>22</sup> This development reflects the search for yield amid low domestic interest rates and a surplus of domestic savings over investment. To enhance returns, these investors have purchased US dollar-denominated securities, which often offer higher returns than domestic securities even accounting for FX hedging costs (although some investors do not always hedge currency risk).

<sup>22</sup> Based on balance of payments, Treasury International Capital (TIC) and IMF Coordinated Portfolio Investment Survey (CPIIS) (Setser (2019)).

An important aspect of some of these expanded activities has been an implicit maturity transformation by institutional investors. Long-term and, in part, illiquid US dollar investments by some investors have been financed with shorter-term funding (effectively via shorter-term FX swaps), in order to enhance returns.<sup>23</sup> An example is the case of life insurers in Chinese Taipei (Setser (2019)).

In Europe, the largest holdings of US dollar bonds are by investment funds. These have doubled over the past five years to around \$1 trillion, and portfolio managers have increased their allocation to US dollar assets (Graph 13, left-hand and centre panels).<sup>24</sup>

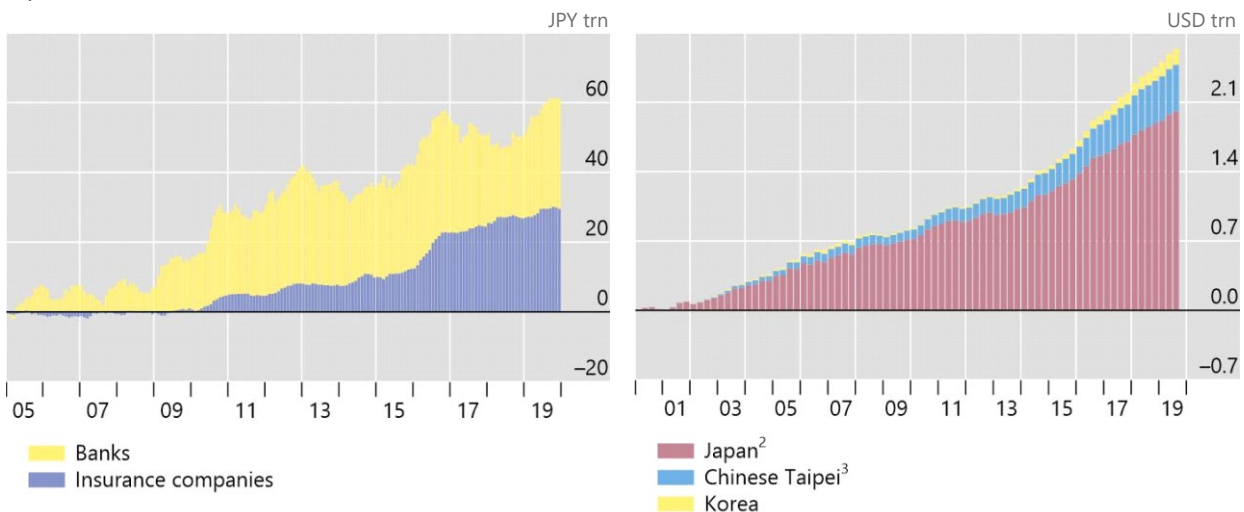
European insurers have also increased US bond holdings, but these remain modest and there is little evidence of the type of maturity transformation seen in Asia (Graph 13, left-hand and right-hand panels). The risk-based capital regime for European insurers (Solvency II) may have dampened the demand for such positions. Two important Solvency II regulations stand out in this regard. First, Solvency II encourages insurance companies to match the maturity of their hedges to that of their US dollar assets through more favourable treatment of liabilities that match the maturity of claims. Second, Solvency II discourages unhedged or open US dollar positions either through limits or capital requirements. For example, insurers must hold capital against any unhedged FX exposures (eg of 25% under the standardised approach). Consistent with this requirement, data collected under Solvency II show that the bulk of the FX derivatives of European insurers are long-term in nature (more than 80% have a maturity of nine to 10 years). Data are more limited for European pension funds, but US dollar bond holdings are reportedly large in some countries (eg the United Kingdom and the Netherlands).

## International activities of Japanese and other Asian entities

Graph 12

Purchases of medium to long-term foreign securities by Japanese entities, all currencies

Holdings of international securities by NBFIs<sup>1</sup>

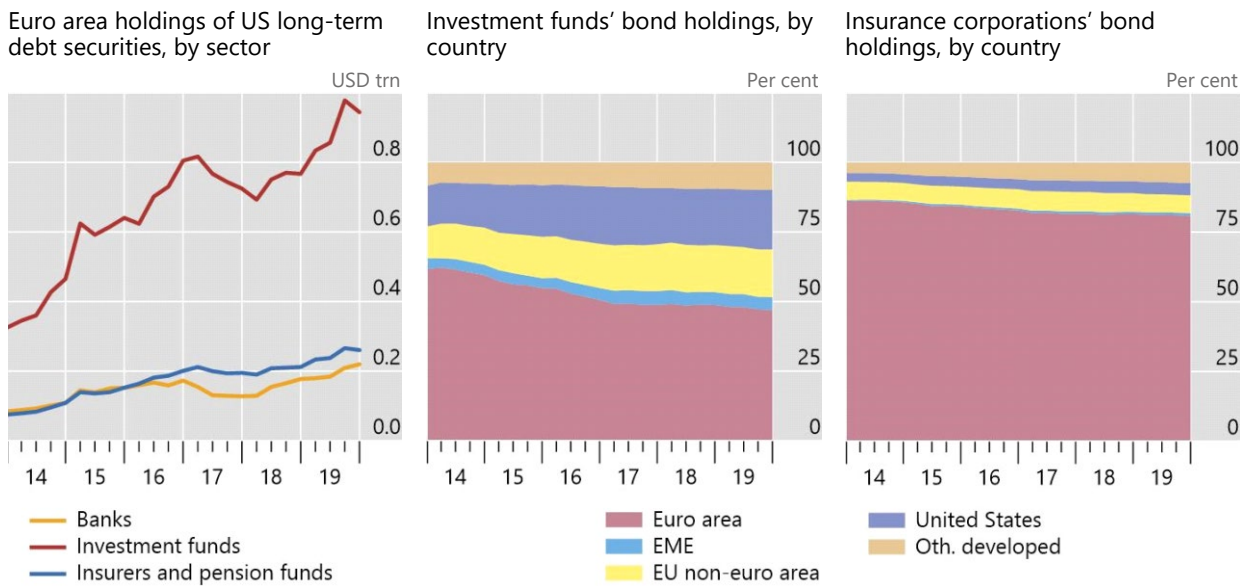


<sup>1</sup> Estimated cumulative outflows: non-bank financial institutions (sum of balance of payments flows, in all currencies). <sup>2</sup> Data prior to 2014 include non-financial corporations, households and non-profit institutions serving households. <sup>3</sup> Includes non-financial corporations, households and non-profit institutions serving households.

Sources: Central Bank of the Republic of China; Bank of Japan; Bank of Korea; IMF; Japanese Ministry of Finance; Refinitiv.

<sup>23</sup> See Setser (2019), IMF (2019), Bank of Japan (2019) and Bank of Korea (2018). The potential implications of this trend are discussed further in the next section.

<sup>24</sup> See ECB (2019).



### 3.6 Core activities and markets are more resilient but remain subject to volatility

#### Central clearing

Since the GFC, the increased use of central clearing has reduced banks' bilateral exposures to one another. Around three quarters of interest rate derivatives denominated in US dollars globally are now centrally cleared. That said, clearing rates for FX products tend to be much lower, at just 4% (across currencies, although the bulk of this market is transacted against the US dollar). This reflects the fact that these are deliverable contracts involving the exchange of principal in different currencies, and so are not well suited to central clearing.<sup>25</sup>

While mandated central clearing of OTC derivatives has reduced banks' interconnectedness in US dollars, it has naturally resulted in an increase in the importance of central counterparties. Reflecting this more important role for CCPs, regulatory standards have been raised over the past decade and CCP compliance with these standards remains an area of international policy focus.

Finally, CCPs have other connections to international US dollar activities.<sup>26</sup> For example, they hold US dollar assets via their default funds and holdings of initial margins, although these investments are smaller than those of some other non-bank investors.<sup>27</sup>

<sup>25</sup> Aramonte and Huang (2019) describe trends in central clearing across currencies. Note that the US dollar figure for interest rate derivatives includes contracts where US counterparties are on either side of the transaction.

<sup>26</sup> For a discussion of CCPs' interdependencies more generally, see BCBS-CPMI-FSB-IOSCO (2018).

<sup>27</sup> CCPs invest these funds in highly marketable securities, as well as secured and unsecured deposits at commercial banks, and some US CCPs have access to US dollar deposit accounts at the Federal Reserve.



## Collateral

Regulatory developments and improved risk management have seen greater use of collateral in US dollar money markets. Broadly, unsecured claims in short-term US money markets have declined markedly, while secured claims have grown (eg Schrimpf and Sushko (2019)). Looking specifically at US financial institutions' short-term lending to foreigners, reverse repo has risen recently while certain unsecured funding activities have declined (eg non-negotiable securities and deposits and certificates of deposit). In the case of the FX swap market, there has been considerably more use of margin collateral since the GFC to mitigate counterparty credit risk (as indicated, for example, by the prevalence of credit support annexes).

## US money market funds

The US MMF sector played a very important role in global dollar funding prior to the GFC, and it was an important source of US dollar funding stress for non-US borrowers during the GFC. However, over the past several years the US MMF sector has undergone major changes. Regulatory reforms implemented in 2016 restricted the investment universe for so-called "prime funds" and triggered outflows of roughly \$1 trillion from these funds. This led to a reduction in US dollars seeking investments in commercial paper and other types of unsecured private sector debt issued by non-US banks and increased the amount of cash invested in repos secured by US government debt. Additionally, the US MMF reform lowered limits on weighted average maturity and created weekly and daily liquid asset requirements. As a result, the weighted average tenor of money market funding to banks has shortened considerably over the past decade (Graph 14, left-hand panel; see also Aldasoro et al (2019b)).

## Sponsored repo programme

Another recent development that affected US MMFs and US dollar repo markets more broadly has been the rise of the sponsored repo programme. In effect, this has meant that the funding that MMFs provide through the repo market generates less leverage among the banks that intermediate such funding (via the matching and netting of trades). Specifically, following rule changes to the Fixed Income Clearing Corporation (FICC), it became easier for MMFs to invest into the FICC through a sponsor and, for the first time, sponsors could also support entities looking to borrow funds in the repo market. This typically allowed US MMFs to earn higher returns than they do in the tri-party repo market or through the overnight reverse repurchase facility at the Federal Reserve (Aldasoro et al (2017a)). A consequence has been the rapid rise in the investments of US MMFs in sponsored repos (Graph 14, centre panel).<sup>28</sup> Another potential consequence of this for non-US banks is tougher competition for funding from MMFs as the sponsored repo programme allows US MMFs to interact with a broader set of counterparties.

<sup>28</sup> Avalos et al (2019) and Afonso et al (2020) argue that a reduction in the investments of US MMFs in the FICC-sponsored repo programme may have contributed to the repo market dislocations in September 2019.

While acting to reduce the leverage of repo intermediaries, the growth of sponsored repo has been associated with leverage among some money market borrowers, particularly hedge funds. Based on the Bank of England's Hedge Fund as Counterparty Survey, between October 2018 and April 2019 hedge funds' cash borrowing from banks in repo markets grew by over 40% to around \$1 trillion, much of which was US dollar repo.<sup>29</sup> A large part of this increase can be ascribed to the surge in the sponsored repo programme, as it made funding more readily available to leveraged accounts, both directly, as sponsored cash borrowers, and indirectly, as traditional cash borrowers in the FICC netting programme. That said, the increase in sponsored service activity by hedge funds could represent a partial substitution away from other funding sources rather than an outright increase in leverage.

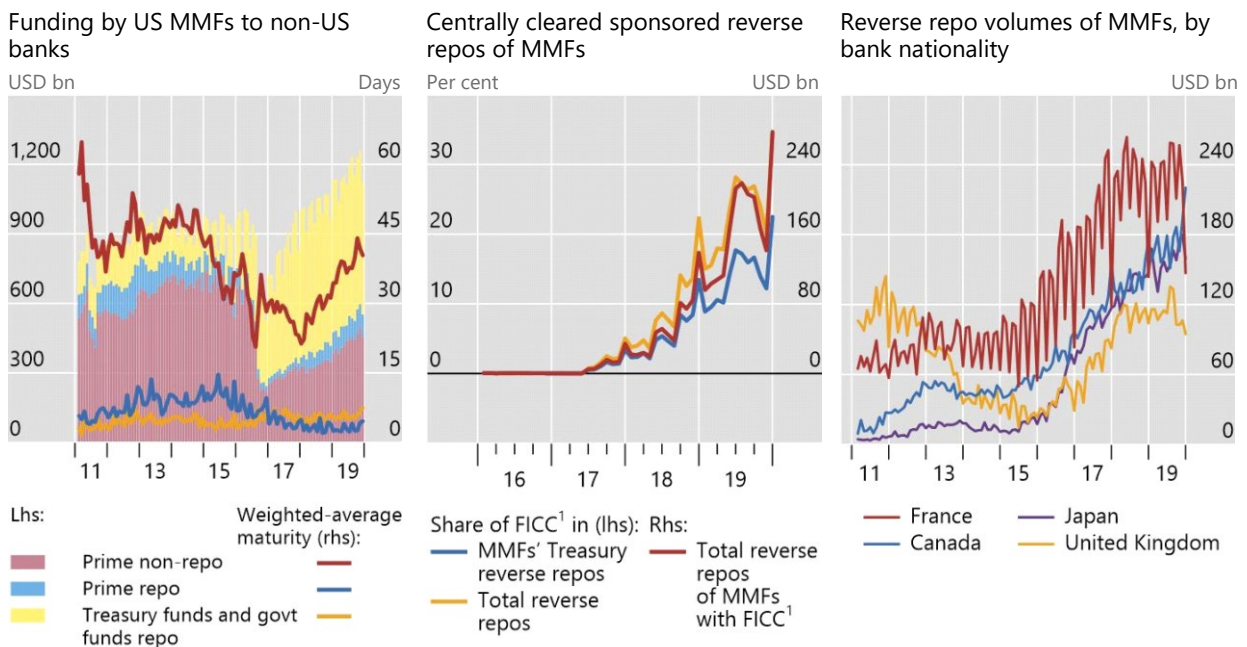
### Market volatility

While these developments have together made activities in core US dollar money markets more resilient, volumes and prices have nevertheless been subject to periods of volatility, including the most recent strain related to the Covid-19 outbreak.

A well documented pattern in repo markets has been the quarter-end reduction in activity (Graph 14, right-hand panel; see also CGFS (2017)). Repo and FX swap markets have seen a widening in the cost of borrowing US dollars, especially around such balance sheet reporting dates. In part, this feature of markets arises because banks are less willing to use their balance sheet to absorb liquidity shocks than in the past, giving rise to price spikes. These patterns have been transitory and without

US money market funds and repo markets since the GFC

Graph 14



<sup>1</sup> Fixed Income Clearing Corporation.

Sources: Aldasoro et al (2019a,b); Crane Data; CGFS Working Group calculations.

<sup>29</sup> Similar patterns can be seen through the Securities and Exchange Commission Form PF filings of hedge funds.

major impact on the rest of the financial system. That said, they have occurred during periods of relative stability in global financial markets.

More importantly, recent events since the global outbreak of Covid-19 have led to increased volatility in US dollar funding markets. As borrowers rushed to secure US dollars, shortages in availability of funding led to surges in unsecured funding rates and FX swap-implied dollar funding costs. The prompt policy response and coordinated action by the Federal Reserve and other central banks have calmed funding markets, supported by the improved resilience of global banks since the GFC (see Section 6 for a discussion of events in the first quarter of 2020).

## 4. Potential vulnerabilities

US dollar funding is channelled through the global financial system, involving entities across multiple sectors and jurisdictions. Participants in these markets face financial risks typically associated with liquidity, maturity, currency and credit transformation. What makes global US dollar funding markets special is the broad participation of non-US entities from all around the world. These participants are often active in US dollar funding markets without access to a stable US dollar funding base or to standing central bank facilities which can supply US dollars during episodes of market stress.

With a limited stable funding base, investors and financial intermediaries use short-term wholesale US dollar funding markets, which creates vulnerabilities related to liquidity and rollover risk. Borrowers of US dollars that receive cash flows in other currencies are vulnerable to changes in exchange rates and interest rates, which can impair their debt servicing capacity.

Vulnerabilities can be managed at the firm level by hedging, by maintaining prudent capital and liquidity buffers, and by following conservative credit standards. But such action is not necessarily sufficient to reduce systemic vulnerabilities.

From a systemic perspective, concern arises from combinations or concentrations of risks or vulnerabilities in important markets or groups of institutions within US dollar funding markets in the absence of an adequate safety net. The complexity and interconnectedness of US dollar funding (discussed in Section 4.3) mean that shocks to a market or a group of institutions can propagate through the entire network of exposures, gathering strength and having a potentially significant effect on the supply of US dollar funding. Institutions may roll back their other activities in response to US dollar funding shocks, passing the effects through to their domestic economies.

A second significant concern is the exposure of some participants to shocks that represent a confluence of risks, such as a tightening of US monetary policy relative to that of other economies, tighter US financial conditions more broadly or a spike in global risk aversion. Such shocks can lead to a stronger US dollar, less risk-taking in global markets and a contraction in cross-border capital flows. To unhedged non-US borrowers, this presents an unfavourable realisation of refinancing, currency and interest rate risks *all at once*. On the other hand, shocks leading to an abrupt weakening of the US dollar can cause losses for unhedged non-US investors in US dollar assets, possibly prompting disorderly asset sales.

A third significant concern is the limited amount of information, and hence understanding, about the vulnerabilities of market participants – especially non-banks –

to these risks. Not only is there little information about their vulnerability to currency risk (in particular, the degree to which their foreign currency funding is unhedged), there is often limited information about their vulnerabilities to liquidity, interest rate and solvency risks.<sup>30</sup>

The following sections elaborate on these concerns as they relate to various entities: banks, NBFIs and NFCs.

#### 4.1 Liquidity vulnerabilities associated with US dollar activities of global banks have generally declined

The primarily wholesale nature of US dollar funding to non-US banks is a structural vulnerability: such funding is likely to be short-term and fickle compared with retail deposits and may be prone to rollover risk during market stress. The vulnerability is more pronounced where such funding is used to hold illiquid assets. When funding stresses materialise, banks may be forced to sell illiquid US dollar assets, with possible knock-on effects on their own solvency, and on other holders of the same assets.

However, funding and liquidity vulnerabilities of global banks associated with US dollar funding have diminished in a number of ways since the GFC. The GFC demonstrated the extreme vulnerability of a business model which funded holdings of long-term US dollar assets with short-term sources of financing. Regulation has also played a role in strengthening resilience. Basel III reforms put a much greater emphasis on management of funding and liquidity risks. The reforms require funding and liquidity risks to be managed at the level of individual currencies, but do not impose quantitative regulatory requirements, such as the minimum Liquidity Coverage Ratio (LCR) and minimum Net Stable Funding Ratio (NSFR), at the currency level. Nevertheless, banks appear to have adjusted their practices. Estimates by the IMF suggest that banks have increased their resilience to US dollar liquidity shocks after the GFC, mainly by increasing holdings of high-quality US dollar liquid assets (Graph 15, left-hand panel; see also IMF (2019)). This tendency is confirmed by national data (Graph 15, right-hand panel). Taken together, these findings suggest that while much progress has been made, prolonged market stress is still a potential concern in the case of substantial shocks to the global economy.

There have also been specific measures taken in jurisdictions with high US dollar funding activity. In the European Union, the European Systemic Risk Board (ESRB) now requires supervisory authorities to closely monitor vulnerabilities associated with US dollar funding and liquidity risks, and to take mitigating actions where necessary and ensure that banks and non-banks develop contingency funding plans for US dollar funding stress.<sup>31</sup> More recently, ECB Banking Supervision (Single Supervisory Mechanism) conducted a stress test to assess banks' ability to withstand hypothetical idiosyncratic liquidity shocks, particularly in significant foreign currencies such as the US dollar. The Bank of England covered similar liquidity risks in its biennial exploratory stress test in 2019. The Bank of Japan has encouraged banks to increase their funding from US dollar deposits with high "stickiness" (such as floating rate deposits, through

<sup>30</sup> For example, the extent to which foreign currency funding is unhedged is a measure of vulnerability to currency risk; liquidity coverage ratios and survival periods are a measure of vulnerability to liquidity risk; and debt service ratios are a measure of vulnerability to solvency risk.

<sup>31</sup> Recommendation of the European Systemic Risk Board of 22 December 2011 on US dollar denominated funding of credit institutions (ESRB/2011/2).

transaction banking) and to reduce their reliance on wholesale funding in preference of more stable funding (Bank of Japan (2019); see also Annex E for measures taken by the Bank of Canada).

The extent of funding vulnerabilities depends on the business model of individual firms. Non-US banks follow three types of models: funding diversification; investment in US dollar assets; and intermediation in US dollar markets. Data constraints make cross-country and cross-firm comparison difficult, but it appears that larger and more diversified banks tend to hold higher liquidity buffers than their smaller peers.

Banks that raise US dollars primarily to diversify their funding sources and take advantage of a funding premium may be less vulnerable than other banks – depending on the term of that funding (for example, see Annex F for such a strategy followed by Australian banks).

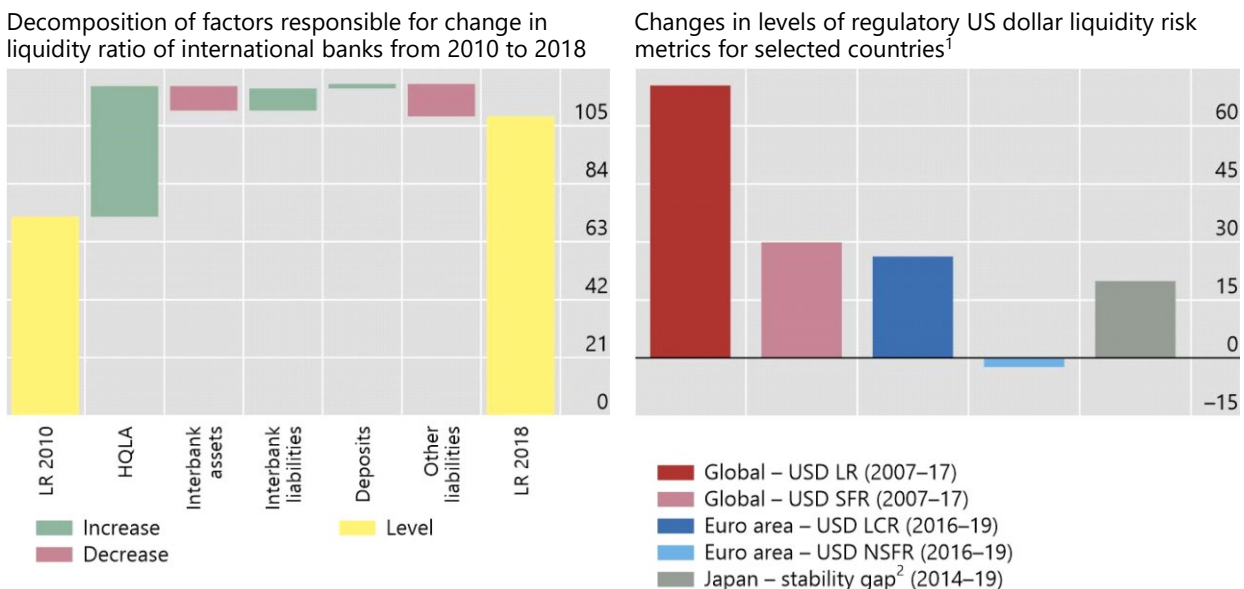
On the other hand, non-US banks which obtain short-term US dollar funding and invest in longer-term US dollar assets, such as loans and other illiquid securities, may be relatively more exposed to liquidity and maturity mismatches. In addition, banks which lend to unhedged non-financial corporations are taking on indirect foreign currency exposure.

Banks that intermediate activity in various US dollar markets (eg repo) tend to avoid large-scale liquidity mismatches, as demonstrated by relatively high LCRs reported by French banks. However, unexpected changes in behaviour during US dollar market stress could still propagate US dollar funding stress through the system (see Section 4.3 for a discussion).

## Short-term US dollar liquidity risks in the banking sector

In per cent

Graph 15



HQLA = High quality liquid assets; LCR = Liquidity coverage ratio; LR = Liquidity ratio; NSFR = Net stable funding ratio; SFR = Stable funding ratio.

<sup>1</sup> Periods selected to show the improvement to date from the lowest level of metric recorded in the available data. The positive figure for the Bank of Japan stability gap denotes a narrowing of the gap, ie improvement of the liquidity risk metric. <sup>2</sup> Defined as the gap between the amount of illiquid loans and stable funding through client-related deposits, medium- to long-term FX and currency swaps, and corporate bonds including total loss-absorbing capacity (TLAC) bonds. Covers internationally active banks.

Sources: ECB; Bank of Japan; IMF, *Global Financial Stability Report*; CGFS Working Group calculations.

US banks could also be affected from US dollar funding strains that impact non-US entities. One such risk (noted above for non-US banks) arises indirectly, through credit exposure to borrowers with unhedged US dollar exchange rate risk. Given its current risk characteristics and scale, US dollar lending to non-US residents appears not to pose significant risks to US banks through this channel, even in the event of a fairly severe exchange rate shock (Annex I).

Data gaps do not allow, however, for benchmarking across countries, or for a comprehensive assessment of vulnerabilities over time. The national implementation of the LCR and NSFR ratios is not harmonised worldwide, restricting comparability of the data across jurisdictions. These ratios may mask vulnerabilities over a different (shorter or longer) horizon than the 30 days prescribed by the LCR rule. Survival periods test for the time horizon over which a bank runs out of liquidity and provide a more detailed picture; however, these measures are only reported in some jurisdictions. Disclosure standards do not require banks to report any of these measures at the level of individual currencies, and most banks do not do so.

#### 4.2 There are some vulnerabilities associated with NBFIs, but systemic implications are hard to evaluate due to data limitations

The growth of market-based finance and the increased role of NBFIs means these institutions now have a larger footprint in US dollar funding markets than pre-GFC (Section 3). The rise of international bond financing and institutional asset managers has meant that the predominant forms of market-based finance are simpler, more transparent and backed by less leverage than those that prevailed prior to the GFC (Adrian (2017), FSB (2017)). Nevertheless, whilst potential vulnerabilities exist for certain types of NBFIs, assessing the systemic implications of these vulnerabilities is hindered by data limitations.

Potential vulnerabilities arise for some non-US NBFIs from their investment in long-maturity foreign currency assets, largely denominated in US dollar (Section 3). If not backed by US dollar liabilities or hedged using derivatives, NBFIs face FX risk. Where hedges are in place, these are often via short-term FX swaps that may be a source of rollover, counterparty and market risk.

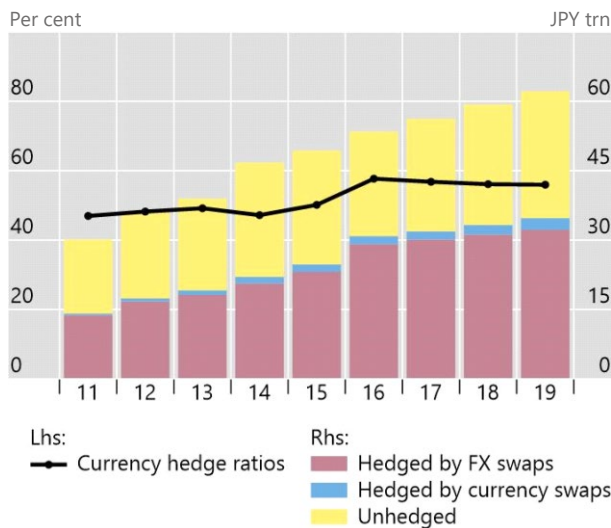
If an NBFI is unable or unwilling to roll over its short-term FX swaps, it may require US dollar funding from other sources such as US dollar repo or the unsecured money market. Such alternative funding sources will entail different levels of currency mismatch between the NBFI's assets and liabilities. The NBFI may need to sell any US dollar assets if it is unable to fund in US dollars, to hedge the currency risk in a short time or to operate with lower hedge ratios. The impairment of sources of US dollar funding on a systemic scale could lead to fire sales, as some NBFIs may lack the infrastructure, experience or client franchise to sell large amounts with little disruption.

There are several examples of NBFIs facing these potential vulnerabilities:

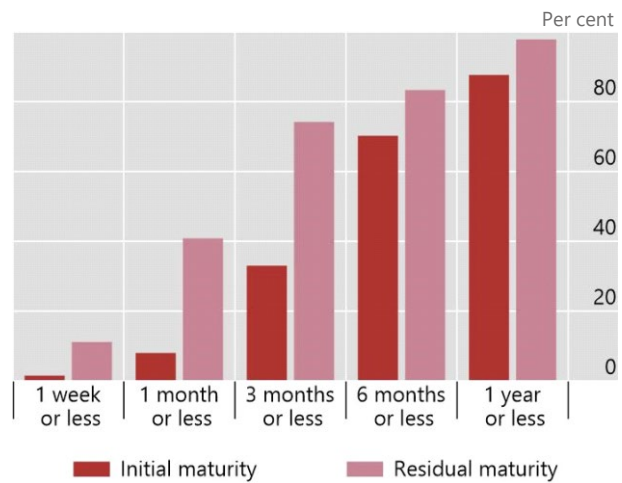
- Non-US insurance companies and pension funds have invested heavily in US dollar assets, largely as a result of low interest rates domestically. Notable examples are firms from Japan, Korea and Chinese Taipei, where US dollar assets have grown significantly since the GFC (IMF (2019), CGFS (2018), Ammer et al (2019)). Japanese life insurers hedge an increasing portion of their foreign securities investments, although the unhedged portion is still about 40% (Graph 16, left-hand panel, black line).



Currency hedge ratios for foreign securities investments among Japanese life insurers<sup>1</sup>



Maturity profile of US dollar FX forwards for sample of Asian insurers and pension funds<sup>2</sup>



<sup>1</sup> Covers nine major life insurance companies. Estimated based on general account. Data refer to Japanese fiscal year-end, for all years except 2019 when they are for end-September 2019. <sup>2</sup> Gross notional, cumulative outstanding positions at 9 July 2019 for a sample of insurance companies and pension funds in Chinese Taipei, Japan and Korea.

Sources: Bank of Japan; DTCC; Regis and UnaVista trade repositories; CGFS Working Group calculations.

- For Japanese insurance companies, investments in foreign securities amount to around a quarter (~\$800 billion) of their total assets. These are mostly US Treasuries, but Japanese insurance companies are also increasingly buying US corporate bonds and agency mortgage-backed securities (Annex C). These longer-maturity assets are often hedged through FX swaps and forwards, which tend to have a relatively short maturity. Indeed, for a sample of Asian insurers and pension funds, around three quarters of FX forwards (by notional) have a residual maturity of less than three months (Graph 16, right-hand panel).
- Insurance companies in Chinese Taipei invest just under two thirds (~\$540 billion) of their assets in foreign currency (mainly US dollar) investments (Morgan Stanley (2020)). Around half of this is estimated to be hedged with FX derivatives (non-deliverable forwards and currency swaps).
- Korean institutional investors' holdings of foreign bonds increased from \$25 billion in 2013 to \$200 billion in 2017. These are mostly long-term assets. Since unhedged foreign currency positions are subject to high capital requirements, almost all foreign investment positions are hedged. However, the maturity of the hedges is typically much shorter than that of the investment. Korean authorities have recognised the risks related to these positions, and the maturity of hedges has shortened in recent years following changes in regulations for Korean insurance companies (Bank of Korea (2018)).

Investment funds with funding sources other than US dollars will generally hedge their US dollar asset holdings with short-term FX swaps. If those swaps cannot be rolled over, or it becomes expensive to do so, fund investors could face significant losses. A decline in the return of investment funds may lead to redemptions by fund investors. This is especially the case for funds investing in less liquid assets, such as AE corporate bonds and EME bonds (Bank of England (2019)). In turn, large

redemptions would force fire sales of the underlying assets by fund managers, driving down asset valuations and triggering a vicious circle.

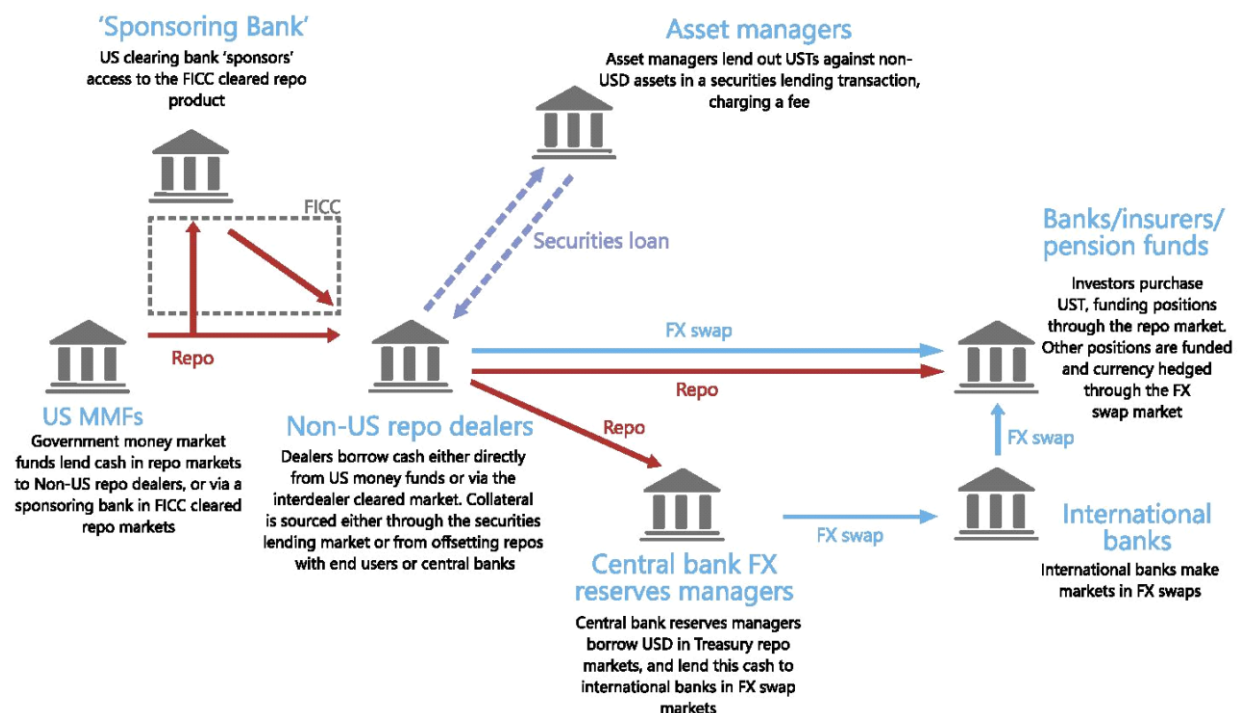
Data on NBFIs' role in US dollar funding markets vary in availability, quality and consistency. For example, US MMFs publicly disclose a snapshot of their portfolios at each month-end. However, many other types of NBFIs are more opaque, particularly with respect to any potential currency mismatches and the specific funding tools used. The importance of some OFCs for non-bank US dollar funding poses additional data challenges. Such data limitations hinder the ability to assess whether vulnerabilities discussed in this section give rise to major systemic concerns.

### 4.3 Cross-jurisdiction and cross-sector linkages leave US dollar funding markets vulnerable to intermediation blockages

Borrowers and lenders of US dollars usually rely on intermediaries. A characteristic of international US dollar funding markets is that they may involve several layers of intermediation that give rise to long and complex funding chains and result in significant interconnectedness for the financial system, more than in most domestic markets. Graph 17 provides illustrative examples where US MMFs act as ultimate lenders; non-US entities are the ultimate users of dollars; and non-US repo dealers, the FICC, central bank FX reserves managers and international banks act as intermediaries. These funding chains cut across jurisdictions and sectors, and add complexity. In addition, it is often the case that whole chains and their interconnections are not visible.

An example of a US dollar funding chain

Graph 17





There are many other examples of funding chains, including as follows:

- Non-US banks issue short-term commercial paper in the United States to lend the funds on in an FX swap or cross-currency swap to other non-US banks, which in turn buy US dollar credit assets. Similarly to events that unfolded in the GFC, disruption of the commercial paper market could unwind this chain and make it difficult for the non-US banks to refinance the positions in the commercial paper market. This may lead to a reduction in supply of US dollars in the FX swap market and make hedging more expensive (or, in the extreme, unavailable), leading to forced sales of the US dollar assets (see Section 6 for a discussion of CP markets during the Covid-19 outbreak).
- NFCs hold surplus cash balances with US MMFs, which lend it in a short-term repo to primary dealers, who in turn fund an inventory of US Treasuries. As demonstrated at quarter-ends and in September 2019, US repo rates may spike and spill over to short-dated FX swaps (Aldasoro et al (2019b)). A similar chain of events may prompt a concurrent spike in the cost of US dollar funding for non-US players.
- EME banks originate US dollar loans to companies in their jurisdictions, obtaining funding in the FX swap market. The suppliers of this funding are major international banks that borrow dollars via non-US repo dealers, which obtain them from US MMFs in the repo market.

Funding chains illustrate how changes in the behaviour of intermediaries can propagate through the system. Even when running so-called “matched books” (ie perfectly hedging exposures), intermediaries can perform vital functions that help the flow of US dollar funding, stepping in between entities with different preferences for maturity, credit and liquidity risks. The resulting maturity, credit and liquidity mismatches can make intermediaries vulnerable to shocks. But even when individual institutions or sectors are resilient, they can affect the US dollar funding markets through changes in their behaviour, either induced by business decisions or frictions arising from regulatory requirements.

The flow of US dollars around the global financial system is subject to significant frictions. For instance, some non-US banks significantly reduce their matched book repo activity at quarter-ends in an effort to window-dress their balance sheets ahead of regulatory reporting dates. The practice is linked to the implementation of Basel III regulations – the leverage ratio in particular (CGFS (2017)). Even though this is a well known pattern, and intermediaries often communicate in advance such reductions in activity to their counterparties, it can still have a knock-on effect on other US dollar funding markets. For example, in the past, quarter-end repo market contractions have spilled over into FX swap markets (Aldasoro et al (2019b)). Even so, such concurrent price actions can also indicate that one market is acting as a safety valve for another, by providing some of the funding that was unavailable or too expensive in the other market (for instance, the FX swap market can provide some of the funding that is either unavailable or too expensive in the repo market).

Frictions and the risk of disruption in US dollar funding markets are aggravated by market segmentation. Some institutions can only access US dollar funding through particular instruments or counterparties and have limited alternative options. Internal liquidity and capital management policies can also play a role. There may be an aversion to going below agreed liquidity targets, which can make individual participants more resilient but impair the redistribution of liquidity in the system. Internal processes may make banks less nimble to reallocate resources when

dislocations occur (eg borrowing unsecured or in FX swap markets to lend into repo markets when rates in repo markets spike).

NBFIs in particular are often less able to access funding through the full range of different instruments compared with banks, either because of regulation or mandate restrictions or for other reasons (eg accounting or taxation factors). For example, Japanese insurance companies have bought longer-dated US bonds funded through the FX spot market and via short-dated FX swaps. This means that Japanese insurance companies can be sensitive to any increases in funding rates implied by FX swaps. When these rates spike, this type of US dollar investor could have limited appetite to access other funding tools as substitutes. For instance, while repo markets might provide funding, they could be less attractive from an accounting and risk perspective. In addition, Japanese insurance companies can hold US dollar assets without hedging (eg by purchasing US dollars outright in the FX spot market), leaving them open to US dollar depreciation risk.

A small group of global banks is at the core of the global US dollar funding network. In order to provide US dollar funding to a variety of non-US users, these banks require large balance sheet capacity, notably in terms of a leverage ratio above minimum requirements and sufficient liquidity buffers. They also need a global presence and broad expertise in providing complex financial products to service customers with different needs efficiently. As a result, substitution of key intermediaries may be particularly difficult.

The cross-sector, cross-jurisdiction nature of US dollar funding markets makes it hard to map the interconnected system of intermediation chains. The complexity of interactions between participants has increased as the less transparent players – in particular NBFIs – have taken on a more prominent role, notably including some intermediation functions. Often interconnections are only apparent when stresses in one part of the system spill over to another. Combined data from multiple jurisdictions are needed to fully assess the potential systemic risk from dollar funding. Such data may include the US dollar assets, liabilities and off-balance sheet positions of individual sectors, broken down by residual maturity and counterparty type.

#### 4.4 Some non-financial firms have taken on currency risk

Historically, currency exposure has frequently contributed to adverse dynamics in financial crises, and the increased US dollar debt financing documented in the previous section has increased the potential exposure of some non-US borrowers (eg Kaminsky and Reinhart (1999), CGFS (2007); also see Annex G for a discussion of borrowers from China). EMEs such as Argentina, Chile, Mexico and Turkey continue to borrow in US dollars on a large scale (Graph 18, left-hand panel). After a shift towards more local currency financing in the early 2000s, US dollar borrowing by EMEs outside China and India has rebounded during the past decade, as a share of domestic GDP (right-hand panel). To be sure, revaluation of outstanding debt as the US dollar appreciated could account for some of the increase.

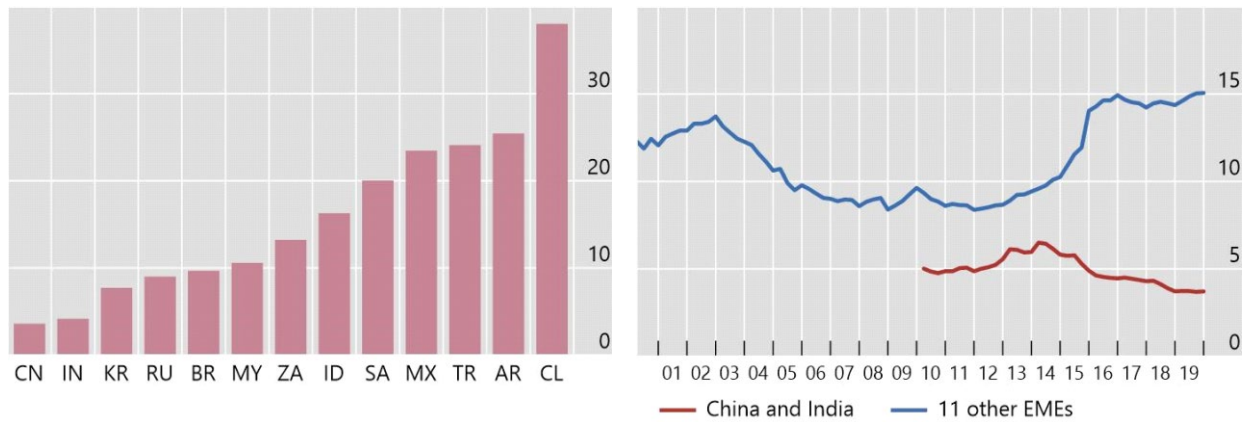
Currency exposure increases vulnerability to insolvency risk, particularly in certain EMEs, where the non-financial sector is also highly leveraged and firms are exposed to interest rate risk and refinancing risk. The vulnerability of EME corporations to refinancing risk has been reduced somewhat by long-term bond financing, but it remains a material concern in several more-leveraged sectors such as real estate

## Outstanding US dollar borrowing by the non-bank sector: selected EMEs<sup>1</sup>

As a percentage of GDP

Graph 18

As of 31 December 2019



AR = Argentina; BR = Brazil; CL = Chile; CN = China; IN = India; ID = Indonesia; KR = Korea; MY = Malaysia; MX = Mexico; RU = Russia; SA = Saudi Arabia; TR = Turkey; ZA = South Africa.

<sup>1</sup> Includes non-financial business, households, government, and non-bank financial firms.

Sources: IMF, *World Economic Outlook*; BIS Global Liquidity Indicators.

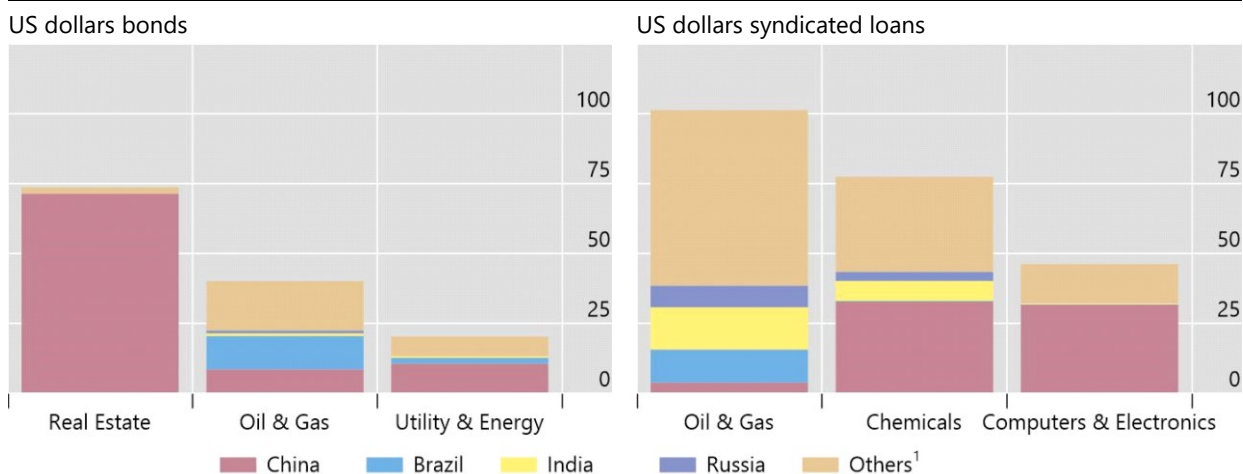
(especially Chinese developers), energy, and utilities that have large amounts of debt maturing by 2021 (Graph 19 and Annex G). Furthermore, it appears to be more pronounced in some EMEs, where NFCs have direct exposure to US interest rates, with US dollar floating rate and short-term (under two years) debt as high as 5–10% of GDP.

Currency risk from US dollar NFC debt financing can be hedged or offset through derivatives, US dollar-denominated assets or US dollar-denominated income. Exposure to currency risk can be difficult to determine ex ante, but can be inferred ex post from firms' quarterly financial accounts. An analysis of the FX

## EME debt outstanding in April 2020 and maturing by 2021

In billions of US dollars

Graph 19



<sup>1</sup> Other EMEs, excl Hong Kong SAR and Singapore.

Sources: Hong Kong Monetary Authority; Dealogic; CGFS Working Group calculations.

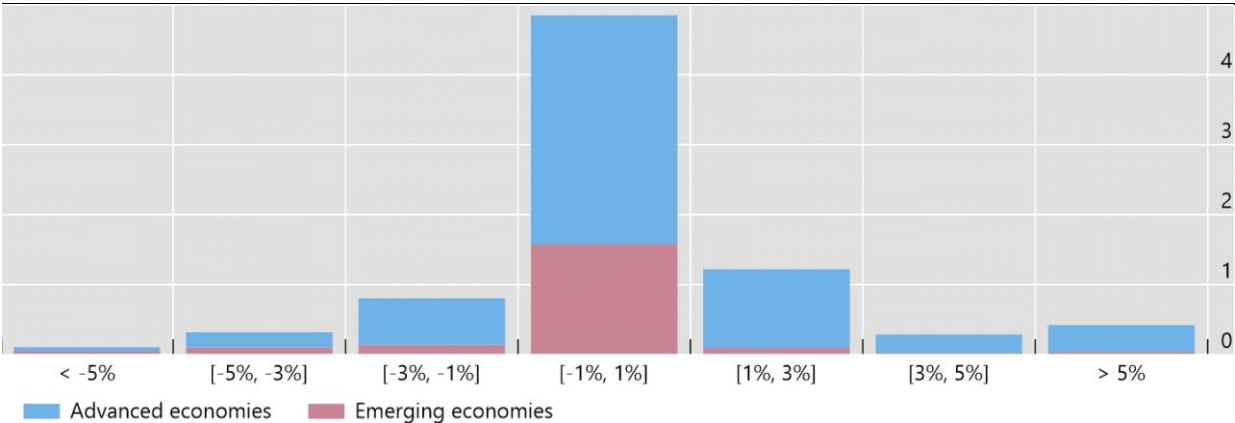
valuation losses of firms during a period of significant US dollar appreciation from 2014 to 2015 shows that there were a wide range of outcomes (Graph 20).<sup>32</sup> For most firms, the balance sheet loss from currency revaluation was fairly modest (less than 3% of assets), while some others (notably multinationals with US operations) experienced material gains. On the downside, there were more than 100 firms with a total of about \$100 billion in debt for which unhedged currency exposure erased more than 5% of net worth over this period. Keeping in mind the strong caveats associated with the specific exercise (limited to a single period and with incomplete sample coverage), these results provide some comfort that unhedged corporate currency exposure is likely to represent a manageable systemic risk in a similar US dollar appreciation as in 2014 to 2015.<sup>33</sup>

Data availability remains a significant obstacle to a fuller assessment of vulnerabilities related to NFC US dollar borrowing. A significant portion of bonds and syndicated loans provide US dollar credit to non-US firms that do not publish financial accounts (including substantial US dollar borrowers in OFCs), and published accounts often do not include detailed currency breakdowns or data on hedging. There is even less information about non-syndicated US dollar lending to closely held firms, and

Corporate debt by firms’ currency exposure during US dollar appreciation of 2014–15<sup>1</sup>

In trillions of US dollars

Graph 20



<sup>1</sup> Each bar shows the total debt of the set of firms for which the ratio of unrealised foreign gain (loss) to total assets ratio falls in the specific range. Observations refer to the period from Q3 2014 to Q1 2015. Firms that reported zero unrealised foreign currency gains in all three fiscal quarters have been omitted.

Sources: Federal Reserve; Refinitiv; CGFS Working Group calculations.

<sup>32</sup> Based on the impact on the net worth of 22,459 non-US firms from US dollar appreciation between 30 June 2014 and 31 March 2015, which averaged 14% across the sample firms’ home currencies. The sample firms had total debt (in all currencies) of \$12.5 trillion at the (mid-2014) beginning of the sample period; for comparison, BIS figures showed non-US NFC debt of about \$50 trillion.

<sup>33</sup> The currencies of some Asian EMEs (including China, Chinese Taipei, India and Thailand) depreciated significantly less against the US dollar during this period, limiting the scope for large currency-related losses for firms in those countries. And a few countries with large depreciations, such as Australia and Russia, are lightly represented in the cross section because many of their firms do not report sufficiently detailed financial accounts on a quarterly basis.

only limited information on US dollar borrowers in many OFCs. There are cases where analysis of regulatory data can supplement publicly reported information about NFC currency exposure, but such cases appear to be the exception rather than the rule.<sup>34</sup>

#### 4.5 The global use of US dollar funding may amplify US specific and risk aversion shocks

The dominant international role of the US dollar and the widespread use of US funding by non-US entities have at least two consequences. First, when entities are borrowing in US dollars, changes in US interest rates – resulting, for instance, from changes in the outlook for US and global economic growth and global risk aversion – can have important effects on their exposures, in particular if they are unhedged.

Second, financial globalisation paired with the dominant role of the US dollar may have led to a more synchronised behaviour of actors in the global financial system, at least in part because many international investors and borrowers are exposed to the US dollar. Greater similarity across portfolios may lead to greater similarity in response to shocks to risk aversion or changes in US interest rates, which can lead to larger reactions overall.

Separately, changes in US interest rates and therefore in interest rate differentials between the United States and other major AEs lead to shifts in global investors' asset allocations. Interest rate differentials have encouraged international investment into higher-yielding US dollar debt, which could help some institutions achieve hurdle rates of return.<sup>35</sup> The expected persistence of the low interest rate environment in many countries and regions may strengthen the search for yield, possibly increasing the demand for US dollar assets further. Such inflows could support more issuance in the United States of lower-rated investment grade securities.

Because global investors hold similar portfolios, specific scenarios entail risks. An idiosyncratic stress in US dollar funding intermediaries could reduce the availability of US dollar funding. That lack of funding could force non-US investors to sell US dollar assets in a short period of time. Similarly, credit downgrades in the US corporate debt market could trigger non-linear behaviours of investors, raising the risk of forced selling for business or regulatory reasons (Ellul et al (2011)). Such fire sales could spread through different sectors and constituencies, as explained in Section 4.3.

Typically, an increase in global investor risk aversion is associated with a stronger US dollar, less risk-taking, a contraction in cross-border capital flows and a surge in the demand for US Treasuries (Bruno and Shin (2015a,b), Cetorelli and Goldberg (2011), Giannetti and Laeven (2012)).<sup>36</sup> Thus, adverse developments that lead to a pullback

<sup>34</sup> India Ministry of Finance (2015) reports that more than 70% of foreign currency borrowing in India was by firms with mostly domestic revenue streams. Using loan-level US bank regulatory data, Niepmann and Schmidt-Eisenlohr (2020) find that home currency depreciation leads to a modest deterioration in loan performance for US dollar borrowers.

<sup>35</sup> See Ammer et al (2018, 2019) for empirical evidence on the search for yield in US securities by non-US investors and the role of low interest rates in their home economies.

<sup>36</sup> This joint behaviour of capital flows and asset prices has been termed "the global financial cycle" in recent academic work. See Rey (2015) and Avdjiev et al (2019) for a direct link to the US dollar, and Habib and Venditti (2019) for an in-depth analysis of the global capital flow cycle.

from risk-taking by global investors can pose significant challenges to both US and non-US borrowers.<sup>37</sup> Those EME corporate and sovereign borrowers in US dollars without robust natural or financial hedges are likely to be particularly affected. In the event of such shocks, these borrowers would face a simultaneous increase in the value of US dollar liabilities in domestic currency terms (exchange rate risk), an increase in the cost of US dollar funding (interest rate risk) and a retrenchment in the US dollar supply (refinancing risk) while also facing a weakening of global economic activity. In this context, any countercyclical responses in US policy rates are unlikely to fully offset the contractionary effects on either international credit conditions or on global activity (Fischer (2014)). As several studies have shown, the extensive use of US dollar funding, especially without FX hedging by the final borrower, may contribute to the emergence of banking crises in recipient countries, particularly EMEs with greater trade and financial exposure to the United States (Durdu et al (2019); see also Annex H).

Finally, an increase in the risk aversion of global investors can also lead to larger CIP deviations (Section 6; see also Avdjiev et al (2020)).<sup>38</sup> The *basis*, ie the difference in funding cost in the same currency between two markets (cash versus synthetic), is a market price that equilibrates supply and demand.<sup>39</sup> Deviations from the CIP might arise because intermediaries may be holding onto their cash instead of using it for arbitrage. These deviations do not necessarily represent major systemic financial stability risk (Debelle (2017); see also Annex B). However, large deviations from CIP may signal inefficiencies in FX markets and distort incentives – for instance, possibly leading to greater unhedged US dollar exposure.

## 5. Policy options

This section sets out a number of policy options that could help to address some of the vulnerabilities outlined in this report. A key policy message is that authorities should seek to reduce the opacity of global US dollar funding markets (and major funding markets where applicable) – for example, through additional data collection or greater data-sharing and/or by improving disclosure. In addition, there are a number of regulatory and structural policy options that could reduce certain ex ante US dollar funding vulnerabilities. Finally, further thought might be given to steps that could further improve the safety nets in place and help dampen adverse effects when US dollar-related vulnerabilities crystallise.

### 5.1 Improve visibility

Improving authorities' visibility of global US dollar funding activity can improve their ability to assess vulnerabilities. It can also help authorities identify those areas where further actions might be most helpful.

<sup>37</sup> Niepmann and Schmidt-Eisenlohr (2019) show that the global financial cycle (or dollar cycle) also affects credit conditions for US corporate borrowers.

<sup>38</sup> According to Krishnamurthy and Lustig (2019), this relationship between risk aversion, the US dollar and the CIP becomes stronger after a significant financial crisis because global risk aversion increases, giving rise to a "US dollar cycle".

<sup>39</sup> As noted earlier, such spillovers can also be indicative of one market serving as a safety valve for another market, and can be beneficial for financial stability.

Data collections need to keep pace with changes in market structure. As discussed in this report, the availability of data, especially on banks' US dollar claims and liabilities, has generally improved over recent years. But substantial data gaps remain regarding the US dollar activities of non-banks and non-US borrowers. These data gaps are associated with a range of issues, including (i) data availability; (ii) data not being at the necessary level of disaggregation; (iii) difficulties sharing or publishing data; and (iv) lack of comparability of data across jurisdictions or sectors.

US dollar funding markets span many jurisdictions and sectors, and no single jurisdiction has the complete picture. Therefore comparable data need to be shared to highlight the links. Some data-sharing mechanisms already exist – for example, those developed by the Financial Stability Board (FSB) and data already collected by the BIS.

Across all sectors, visibility of activity in global US dollar funding markets could be improved by increased disclosure. This could also help reduce vulnerabilities through market discipline. For example, NBFIs and NFCs could disclose a currency breakdown of key assets and liabilities in their quarterly or annual reports.

However, changes in data collection and disclosure (eg scope, granularity or frequency) would need to be proportionate to the potential systemic importance of sectors and activities, and care would be needed to avoid overburdening smaller entities with onerous reporting requirements.

### Non-bank financial institutions

For some NBFIs sectors, there are extensive reporting requirements (eg US MMFs). For others, data are available in annual reports, some of which have been collated by central banks or other authorities. However, significant gaps remain regarding some NBFIs' roles in US dollar funding markets.

Data gaps in general for NBFIs have been a challenging issue, not only related to US dollar funding markets. Under the G20's Data Gaps Initiative, the FSB releases an annual Global Monitoring Report on Non-Bank Financial Intermediation (FSB (2020)). While the international community has made significant progress towards understanding risks in the non-bank financial system as a whole, there has been little focus on currency-specific risks. And, unlike for the banking sector, currency breakdowns of assets and liabilities are unavailable for much of the non-bank financial system.

Jurisdictions could therefore consider improving data collection on NBFIs' involvement in US dollar funding markets where these are likely to be material. The FSB could potentially play a role in catalysing this by considering including a statistically consistent currency dimension to its Global Monitoring Report on Non-Bank Financial Intermediation (at least initially on a voluntary, "best endeavours" basis).

A way to shed some light on which jurisdictions may have NBFIs with significant involvement in US dollar funding markets would be to use BIS data on banks' balance sheet linkages with non-bank counterparties (Garcia Luna and Hardy (2019)). However, this would not capture off-balance sheet liabilities, in particular FX swaps.

### Non-financial corporations

While some jurisdictions have partial data on the US dollar claims and liabilities of their non-financial corporate sectors, significant gaps remain. Moreover, even when



data are reported, it is not possible to tell how much of NFCs' US dollar exposure is unhedged. Another gap is NFCs' offshore US dollar deposits.

One longer-term option to address these gaps would be to improve disclosure standards – for example, via standards for traded debt securities or as part of requirements for listed companies. In the shorter term, occasional surveys by national statistical agencies can help. For instance, since 2001 the Australian Bureau of Statistics has regularly surveyed firms' foreign currency exposures and the extent to which they are hedged (RBA (2017)).

## Banks

Authorities already have, for the most part, comprehensive data on banks' activities in US dollar funding markets. The main gaps are around disclosure of such data to the public, comparability across some jurisdictions, especially on currency-level liquidity, and on visibility of interlinkages (eg how interconnected banks are both directly and indirectly via US dollar funding chains). This may be an issue that could be considered in more detail by a body such as the Basel Committee on Banking Supervision.

For some jurisdictions, existing data collections could be supplemented by additional exercises to obtain more detailed information. For example, the ECB performed a sensitivity analysis of individual banks' liquidity risk as part of its annual supervisory stress test for 2019 (ECB (2019)).<sup>40</sup>

Another potential gap is a comprehensive view into the importance of banks as intermediaries in particular markets – such as US dollar repo or FX swaps – in terms of either their market share or their centrality. This could be assessed using transaction or position data, where available (eg data on FX derivatives collected by trade repositories under the European Market Infrastructure Regulation).

## Stress tests and simulations

Improved data collection could be supplemented by including US dollar funding in liquidity stress tests, at least after markets and institutions have returned to a more stable state.<sup>41</sup> The extreme funding stress this year may provide lessons about the liquidity stresses that might be captured in future stress tests.

A few previous regulatory exercises have incorporated liquidity risks. For example, the Bank of England's 2019 biennial exploratory scenario examined the implications of a severe and broad-based liquidity stress affecting major UK banks simultaneously (Bank of England (2019)). This scenario included FX swaps becoming increasingly expensive and, ultimately, banks then losing access to the FX swap market for two weeks.

Where possible, stress-testing US dollar funding liquidity risk could also be expanded to a broader set of financial institutions to understand better how they might respond to a US dollar funding stress. This could be considered by jurisdictions where NBFIs are significant intermediaries in US dollar funding markets, or

<sup>40</sup> This found that, for euro area banks, "survival periods" (ie how long banks can last before running out of liquidity if funding cannot be rolled over) were generally shorter in US dollars than in euros.

<sup>41</sup> In countries where other foreign currencies are also a significant source of funding, those currencies might also be considered for inclusion in stress tests.

where they have significant exposures – for example, insurers and pension funds in some jurisdictions.

Financial regulators could consider extending the scope of stress testing of banks and other financial institutions under their regulatory oversight to cover their exposure to stress experienced by NFCs with elevated unhedged US dollar (or foreign currency more broadly) positions.

The cross-jurisdiction, cross-sector nature of US dollar funding markets means that the actions of one set of participants can affect other sectors and jurisdictions. Greater communication or cooperation on stress testing across some jurisdictions with banks or non-banks heavily involved in US dollar funding markets could help in this regard.

Interlinkages could be assessed using system-wide stress simulations, similar to the assessment of portfolio rebalancing behaviours by asset managers and institutional investors on liquidity in fixed income markets undertaken by the FSB Standing Committee on Assessment of Vulnerabilities (FSB (2017, 2018)). This could, for example, be a way of examining the impact of particular US dollar funding shocks across some banks and NBFIs for a range of jurisdictions in a coherent way.

### Global views of specific markets

Markets with short-maturity instruments such as repo and FX swaps are particularly important to understand for assessing vulnerabilities. But there is limited transparency of some aspects of these markets.

The BIS Triennial Central Bank Survey of Foreign Exchange and Over-the-counter Derivatives Markets (BIS (2019)) already provides a high-level picture of FX derivatives markets. However, it does not have information on the directionality of FX derivatives positions and it lacks a harmonised application of granular breakdowns by counterparty and maturity in key parts of the survey (turnover vs amounts outstanding). The BIS could consider whether the statistic can be made more useful without materially increasing overall reporting burden. Of greatest importance is information about the direction of FX derivatives positions and finer detail on maturity.

This type of information can also be obtained from transaction-level data. There has been significant progress in individual jurisdictions collecting such transaction-level data on derivatives – including FX swaps and forwards – following the G20 commitments to reform derivatives markets made in 2009 (FSB (2019)). Some jurisdictions therefore have good visibility of part of the FX swap market (as shown in Section 2). However, progress on aggregating such data across countries has stalled, hindering the ability to see a complete global picture. More progress in this regard would be very beneficial for better visibility of FX derivatives markets and potential vulnerabilities.

Some data are available on US dollar repo markets operating in the United States. But offshore US dollar repo activity is more opaque. One option to consider would be to develop a survey similar to the BIS FX and OTC derivatives survey for other important instruments such as US dollar repos, although a higher frequency than triennial would be more useful for risk assessment. In the European Union, the implementation of the Securities Financing Transactions Regulation will mean authorities will have better view of US dollar repos involving at least one EU counterparty.

## 5.2 Reduce vulnerabilities

Where authorities have reasonable visibility of US dollar funding markets, some steps could be taken to further reduce the accumulation of potential vulnerabilities. In some cases, reducing overall vulnerabilities related to currency mismatches would be an important general objective, as an exclusive focus on US dollar positions could see vulnerabilities shift into other currencies.

### Banks

Post-crisis regulation has improved the resilience of banks, including their exposure to risks associated with US dollar funding and their management of those risks. However, as noted earlier, the way some regulatory measures are calculated in some jurisdictions may result in incentives to reduce intermediation activity across asset classes. This can particularly affect short-term US dollar funding markets at selected times such as quarter-end and year-end, which could lead to temporarily heightened volatility in short-term US dollar funding markets. This finding strongly supports steps taken by the Basel Committee to address “window-dressing” by some banks, including and especially the Committee’s commitment to continue to carefully monitor window-dressing behaviour (Basel Committee (2019)).

Jurisdictions could consider policies that seek to reduce potential vulnerabilities arising from banks’ exposures to elevated US dollar debt financing and to NFC borrowers with elevated foreign currency exposure. For instance, they could consider macroprudential measures such as caps on banks’ lending to NFCs with elevated US dollar or other foreign currency mismatches.<sup>42</sup> These could be complemented with strategies to address potential leakages outside the initial scope of such macroprudential measures, such as through jurisdictional reciprocity agreements.

### Non-bank financial institutions

Jurisdictions could consider policies to reduce the vulnerabilities arising from some non-US NBFIs’ activities in US dollar funding markets:

- Regulators of NBFIs could provide guidance, such as on how NBFIs’ liquidity risk management should include a currency dimension. For example, in the United Kingdom the Prudential Regulatory Authority’s supervisory statement on liquidity risk management for insurers sets out clear expectations that UK insurers consider their foreign currency liquidity needs (Bank of England (2019c)).
- NBFIs could be encouraged to match the maturity of their hedges to that of their US dollar assets through more favourable treatment of liabilities that the maturity of claims (such as in the “matching adjustment” in European Solvency II insurance regulations).
- Unhedged or open US dollar positions could be discouraged for some NBFIs. Foreign currency exposures and the extent of hedging are an important part of many jurisdictions’ capital framework for insurers. For example, there are capital

<sup>42</sup> For example, the European Systemic Risk Board made a number of recommendations to financial regulators of member states in 2011 to reduce potential systemic risks arising from higher foreign currency lending to unhedged borrowers, with one of the recommendations specifically being the imposition of extra capital requirements if the regulators consider the risks related to foreign currency lending are not sufficiently addressed (ESRB (2011)).

requirements for unhedged foreign currency exposures in European Solvency II insurance regulations.

- The substitutability of funding sources (instruments and counterparties) for NBFIs could be assessed to ensure that, under stress, sources of funding – including US dollars and any other material foreign currency – are sufficiently diverse to ensure continued market access.

### Economy-wide

As well as reducing vulnerabilities at a sector-by-sector level, jurisdictions could consider their economy-wide US dollar funding risks and seek to address vulnerabilities through longer-term structural changes.

In the longer term, national authorities (especially in EMEs) could implement structural improvements to support the deepening of their domestic capital markets and encourage an expansion of the domestic institutional investor base to provide greater stability in funding, especially during times of stress in foreign markets. For example, EME national authorities and financial regulators could encourage the development of local hedging markets and instruments, which are still relatively small in most EMEs (CGFS (2019a)). Better access to and availability of hedging instruments could help to reduce the exposure of US dollar borrowers to US dollar appreciation.<sup>43</sup> And deeper domestic capital markets could encourage greater domestic currency issuance, reducing the undue use of US dollar funding markets.

## 5.3 Improve safety nets

Safety nets can help cushion the negative impact when vulnerabilities in US dollar funding markets crystallise: they can prevent a liquidity crisis from turning into a solvency crisis.

Before the GFC, a major source of protection against risks related to foreign currency exposure was countries' own foreign exchange reserves (a form of self-insurance). Whilst often motivated partly by, or a by-product of, foreign exchange stabilisation policies, holding adequate reserves improves the ability of central banks to foster financial stability by providing access to foreign exchange when a country's access to external credit markets is otherwise impaired. The IMF recognises the need for countries to hold adequate foreign exchange reserves (eg IMF (2016)) and assesses the reserve adequacy of IMF members in its annual Article IV reviews. Nevertheless, there may be costs associated with self-insurance, such as the opportunity cost of investing reserves in low-yielding safe assets.

During and since the GFC, a network of bilateral central bank swap lines has been established, covering a range of currencies (Denbee et al (2016)). Most relevant to US dollar funding markets are the US dollar liquidity swap lines agreed between the Federal Reserve and major foreign central banks. These were initially set up in response to US dollar funding shortages in the GFC (Annex A) and were seen as effective in reducing pressure in funding markets by providing an important signal and acting as a vital liquidity backstop. They were reintroduced in 2010 during the

<sup>43</sup> See eg the Local Currency and Capital Markets Development Initiative of the European Bank for Reconstruction and Development.

euro crisis and again proved effective in muting stresses in funding markets. There are standing (that is, permanent) bilateral liquidity swap lines between the Federal Reserve and five other central banks providing a prudent liquidity backstop (CGFS (2019b)).<sup>44</sup> A number of other central banks have also entered into bilateral or regional currency swap lines, for a variety of reasons.

Most recently bilateral swap lines have been used to ease US dollar funding pressures arising in the ongoing Covid-19 crisis. In coordination with the five central banks with standing swap line agreements, the Federal Reserve lowered the cost of its swap lines, added an 84-day swap to its existing seven-day swap agreements, and agreed to daily US dollar auctions. The Federal Reserve also established temporary swap line agreements with nine additional central banks.<sup>45</sup> Additionally, the Federal Reserve established a temporary repurchase agreement facility for foreign and international monetary authorities (FIMA). This FIMA Repo Facility allows central banks and other international monetary authorities with accounts at the Federal Reserve Bank of New York to enter into repurchase agreements with the Federal Reserve, exchanging their US Treasury securities held with the Federal Reserve for US dollars, which can then be made available to institutions in their jurisdictions.<sup>46</sup> These steps, as well as measures undertaken by the Federal Reserve to support money market and short-term funding more broadly, have had a noticeable effect on improving the conditions in dollar short-term funding markets.<sup>47</sup>

The Federal Reserve swap lines serve as an important liquidity backstop to ease strains in global dollar funding markets, and they help to prevent strains in these markets from hampering the supply of credit to households and businesses in the United States and abroad. However, the swap lines are best suited to address short-term strains in the functioning of dollar funding markets. They are not well suited to provide credit to distressed borrowers for long periods of time or for meeting balance of payments needs. For these reasons, they are not a substitute for the longer-term funding that might be available through an arrangement with the IMF or other international financial institutions.

The benefits and challenges of a potential global financial safety net have been the subject of debate for some time, but policymakers have not achieved international consensus on this issue. Advocates of a global safety net point to a role for the IMF to provide a liquidity backstop that can make access more timely and reduce the stigma associated with participation in existing IMF lending programmes.<sup>48</sup> However, as with any backstop provision of emergency credit, a number of issues would need to be addressed, including the sources and size of resources devoted to the endeavour, the modalities and governance of the liquidity instrument, and the means of ensuring continued pursuit of prudent policies and strong risk management. The

<sup>44</sup> The Bank of Canada, the Bank of Japan, the ECB, the Swiss National Bank and the Bank of England.

<sup>45</sup> The Reserve Bank of Australia, the Central Bank of Brazil, Danmarks Nationalbank, the Bank of Korea, the Bank of Mexico, the Reserve Bank of New Zealand, the Central Bank of Norway, the Monetary Authority of Singapore and Sveriges Riksbank. These are the same central banks with which the Federal Reserve had dollar liquidity swap lines during the GFC.

<sup>46</sup> Although the term of the agreement is overnight, it can be rolled over as needed.

<sup>47</sup> For instance, the Commercial Paper Funding Facility, the Primary Dealer Credit Facility and the Money Market Fund Liquidity Facility.

<sup>48</sup> One example of this is contained in the Report of the G20 Eminent Persons Group (EPG) on Global Financial Governance (2018).

discussions are ongoing and the aspects of the design of such a safety net are beyond the purview of this report.

Finally, to be effective, safety nets – in whatever form – need to be accompanied by a means of channelling US dollars to the institutions that require them (subject to eligibility). This is usually via access to central bank facilities. An earlier report (CGFS (2017)) highlighted that central banks need to give increasing consideration to the provision of liquidity assistance in a cross-border context. It also found that a number of central banks have formalised the conditions under which liquidity assistance may be provided to NBFIs or on a market-wide basis, typically taking into account their systemic importance and the desire to mitigate moral hazard and financial risks. The report emphasised that a robust regulatory and supervisory framework should first and foremost form the basis upon which liquidity assistance is considered.

## 6. International US dollar funding during the Covid-19 pandemic: an update

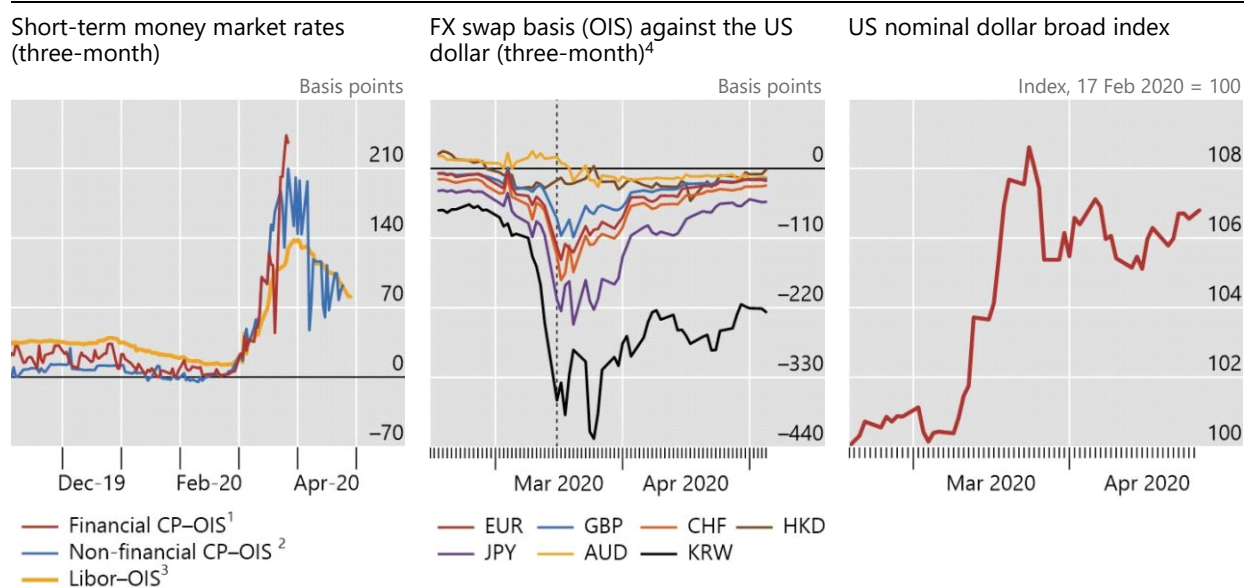
*The bulk of the work in the report was completed prior to the Covid-19 pandemic. This section summarises recent developments and relates them to the trends, vulnerabilities and policy implications identified in the report.*

The Covid-19 pandemic led to tighter funding conditions globally, including in US dollars. This was triggered by expectations of a severe global economic downturn, which rapidly gave rise to a global liquidity shock via increased risk aversion and liquidity hoarding on the part of borrowers, lenders and intermediaries around the globe. While funding conditions tightened in many currencies, the US dollar's dominant role in international funding activities meant that strains in US dollar markets were of particular importance.

In March 2020, US dollar money markets became severely strained, with funding more expensive or difficult to obtain for many borrowers. That was particularly evident in the US commercial paper market and US dollar Libor (Graph 21, left-hand panel). Stressed conditions were also seen in FX swap markets, with a sharp widening of the FX swap basis across a range of currencies, most prominently in parts of Asia (centre panel).<sup>49</sup> These developments were accompanied by strong demand for US

Price of US dollar funding during the Covid-19 pandemic

Graph 21



The vertical dashed line in the centre panel indicates 15 March 2020 (the announcement of the enhancement of swap lines between the Federal Reserve and five central banks).

<sup>1</sup> Difference between interest rates on US Commercial Paper (AA) Financial and overnight index swaps (OIS). Data are missing after 26 March due to an insufficient number of transactions. <sup>2</sup> Difference between interest rates paid by US Commercial Paper (AA) Non-financial and OIS. <sup>3</sup> Difference between US dollar Libor and OIS. <sup>4</sup> Defined as the spread between OIS and FX swap-implied US dollar rates.

Sources: Federal Reserve; Bloomberg; CGFS Working Group calculations.

<sup>49</sup> For further discussion of FX swap market stress during the Covid-19 crisis, see Avdjiev et al (2020) and Eren et al (2020).



dollars in spot markets, resulting in a sharp appreciation of the US dollar against many currencies (right-hand panel). These pressures then eased to a significant extent following a broad and extensive policy response.

## 6.1 Drivers of the funding stress

The tightening in global US dollar funding conditions reflected a widespread increase in the demand for liquidity coupled with a decline in the willingness or ability to supply or intermediate funding. This was accompanied by large shifts in the distribution of US dollar liquidity, placing pressure on particular activities and participants and leading to stresses spilling over to a range of related markets. While the key contours of the stress can be identified – relating to the activities of banks, NBFIs and NFCs – pinning down the precise drivers is hindered by the opaque, interconnected and cross-border nature of many activities (Section 5.1).

The prospect of a severe economic downturn drove a significant increase in demand for US dollar liquidity. Many businesses around the globe, anticipating sharp declines in their revenues, sought to borrow funds (including US dollars) to meet upcoming expenses such as paying suppliers or servicing debts. US dollars were in particularly high demand given the dollar's extensive international use in the invoicing of trade, short-term trade finance and long-term funding (Section 1). Faced with uncertainty about how large such needs would be, many firms, as a precaution, chose to draw on any source of US dollar funding they could obtain.

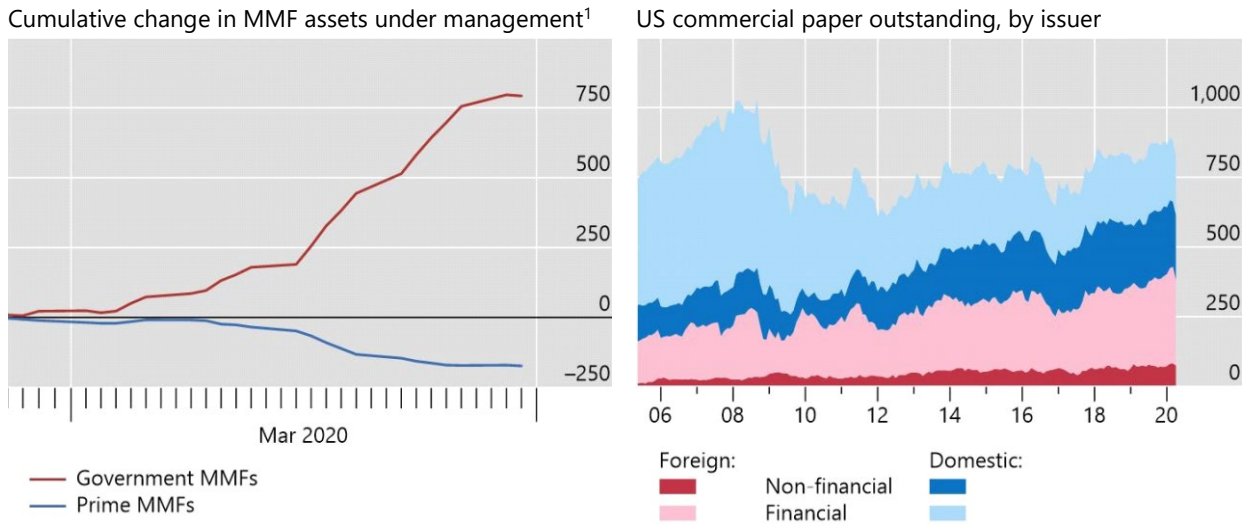
The activities of NBFIs also appear to have contributed to strong demand for US dollar liquidity. In recent years, non-US insurers and pension funds have funded large positions in US dollar assets by borrowing US dollars on a hedged basis (Section 3.5). The appreciation of the US dollar meant that these NBFIs in some jurisdictions were required to make margin payments, potentially adding to demand for US dollar funding. Demand from some NBFIs was relatively dependent on market conditions; indeed, these entities would be vulnerable to a prolonged difficulty in raising US dollars owing to their use of short-term hedges to cover long-term and sometimes illiquid US dollar assets, while at the same time having only limited recourse to other sources of US dollar funding (Section 4.4).

At the same time, US dollar funding became much more difficult to obtain in global capital markets as suppliers of funding shifted into cash and very liquid assets. This was seen, for example, in a sharp rise in inflows to US money market funds that invest in short-term Treasuries and repos secured by government-backed collateral (Graph 22, left-hand panel). As a result, US dollars that would previously have been available in various other markets (including to non-US entities via commercial paper (CP), certificates of deposit and FX swaps) became scarce. Prime money market funds were particularly affected. Though smaller than in the past, these funds remain important investors in short-term paper issued by banks and corporations (Sections 3.6 and 4.3). In the face of large outflows from their funds, and the prospect of more outflows, prime funds significantly scaled back the size and term of their lending. That retrenchment directly affected non-US banks and corporations, which account for a significant share of the commercial paper market in the United States (right-hand panel). Similarly, money market funds domiciled in Europe that invest US dollars also saw large outflows (including potentially from investors outside the euro area), and so scaled back their investments such as US dollar CP issued by European banks.

## Money market fund flows and commercial paper markets

In billions of US dollars

Graph 22



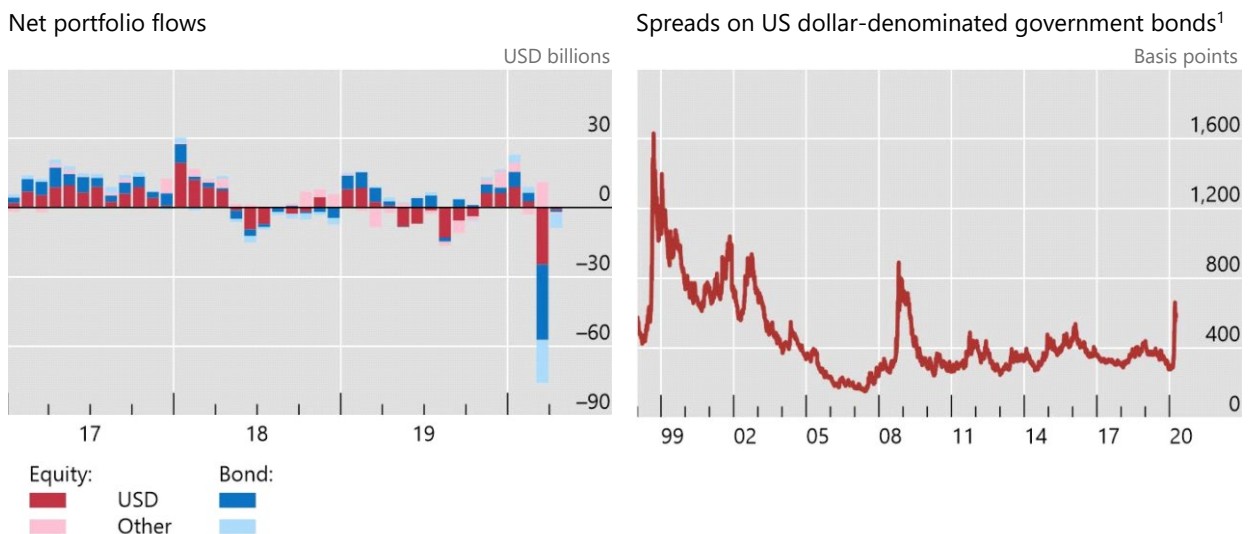
<sup>1</sup> Cumulative flow from 25 February 2020.

Sources: Federal Reserve; Crane Data; CGFS Working Group calculations.

These developments placed pressure on bank and dealer balance sheets, both in the United States and abroad. Corporations drew upon their precommitted credit lines with banks, including in US dollars. Dealers partly absorbed the sales through money market funds of US dollar assets. Doing so placed pressure on the balance sheets of these intermediaries at the same time that they faced increased risks, including the prospect of borrower defaults and declines in asset prices. Some dealers appeared to have responded by scaling back activities such as lending US dollars in

## US dollar funding pressures in emerging markets

Graph 23



<sup>1</sup> JPMorgan Emerging Market Bond Index (EMBI) Global index; government bond US dollar-denominated spread to US government bond yield.

Sources: EPFR; JPMorgan; CGFS Working Group calculations.

FX swap and capital markets, further impairing the functioning of those markets. Capacity for intermediation was also affected by the fact that increased demand for US dollars emerged shortly ahead of quarter-end, when some intermediaries' balance sheets tend to be relatively inflexible (Section 4.3). Even so, the balance sheets of these intermediaries were more resilient through this period of liquidity stress than in previous crises due to the substantial improvements in risk management over the past decade (Sections 3.2, 3.3 and 4.1).

Finally, EMEs that raise US dollar funding have faced particular strain. Over the past decade, corporations, banks and sovereigns in EMEs had issued large volumes of US dollar debt securities, partly owing to a shift away from bank-intermediated funding (Section 3.3). The pandemic has seen fund managers substantially shift their portfolios away from US dollar bonds issued by EME borrowers (Graph 23, left-hand panel). At the same time, many EME governments and corporations have an increased demand for funding (across currencies), owing to fiscal expansions and sharply lower revenues, including from commodity exports. Together, these pressures have contributed to a spike in US dollar bond yields for EME sovereigns and corporations (right-hand panel). For EME issuers that have borrowed US dollars without natural or financial hedges, the depreciation of local currencies against the US dollar has made repayment of these debts more costly (Section 4.4). Indeed, foreign official investors from emerging markets and oil exporting economies sold US Treasuries to support their currencies.

## 6.2 The policy response

Policymakers have responded decisively with a range of actions that have substantially eased strains in global US dollar funding markets. The Federal Reserve implemented an array of measures to alleviate the severe dislocations that arose in a number of US dollar financial markets. These actions have improved the ability of US and non-US entities to source US dollar funding in these markets, thereby helping to mitigate the effects of such strains on the supply of credit to households and businesses, both within the United States and abroad. That has included a lessening of strains in FX swap markets, seen for example in a narrowing in FX swap basis spreads and improved market depth.

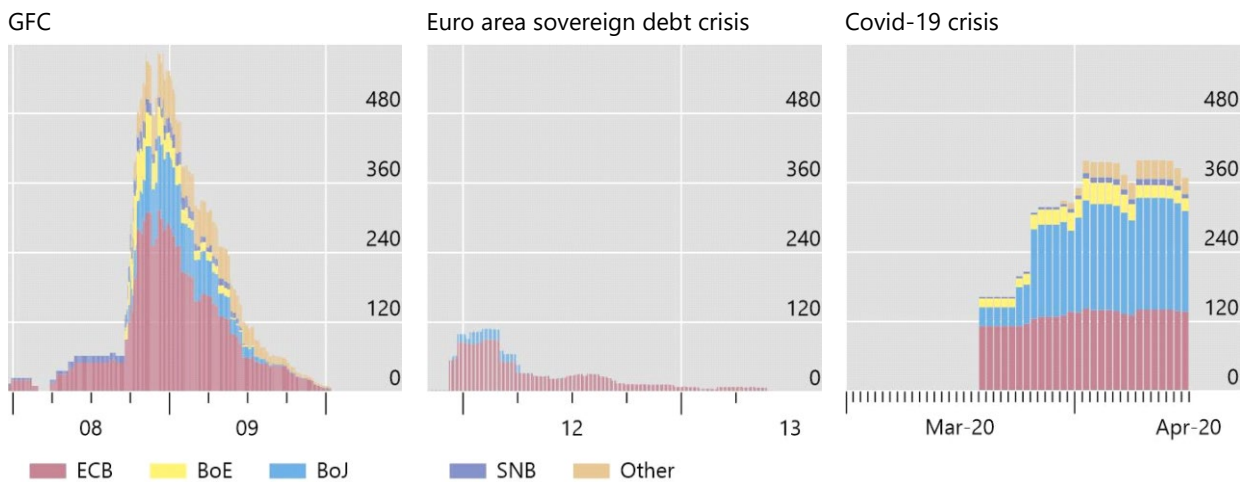
Of note for non-US entities:

- Paper issued by entities located within the United States that have non-US parents is eligible for the Federal Reserve's CP and money market programmes.
- The Federal Reserve, in coordination with 14 other central banks, bolstered the ability of these central banks to deliver US dollar funding in their jurisdictions. For the standing swap lines with five major central banks, the cost of liquidity was reduced, tenors lengthened and the frequency of seven-day maturity operations increased from weekly to daily. In addition, temporary US dollar swap lines were set up with the nine other central banks in advanced and emerging market economies that had been provided with swap lines during the 2008 financial crisis. The take-up of these swap lines has been significant. Within a month, usage had totalled a little over \$400 billion, compared with the peak reached during the 2008 crisis of nearly \$600 billion (Graph 24). Usage by European banks has been less than in 2008, while that by Japanese banks has been greater, potentially reflecting changes in business models during this time (Section 3.3).

## US dollar swap line drawings

In billions of US dollars

Graph 24



Source: National data.

- The Federal Reserve established a temporary facility for a wider range of foreign central banks to repo US Treasury securities that they hold in accounts at the Federal Reserve Bank of New York.

In addition, policymakers in some economies have eased prudential rules (such as requirements for banks to hold foreign currency liquidity) or collateral requirements, including on their US dollar repo facilities. These actions could help to free up bank and dealer balance sheet space to supply US dollar liquidity to non-banks.

Finally, various multilateral measures have been implemented which will assist EMEs. The IMF has bolstered its existing safety net by establishing a new Short-term Liquidity Line and temporarily doubled the access limits for its emergency funding facilities. G20 nations have agreed to a suspension of bilateral government debt service payments for the poorest countries. These measures are not specific to US dollars, and many of these economies face wider balance of payments problems.

### 6.3 Potential further vulnerabilities

These recent developments underscore the key findings of this report, including the ongoing policy challenges discussed in Section 5. Global US dollar funding activities are highly dispersed and interconnected, meaning that strains can easily transmit across different financial markets and across regions. Moreover, these linkages can be highly complex and opaque. Reforms since the financial crisis have been of benefit, with banks having become much more resilient to such liquidity strains than in prior episodes. However, where vulnerabilities appear to have been the greatest or where safety nets are the least developed (such as for some non-banks and EMEs), the recent strains have been acute.

There also remains a further risk of financial market stress, notwithstanding the actions of central banks, which could include US dollar funding. In some cases, market segmentation and intermediation frictions may prevent amply supplied US dollar liquidity from reaching those that need it. For example, some banks may not be willing

to lend US dollars to NBFIs or corporations that need them. Moreover, cross-border banks may face frictions on their ability to move US dollar liquidity to where it is needed via their international branch or subsidiary structures. Policymakers should be alive to such pockets of liquidity stresses arising, and attempt to improve transparency where feasible (as discussed in Section 5). The uncertain depth and severity of the economic repercussions of Covid-19 mean there is a risk both of further increases in demand for US dollar liquidity and further intermediation challenges.

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## Annex A Crystallisation of US dollar funding vulnerabilities during the GFC and the euro area sovereign debt crisis

In the run-up to the GFC, non-US banks' US dollar assets and liabilities increased significantly. Their US dollar-denominated balance sheets more than tripled from 2000. By the end of 2007, US dollars accounted for a significant share of some non-US banks' aggregate balance sheets (McGuire and von Peter (2009)).

In general, non-US banks borrowed US dollars to fund their US dollar assets so as to avoid a currency mismatch. Given the cost and challenges associated with building a retail deposit base, some non-US banks – particularly European banks – chose to meet their US dollar funding needs during the pre-GFC period by issuing US dollar-denominated wholesale debt. Most of the US dollar-denominated wholesale debt issued was in the form of short-term securities (ie commercial paper and certificates of deposit) and repurchase agreements. US MMFs were key investors in these instruments and non-US banks could access cheap funding directly from US MMFs.

This US dollar funding model proved to be fragile during the GFC. Global banks had to roll over increasingly large amounts of their funding at shorter maturities even though they had relatively long maturity assets. Hence, their maturity mismatch worsened considerably. Some European banks with low ratings lost access to US dollar funding and were forced to finance their US dollar assets by tapping the foreign exchange swap market, further propagating financial stress through this market (Baba and Packer (2009)).

Fragility of this US dollar funding model was laid bare once again during the euro area sovereign debt crisis. When vulnerabilities emerged in the European sovereign debt market in 2010, US MMFs, which were the usual counterparties of European banks, were concerned about the credit risk of European banks and decided to quickly rebalance their portfolios toward other counterparties or to lend, but only at very short maturities. As a result, US MMFs' exposure to Europe, as a share of total assets, fell from 55% in the second half of 2009 to about 33% in February 2012 (Ivashina et al (2015)). The MMF run on European banks also spilled over to non-European issuers in the same market (Chernenko and Sunderam (2014)).

Shortages in US dollar funding during both the GFC and the euro area sovereign debt crisis led to large changes in pricing in the FX swap market because the surge in demand for swaps was not matched by supply. The cost of swapping euros for US dollars – an indicator of stress in US dollar funding markets – peaked in October 2008, and it peaked again in late spring 2011, when the focus turned to sovereign debt problems in Europe.

US dollar funding shortages impacted inter-office positions and lending of non-US banks during the GFC and the euro area sovereign debt crisis, albeit somewhat differently. Non-US banks that were exposed to the collapse of funding markets during the GFC absorbed the shocks in part by transferring dollar funding internally from US branches to the parent. At the same time, US branches reduced their local lending (Cetorelli and Goldberg (2012)). Conversely, when US branches of non-US banks faced the run by US MMFs in 2011, these branches increased their borrowing from the parent to cope with evaporating US dollar funding (Aldasoro et al (2019b)). Tapping internal funding markets did not suffice, however, to prevent these branches from reducing their lending to NFCs (Correa et al (2016)).

Ivashina et al (2015) show that, in the year that followed the MMF run on European banks, US dollar lending by euro area banks fell relative to their euro lending.

In response to US dollar funding tensions, the Federal Reserve, in coordination with other central banks, implemented temporary central bank liquidity swaps in December 2007 (Baba and Packer (2009), Goldberg et al (2011)). These swap arrangements lessened strains in markets and significantly diminished the US dollar funding shortage, leading to a narrowing of the cross currency basis (Goldberg et al (2011), McGuire and von Peter (2012)). In May 2010, the central bank liquidity swaps were reintroduced in response to the resurgence of the stress in the short-term dollar funding markets. However, until December 2011, banks made little use of the swap arrangements compared with the 2008 crisis. Then, on 30 November 2011, to mitigate the risk that US dollar funding strains could affect the supply of credit in US dollars, the Federal Reserve and other central banks agreed to reduce the pricing on the dollar liquidity swaps. According to Bahaj and Reis (2019), the unexpected announcement in November 2011 lowered average CIP deviations and reduced foreign banks' funding costs. These swap lines were subsequently converted into standing facilities in order to provide a liquidity backstop in case of future global financial strains.



## Annex B What can we learn from covered interest parity deviations?

Foreign market participants may obtain US dollar funding by exchanging foreign currency for US dollars in the FX swap market, instead of borrowing US dollars directly in the *cash* market. The typical FX swap transaction involves purchasing US dollars with foreign currency and concurrently entering into an agreement to sell the US dollars at a predetermined exchange rate at a future date, when the FX swap matures. The difference in annualised costs between FX swap funding and *cash* is the FX swap basis. In a frictionless world, the FX swap basis should be close to zero (as implied by “covered interest rate parity”), but US dollar funding via the FX swap market has been more costly than cash since the GFC, implying sizeable deviations from covered interest parity. One may wonder whether the existing deviations from the covered interest parity signal the emergence of particular tensions in the US dollar funding markets and represent an independent source of risk. This annex argues that CIP deviations do not necessarily translate into vulnerabilities, since they simply provide a barometer of the relative supply and demand for funding in different currencies amid limits to arbitrage. However, large deviations and large fluctuations in the FX swap basis may indicate financial stability concerns.

Covered interest parity deviations first emerged during the GFC and later during the escalation of the euro area sovereign debt crisis in 2011 as financial institutions faced difficulties obtaining US dollar funding. This US dollar funding shortage emanated from a reduction in US MMFs’ lending to European banks that had to instead obtain funds offshore through FX swaps. Spikes in deviations from CIP during these periods signalled tensions in funding markets and created a potential source of risk, as non-US banks were forced to rapidly reduce their US dollar lending activities or increase their funding via the FX swap market (Annex A). However, deviations subsided quickly as central banks responded by establishing currency swap lines that provided dollar liquidity. These crisis period spikes in the FX swap basis spreads and the sharp increases in dollar scarcity that they reflected were short-lived due to effective central bank responses (Goldberg et al (2011), Bahaj and Reis (2019)).

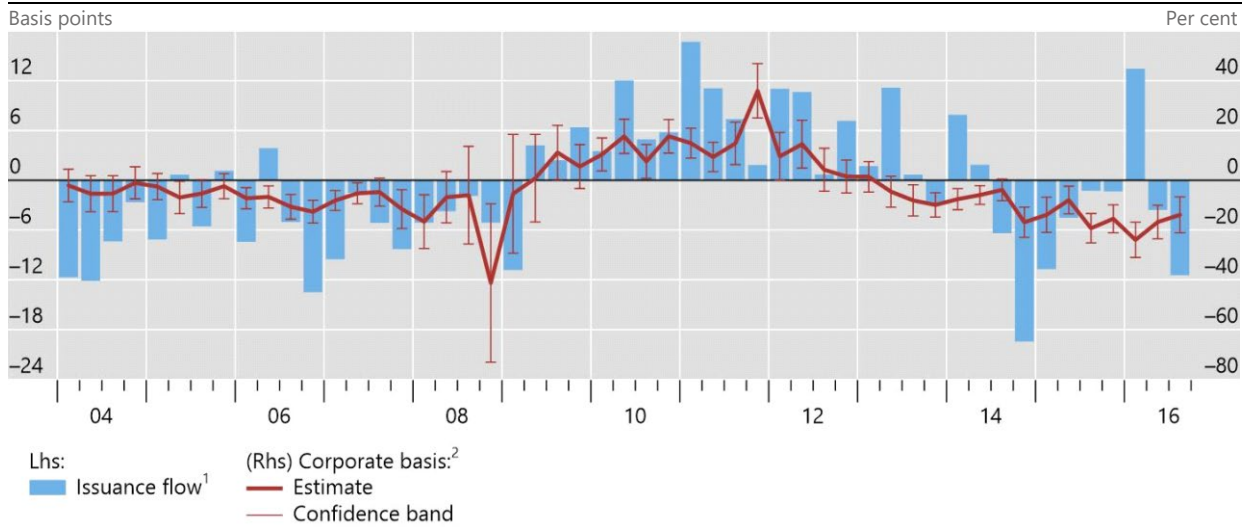
Since 2014, large and systematic CIP deviations have re-emerged. A combination of supply and demand factors may underlie persistent non-zero spreads in the FX swap basis.<sup>50</sup> Supply factors include regulatory requirements that were introduced after the GFC (Borio et al (2016)) and constraints on the ability of banks to expand their US dollar balance sheets (Du et al (2018)), leading to a rise in the intermediation spread. Others have attributed these deviations to demand factors, including monetary policy divergence among major currency areas, increased dollar safe asset demand and the presence of a “convenience yield” for holding US dollar assets, leading to an increasing need to hedge these assets by non-US investors (Jiang et al (2018)).

Against this backdrop of imbalance in global asset demand and limited liquidity supply by traditional financial intermediaries, large corporations and other global debt issuers – such as supnationals – have taken on the role of equilibrating

<sup>50</sup> See Cerutti et al (2019) for a review and an assessment.

## Corporate FX basis and debt issuance flow between the euro area and the United States

Graph B1



<sup>1</sup> Defined as the amount of US dollar debt issued by euro area firms minus the amount of euro debt issued by US firms scaled by the total amount of debt issuance each quarter. <sup>2</sup> The corporate basis estimate and confidence bands are obtained from Liao (2019). It is an estimated measure of FX-hedged borrowing costs between the euro and the dollar. A higher corporate basis means it is cheaper to borrow in US dollars, and vice versa. Source: Liao (2019).

FX-hedged borrowing cost differentials and arbitraging CIP deviations at longer maturities. Large developed market borrowers with access to the FX swap market have an incentive to issue debt in the cheaper funding currencies on a FX hedged basis (Liao (2019)).<sup>51</sup> These cross-currency debt borrowing behaviours have varied over time – non-US firms’ debt issuance in the US dollar dominated following the GFC but later reversed as the cost of FX-hedged borrowing became cheaper in other currencies (Graph B1). Hedging costs that arise from the FX basis also affect the behaviour of regulated entities in their cross-currency investment activities (Eguren-Martin et al (2018)). At the core of the friction, investors seem to have a strong home currency bias – with the exception of non-US investors’ holdings of US dollar securities issued by US residents – which may reflect institutional constraints that prevent efficient flow of investor capital across currency boundaries (Maggiore et al (2018)).

Are there financial stability risks associated with deviations from CIP? A non-zero FX basis is a market price that helps to equilibrate supply and demand, but the existence of deviations from CIP should not necessarily raise specific concerns per se (DeBelle (2017)). Nonetheless, the episodes of divergences in CIP are informative of spillovers and transmissions of shocks across global financial markets. Such market prices provide information about demand and supply of US dollar funds that otherwise would be difficult to measure. At the same time, large deviations from CIP may signal inefficiencies in the US dollar market (Section 6; see also Avdjiev et al (2020)). In particular, if the FX basis is too wide, it could make currency hedging too expensive and give an incentive to borrowers that have large US dollar liabilities and no natural hedge, to take unhedged currency exposures (DeBelle (2017)).

<sup>51</sup> Liao (2019) estimates based on a textual analysis of Securities and Exchange Commission filings that at least 40% of S&P 500 firms in 2016 engaged in currency-hedged foreign currency borrowing.

## Annex C Individual country experiences: Japan

Japanese banks' claims denominated in US dollars have grown since the GFC (Section 3). The prolonged low interest rate environment as well as structural factors such as the secular decline in loan demand associated with the shrinking population and the decline in the potential growth rate have encouraged Japanese banks, particularly major banks, to increase foreign lending and securities investment to support their profitability. Under these circumstances, Japanese banks' need for US dollar funding has increased.

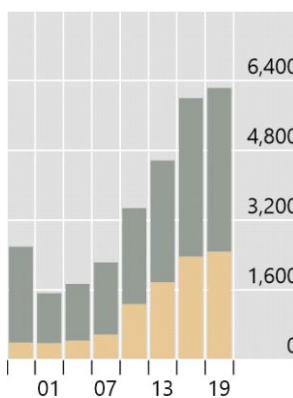
Over recent years, Japanese banks, which lack the funding base for retail deposits in the United States, have worked to secure more stable US dollar funding sources elsewhere. For example, they have increased client-related deposits, particularly floating rate deposits through transaction banking, and have issued more corporate bonds (Bank of Japan (2019)). Furthermore, they have shifted away from funding through FX swaps, maturities of which tend to be short, to cross-currency swaps with longer maturities to avoid on-balance sheet currency mismatches (Graph C1, first panel). These developments have outpaced the increase in lending and, as a result,

### US dollar activities of Japanese banks and other financial institutions

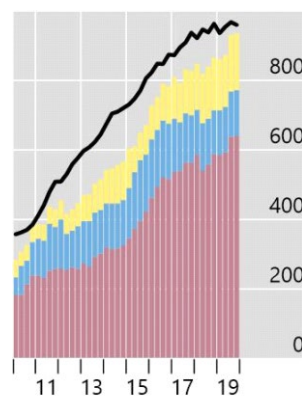
In billions of US dollars

Graph C1

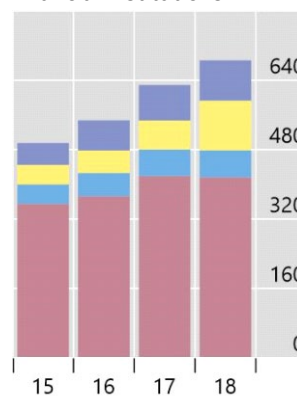
Nominal amounts outstanding of US dollar-denominated OTC contracts in Japan<sup>1</sup>



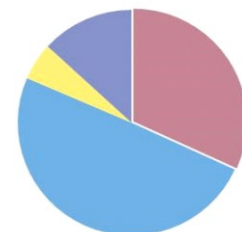
Stability gap among major banks<sup>2</sup>



Outstanding amount of overseas credit product investment among major Japanese banks and other financial institutions<sup>4,5</sup>



Life insurance companies' investments in foreign securities<sup>6</sup>



Legend for OTC contracts:

- Currency swaps
- Forwards and FX swaps

Legend for Stability gap:

- Client-related deposits
- Medium- to long-term FX and currency swaps<sup>3</sup>
- Corporate bonds<sup>3</sup>
- Loans

Legend for Overseas credit product investment:

- Investment grade corporate bonds
- High-yield bonds
- CLOs<sup>5</sup>
- Other overseas credit products

Legend for Life insurance companies' investments:

- Government bonds
- Corporate bonds
- Equities
- Others

<sup>1</sup> End of the year. <sup>2</sup> Defined as the gap between the amount of illiquid loans and stable funding through client-related deposits, medium- to long-term FX and currency swaps, and corporate bonds, including TLAC bonds. Covers internationally active banks. <sup>3</sup> Until end-March 2012, indicates funding maturing in more than three months; thereafter, funding maturing in more than one year. <sup>4</sup> Covers major Japanese banks, Japan Post Bank and a central organisation of financial cooperatives. Aggregated at Japanese fiscal year-end. <sup>5</sup> AAA-rated tranche accounts for 99% of collateralised loan obligation (CLO) tranches held by the above institutions. <sup>6</sup> End of March 2019.

Sources: Bank of Japan; The Life Insurance Association of Japan.

“the stability gap” of major banks has narrowed to the record low of 2.5% as of end-November (second panel).<sup>52</sup>

Regarding investments in overseas credit products, major Japanese banks have rapidly increased the outstanding amount of collateralised loan obligations (CLOs) in recent years (Graph C1, third panel). While their share of the total amount in the global CLO market is considerable, accounting for approximately 15%, more than 99% of their CLO holdings are AAA-rated tranches. Furthermore, about three quarters of their CLO investment is classified as held-to-maturity with a stable funding plan. Given these characteristics, it is likely that the risk entailed in the CLO investment of major Japanese banks is modest on the whole.

NBFIs such as life insurance companies have also increased investments in foreign securities due to the difficulty in securing sufficient rates of return amid declining Japanese long-term interest rates. In many cases, life insurance companies hedge their foreign bond investments through short-term FX swaps. This implies that life insurance companies – in obtaining US dollar funding – face FX swap rollover risk; however, they try to minimise this risk by investing in highly liquid assets such as government bonds and corporate bonds, most of which are investment grade (Graph C1, fourth panel).

<sup>52</sup> The stability gap indicates the ratios of the gaps between stable funding, including corporate bonds, medium to long term FX and currency swaps, and client related deposits, to the loans.

## Annex D Individual country experiences: France

A decade after the GFC, French banks remain significant intermediaries of US dollar transactions in global financial markets (Sections 2 and 3). But their importance has declined in absolute value and in relative terms. US dollar-denominated assets of French banks have declined, from more than \$1.5 trillion in July 2008 to \$1 trillion in July 2018. The share of US dollar assets in the French banking system balance sheet has increased, from 9% at the end of 2010 to 13.6% by mid-2018.

Following the lessons learnt after the GFC, French banks shifted toward shorter-term activities, in particular towards repo intermediation, replacing long-term loans. In the meantime, French banks have been affected by the 2016 US MMF reform, which has triggered a reduction in the maturity of their funding received from US MMFs. While this trend has been observed for European banks overall, it has been stronger for French banks. Following the euro area sovereign debt crisis, US branches of French banks became net receivers of US dollar funds from their headquarters, investing them mostly in their reserve accounts at the Federal Reserve (Aldasoro et al (2019b)). Consequently, the US dollar activities of French banks are now more short-term and easily scalable in the event of stress in US dollar funding markets.

The LCR of French banks in US dollars has been increasing steadily since the end of 2017, primarily reflecting an increase in US dollar high-quality liquid assets (HQLA) and a decline in the net outflows denominated in US dollars. According to the IMF, US dollar liquidity for French banks is above that of their overall balance sheet as measured by an all-currencies liquidity ratio. Although there is no requirement to reach a predefined NSFR target in US dollars, the US dollar stable funding ratio (a proxy of the NSFR) for French banks has improved since 2014 and is now in the highest part of the distribution of non-US jurisdictions according to the IMF (IMF (2019)). In addition, during the French Financial Sector Assessment Program,<sup>53</sup> the IMF found that, over a one-month horizon and based on stressed scenarios, the liquidity gap in US dollars was relatively small in terms of total assets for French banks and would be covered by the large amounts of US sovereign debt securities accumulated by French banks.

Some of the largest French banks have historically been active in US repo markets as intermediaries. On the liability side, they raise funding mainly via overnight repos from US MMFs; and on the asset side, they provide short-term financing, mainly via reverse repos to other counterparties such as banks, hedge funds and securities lenders. In particular, these French banks are intermediaries for other Asian or European institutions holding US Treasuries with US asset managers looking to invest in this type of collateral. They gain the term spread due to differences in borrowing/lending rates (see Aldasoro et al (2019b) for a discussion of French banks' repo intermediation).

In terms of risks, liquidity risk is limited since French banks have a matched repo book, as securities borrowed are matched by securities lent. As the majority of French banks' US repo books are US Treasuries representing HQLA Level 1, valuation and subsequent contingent liquidity risks due to volatility of collateral prices from such operations are limited. Regarding concentration risk, US MMFs have become the

<sup>53</sup> See <https://www.imf.org/en/Publications/CR/Issues/2019/10/28/France-Financial-Sector-Assessment-Program-Technical-Note-Risk-Analysis-of-Banking-and-48758>.

most important repo counterparties to French banks, but French banks employ internal metrics and limits in order to control MMF funding concentration.

In conclusion, the amount of US dollar funding has declined and the liquidity risk metrics of French banks have significantly improved over the past few years. Nevertheless, supervisory authorities continue to monitor the situation: for instance, large French banks took part in the 2019 supervisory stress test of the Single Supervisory Mechanism focusing on liquidity, which included consideration of significant foreign currencies such as the US dollar.

## Annex E Individual country experiences: Canada

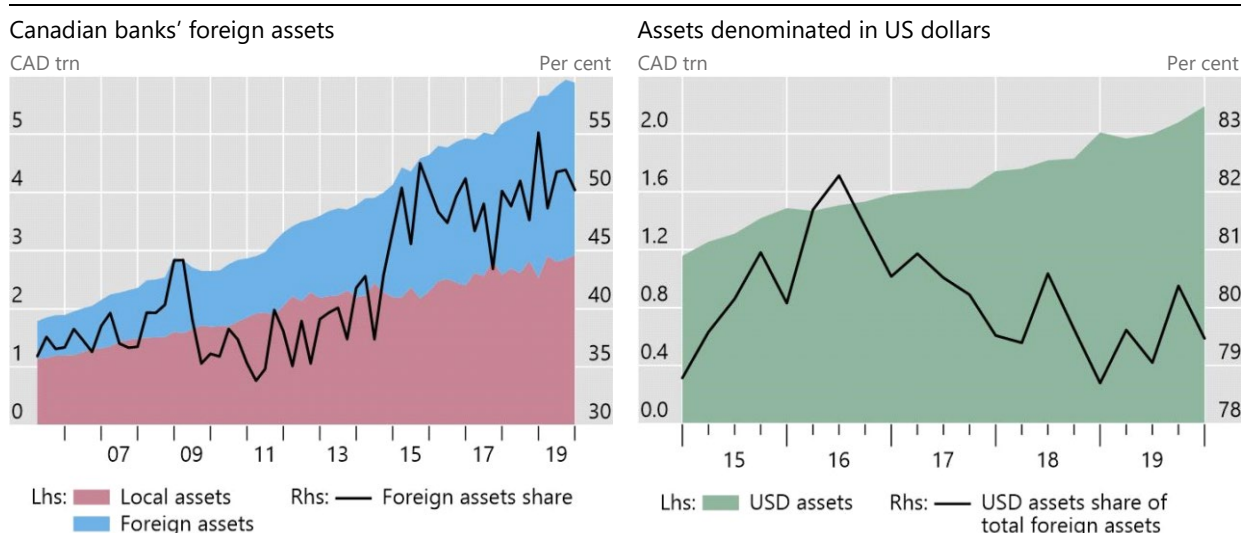
There are nearly 150 federally regulated deposit-taking institutions in Canada. However, the six domestic systemically important banks (D-SIBs)<sup>54</sup> account for 90% of the domestic assets. For the D-SIBs, foreign assets and liabilities have grown at a more rapid rate than domestic assets and liabilities since 2005 (Graph E1, left-hand panel). This can be partly explained by an increase in activity in the United States (right-hand panel). Foreign currency funding helps to support international expansion, further diversifies banks' funding base and can potentially provide a source of lower cost funding. Nevertheless, proper monitoring and sound risk management remain key to containing vulnerabilities with regard to foreign currency liabilities.

This annex explores Canadian D-SIBs' exposures to US dollar wholesale funding and the trade-off between efficiency and stability.

The proportion of foreign assets for the D-SIBs was approximately 40% of total assets in 2005, but it has grown to over 50% as of 2018, mostly denominated in US dollars (Graph E1). This increased footprint in the United States coincided with an increase in the D-SIBs' foreign currency debt issuance. The share of wholesale funding issued in foreign currencies increased from slightly less than 55% in 2005 to nearly 80% at the end of 2019 (Graph E2, left-hand panel). In 2019, the D-SIBs received a record amount of foreign currency wholesale funding, nearing CAD 1 trillion (or \$750 billion). Since December 2014, D-SIBs report the composition of major currencies in their foreign funding. The US dollar funding share of total foreign funding has decreased, which indicates more diversification of currency exposures (Graph E2, centre panel; see also Bank of Canada (2018)).

Domestic, foreign and US dollar-denominated assets of Canadian banks

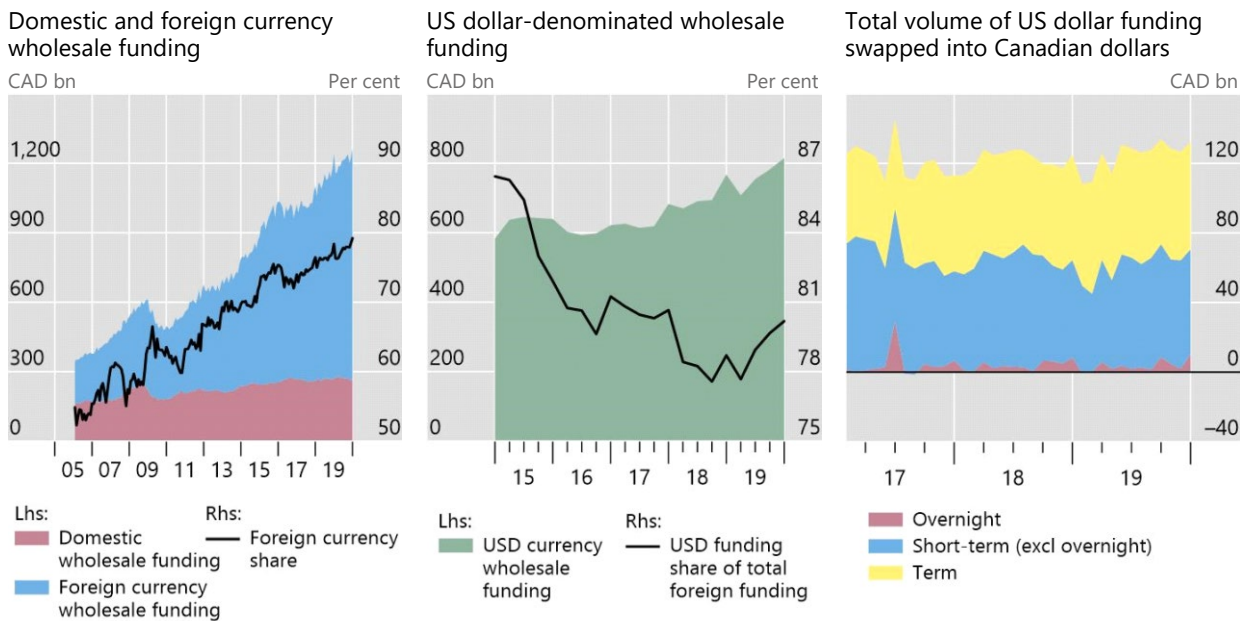
Graph E1



Sources: Bank of Canada; Canadian banks' regulatory filings.

<sup>54</sup> The Bank of Montreal, the Bank of Nova Scotia, the Canadian Imperial Bank of Commerce, the National Bank of Canada, the Royal Bank of Canada and TD Bank Group.





Sources: Bank of Canada; Canadian banks' regulatory filings.

As noted above, a sustained increase in foreign currency wholesale funding for the D-SIBs may represent a vulnerability if the funding is not matched by foreign currency assets (ie "natural" hedges) or hedged with proper derivative tools. The D-SIBs' "northbound" funding is defined as US dollar funding (eg bond issuance) that is swapped into Canadian dollars to fund local assets (Graph E2, right-hand panel). If not properly hedged, northbound funding can add to banks' currency risk, making them vulnerable to a sharp increase in the cost of funding. However, as of 2019, the amount of northbound funding for the D-SIBs remains relatively modest, at around CAD 125 billion, which represents less than 13% of all of their US dollar liabilities. Moreover, only a small fraction of northbound funding is overnight.

Foreign currency exposures are monitored closely by the banks, and the regulatory authorities in Canada have established several regulatory requirements and monitoring metrics. For example, the Office of the Superintendent of Financial Institutions (OSFI) has established the Liquidity Adequacy Requirements guideline and Guideline B6 – Liquidity Principles. These guidelines are in place to monitor and stabilise domestic and cross-border funding profiles over the long term. In addition to regulatory requirements, monitoring metrics, such as currency-specific funding exposures, are regularly reported to the regulatory authorities.

In conclusion, while the amount of US dollar funding engaged in by Canadian banks has grown, the combination of natural hedges (funding US businesses) and prudent regulatory requirements and monitoring mitigates the relevant vulnerabilities. Nevertheless, regulatory authorities as well as policymakers need to continue to monitor the situation.



## Annex F Individual country experiences: Australia

Australian banks make significant use of funding in US dollar wholesale markets. Offshore funding accounts for a little under 20% of the total funding of the banks' domestic books, and a large portion of this is US dollar-denominated (Graph F1, left-hand panel).<sup>55</sup> Banks choose to raise funds in US dollar markets to diversify their funding base and because these markets can absorb large issues at relatively attractive prices compared with issuing these volumes domestically (Black and Munro (2010)).

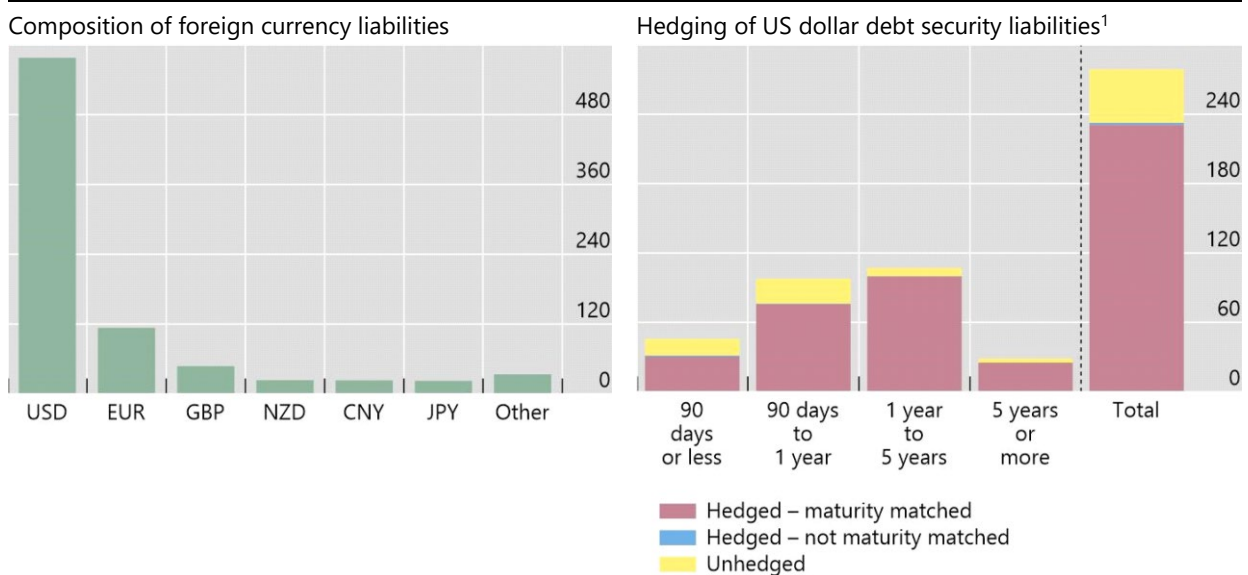
Such offshore funding is a potential source of vulnerability for the banks, in part because US dollar investors may reduce funding and/or exhibit "home bias" in periods of stress. However, these vulnerabilities are appropriately mitigated by several factors (RBA (2019), Debelle (2019), Bellrose and Norman (2019)):

- The banks offset the exchange rate and interest rate risk that would arise from US dollar funding via hedging (Kent (2018)). Banks use derivatives (primarily cross-currency swaps) to hedge almost all of their US dollar debt security liabilities, and about two thirds of their overall US dollar liabilities.<sup>56</sup> The maturities of these derivatives are closely matched to those of the underlying

### Foreign currency liabilities and hedging behaviour of Australian banks

In billions of Australian dollars

Graph F1



<sup>1</sup> As of 31 March 2017.

Sources: Reserve Bank of Australia; Australian Bureau of Statistics.

<sup>55</sup> This figure is somewhat higher (around one third of total funding) when looking specifically at the four major banks and considering their global (rather than domestic) operations (Bellrose and Norman (2019)).

<sup>56</sup> Given the importance of hedging, the Reserve Bank of Australia initiated (around 20 years ago), and has since provided funding for, the Australian Bureau of Statistics to regularly survey firms' foreign currency exposures and the extent to which they are hedged. See Berger-Thomson and Chapman (2017) for the most recent survey results.

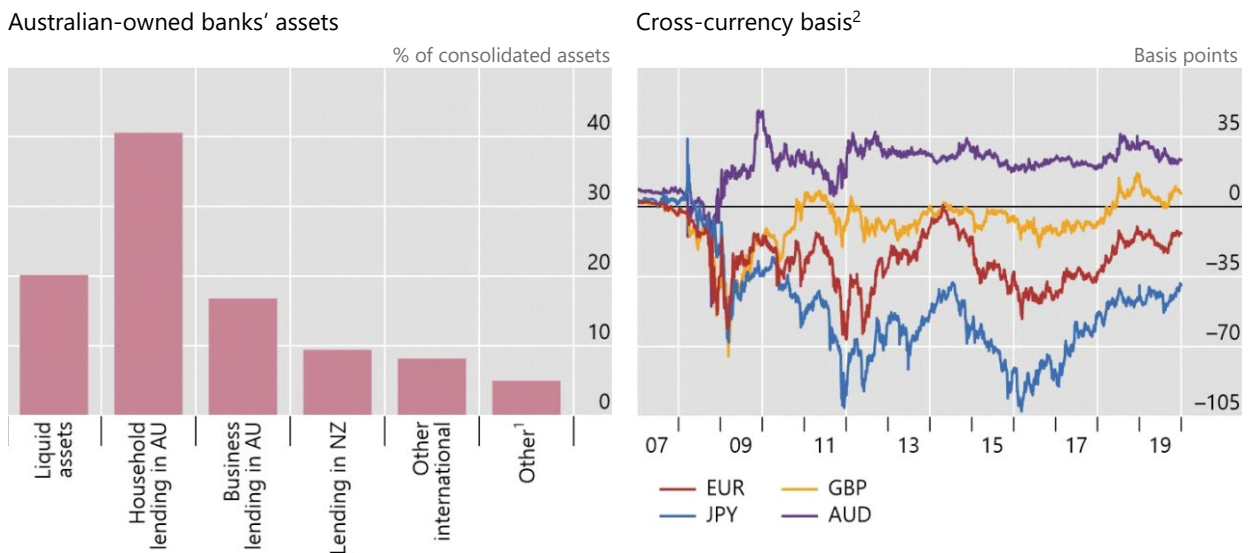
debt securities. Hence, the banks are not exposed to the risk of hedges becoming more expensive or more difficult to obtain before the underlying debt matures (Graph F1, right-hand panel). For the relatively modest portion of US dollar liabilities that are not hedged with derivatives, there is typically a matching asset in US dollars (including high-quality liquid assets held in US dollars). The vast bulk of the counterparty exposure on these hedges, which are predominantly to foreign banks, are collateralised (Cole and Ji (2018), Arsov et al (2013)).

- In addition, should foreign investors become less willing to fund Australian banks, the Australian dollar may depreciate, as happened during the financial crisis. In that event, Australian banks' offshore borrowing needs actually decline (in foreign currency terms) and they receive net inflows from hedge counterparties (via margin calls); these inflows were sizeable during the GFC.
- Finally, the fact that (currency-hedged) US dollar funding is used to extend Australian dollar loans means that if US dollar funding conditions were to tighten, the banks could replace US dollar funding with domestic sources of funding.<sup>57</sup> The Australian banks tend to have domestically oriented lending, reflected in a low share of overall international assets by comparison with many other banking systems (Turner and Nugent (2015)) (Graph F2, left-hand panel).

Because they are hedging a net US dollar liability, Australian banks on balance *supply* US dollars in the cross-currency swap market. That contrasts with banking systems that are funding net US dollar assets and so, on balance, *demand* US dollars

### Domestically oriented lending by Australian banks and its implications for hedging costs

Graph F2



<sup>1</sup> Mainly comprising derivatives. <sup>2</sup> Five-year cross-currency basis.

Sources: Reserve Bank of Australia; Australian Prudential Regulation Authority; Bloomberg.

<sup>57</sup> Moreover, if domestic markets cannot expand sufficiently quickly to fully replace reduced offshore funding, which would seem likely for larger shocks, as a last resort the Reserve Bank of Australia can provide liquidity assistance against eligible collateral.

in the swap market. This structural difference means that the AUD/USD cross-currency basis generally behaves somewhat differently from that of other currencies. First, the AUD/USD basis is positive, implying a small hedging cost to obtain Australian dollars (supply US dollars) in the swap market. For many other currencies, the basis tends to be negative, implying a small hedging cost to obtain US dollars (Graph F2, right-hand panel; see also Annex B). For the Australian dollar, this hedging premium arises because while there are a number of natural counterparties to Australian banks, these do not have sufficient hedging needs to match all of the hedging demands of the Australian banks. Second, the AUD/USD basis has been less prone to volatility and tighter availability of US dollars around quarter-ends in recent years. That is because the suppliers of US dollars in this market, the Australian banks, are not subject to the quarter- or year-end balance sheet constraints that arise for banks in some other jurisdictions.

## Annex G China's demand for and supply of US dollars

A major driver of rising US dollar indebtedness both globally and for EMEs has been the steep rise in offshore US dollar bond financing by Chinese non-financial firms (Graph G1, left-hand panel). As a result, Chinese firms now have around \$590 billion of US dollar bonds outstanding (36% of the EME total), most of which is issued offshore.

As a percentage of GDP, Chinese firms' outstanding US dollar bonds are small, at around 4% (and around 19% of China's foreign currency reserves), but they are concentrated, with property developers and Local Government Financing Vehicles (LGFVs) having issued around 40% of the total. These are borrowers with limited or no foreign income.<sup>58</sup> For example, borrowings via LGFVs, though largely counted as corporate borrowing, often represent "shadow borrowing" by local governments to support public policy and funding of local investment projects (Chen et al (2018)). Firm-level data also indicate elevated leverage of Chinese property developers. In particular, firms may issue bonds denominated in US dollars because of lower issuance costs and the ability to tap a broad pool of international investors, but are not hedged either financially or "naturally" by US dollar income. Accordingly, such carry trade-like transactions leave them vulnerable to US dollar appreciation (Bruno and Shin (2018)). Indeed, during the 2015–16 dollar appreciation episode, an unwinding of carry trade and the repayment of external debt contributed to substantial capital outflows from China (IMF China Article IV 2016 and IMF Global Financial Stability Report (2016)).

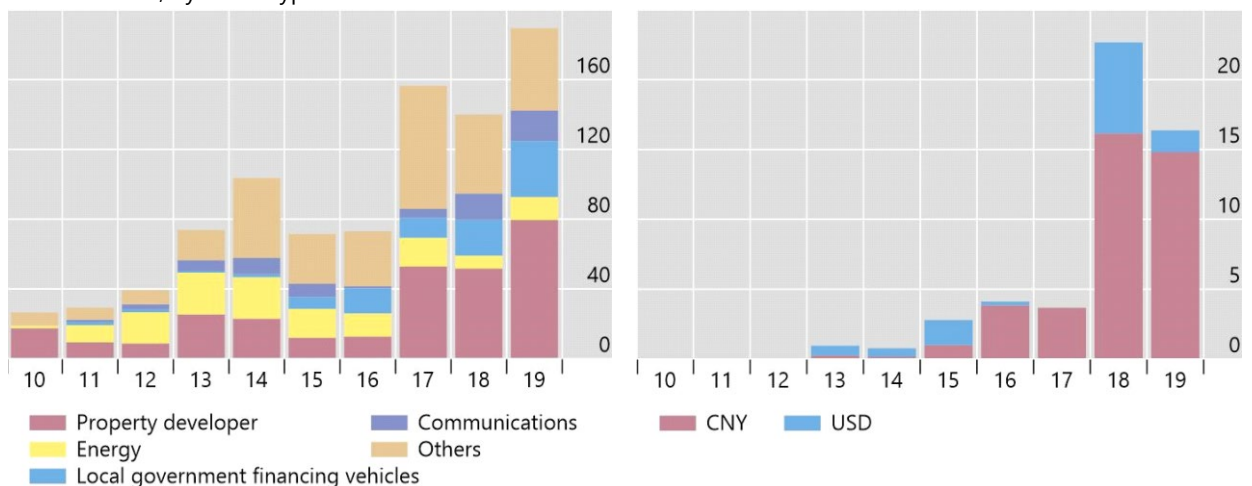
### Chinese non-financial corporates' offshore US dollar bond issuance and defaults

In billions of US dollars

Graph G1

Chinese non-financial corporates' offshore US dollar bond issuance, by issuer type

Defaults by Chinese non-financial corporates



Sources: Hong Kong Monetary Authority; Bloomberg.

<sup>58</sup> Recent default cases onshore suggest past assumptions around implicit government guarantees for LGFVs may be softening, in line with a general desire to reduce moral hazard concerns.

In 2017 and early 2018, as US monetary policy was tightened further against a backdrop of weakening Chinese growth, the US dollar appreciated and borrowing costs on both US dollar and renminbi debt rose. In that context, defaults on Chinese corporate bonds (in both US dollars and renminbi) rose sharply in 2018 – albeit from very low levels – (Graph G1, right-hand panel) and as a percentage of debt outstanding. The share of defaults on state-owned enterprises was much lower, reflecting sustained policy support (Amstad and He (2019)).

Over the next five years, around \$488 billion of US dollar bonds issued by Chinese firms will come due; property developers in particular face \$80 billion in maturing US dollar debts by end-2021 (and a further \$165 billion in maturing renminbi). Difficulties in refinancing these US dollar bonds pose direct solvency risks for indebted Chinese firms and could lead to losses for banks and investors with significant exposures to these borrowers.

China has also become a major global US dollar creditor over the past 20 years. Balance of payments data indicate that direct loans and trade credits totalled \$1.6 trillion in 2018; of this, Horn et al (2019) estimate that around \$530 billion (less than 20% of China's foreign exchange reserves) is predominantly in the form of official US dollar-denominated loans and grants to low- and middle-income countries. This points to a growing role of China as an overseas official lender in US dollars, with EMEs often receiving direct loans from China's state-owned banks, at market rates and backed by commodity collateral, to finance large-scale and infrastructure projects.

## Annex H Net US dollar exposure and banking crises

Recent empirical studies suggest that reliance on US dollar funding may contribute to banking crises in recipient countries. In particular, a monetary policy tightening in the United States increases the probability of banking crises in non-US banking systems, mainly for those countries with direct linkages to the United States in the form either of trade links or of significant share of US dollar-denominated liabilities (Durdu et al (2019)). Cesa-Bianchi et al (2019) show that credit growth in the rest of the world (a proxy for “the global financial cycle”) may increase the likelihood of a domestic banking crisis *over and above* the impact of domestic variables (domestic credit growth, GDP growth, inflation). This annex looks at these two determinants of banking crises: the global financial cycle and US dollar funding exposure.

The model of Cesa-Bianchi et al (2019) is extended with an economy-wide measure of US dollar exposure (total US dollar foreign liabilities minus US dollar foreign assets as a share of GDP, taken from Bénétrix et al (2015)).<sup>59</sup> In addition, the model includes a measure of de jure capital account openness (Chinn-Ito index), which accounts for the greater exposure of open economies to the global financial cycle, the political risk rating from the International Country Risk Guide to ensure that the US dollar exposure variable will not capture other intrinsic systemic vulnerabilities (eg EME “original sin”) and the current account to control for broader external sustainability concerns. These variables are included separately, to understand whether they help to predict crises independently. The same variables are interacted with foreign credit growth to study if they act as amplifiers of the global financial cycle. Estimated coefficients are reported in Table H1.

The first column of Table H1 shows that the net US dollar exposure has a positive and statistically significant impact on the crisis probabilities: countries with larger net US dollar liabilities as a share of GDP are more likely to enter a crisis, as they are more exposed to fluctuations in the value of the US dollar and retrenchment of US dollar funding. For instance, at the average level of net US dollar exposure in the sample, which corresponds to an economy with a *long* US dollar external position of around 17% of GDP, the probability of crisis predicted by the model is around 17%, which is also the unconditional average for the whole sample. An increase in the US dollar exposure by almost 50 percentage points – one standard deviation of the distribution of this variable – corresponds to an economy with a *short* US dollar external position of 30% of GDP. This increase would raise the crisis probability to almost 40%. However, the net US dollar position does not appear to have an amplifying role for foreign shocks. This result is robust to the joint inclusion of the additional control variables, such as capital account openness, a measure of political risk rating and the current account and their interaction terms with foreign credit growth in the regressions (column 5).

In conclusion, a large economy-wide US dollar exposure appears as an additional source of risk for the financial sector, increasing the probability of banking crises, independently from the strength of foreign credit growth.

<sup>59</sup> It should be noted, though, that this measure of currency exposure does not account for the impact of potential hedging activities.

## Banking crisis prediction: the role of net US dollar exposure

Table H1

	1	2	3	4	5
Net USD exposure (USD EXP), $t-1$	2.92**				3.81**
	(1.26)				(1.80)
Foreign credit growth, $t-1$ * USD EXP, $t-1$	0.05				0.03
	(0.15)				(0.18)
Capital account openness (KAOPEN), $t-1$		-2.30*			-3.62**
		(1.31)			-(1.68)
Foreign credit growth, $t-1$ * KAOPEN, $t-1$		0.39*			0.45
		(0.20)			(0.38)
Political risk rating (RATING), $t-1$			0.01		-0.02
			(0.04)		(0.06)
Foreign credit growth, $t-1$ * RATING, $t-1$			0.01		0.00
			(0.01)		(0.01)
Current account (CA), $t-1$				-0.23***	-0.30***
				(0.07)	(0.07)
Foreign credit growth, $t-1$ * CA, $t-1$				0.01	0.01
				(0.01)	(0.01)
Observations	363	410	410	388	324

The dependent variable is a dummy variable capturing banking crises. Robust standard errors in parentheses. \*\*\*/\*\*/\* indicates statistical significance at the 1/5/10% level. The probit model includes real GDP growth, CPI inflation, terms of trade, country fixed effects and four lags of domestic credit growth, omitted for reasons of space. The sample includes annual data for 40 countries since 1990.

Sources: IMF; International Country Risk Group (ICRG); BIS; and CGFS Working Group calculations. The model is an extension of Cesa-Bianchi et al (2019). Banking crises are obtained from Laeven and Valencia (2018). Capital account openness is measured using the de jure index developed by Chinn and Ito (2006). The political risk rating is a synthetic index from ICRG measuring variables such as political unrest and the presence of conflicts, government stability, the investment climate, corruption, the rule of law and the quality of bureaucracy.

## Annex I Indirect exchange rate exposure of US banks

One risk facing US banks from lending in US dollars to non-US residents is the additional credit risk that arises from borrowers that have not hedged their exchange rate risk. A sharp US dollar appreciation could affect all exposed obligors at the same time. The magnitude of this indirect exposure to US dollar appreciation depends on how much US banks have lent in US dollars to borrowers with unhedged currency exposure and these borrowers' financial resilience. By combining aggregate banking statistics with analysis of granular supervisory data, we can gauge the magnitude of this risk.

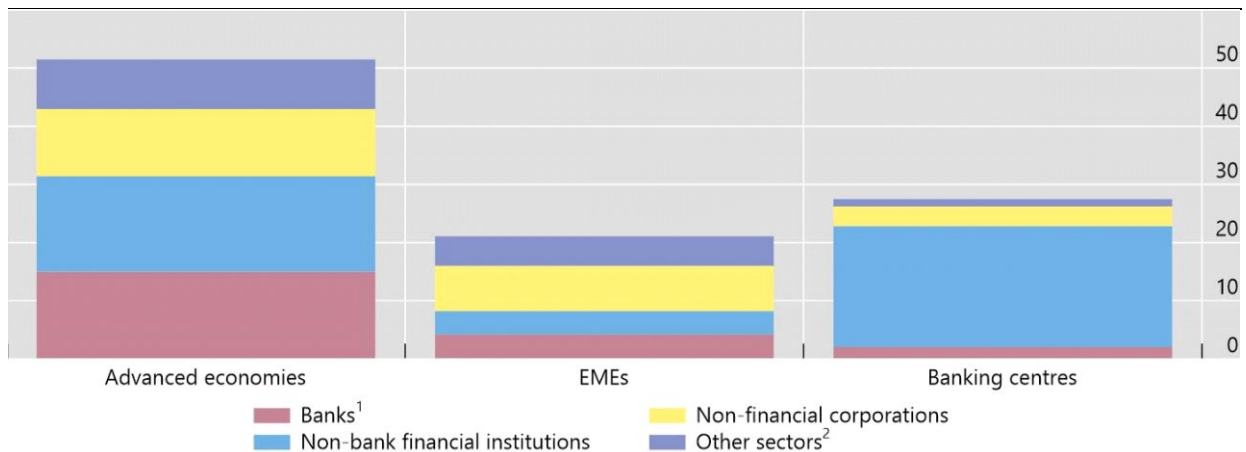
Aggregate statistics indicate that US banks' US dollar claims on all non-US borrowers – hedged and unhedged – stand somewhere between \$1.5 trillion and \$1.9 trillion, less than twice the total Tier 1 capital of the reporting banks.<sup>60</sup> Shares by country groupings and broad sectors are shown in Graph I1. Total claims on EME borrowers amount to only about 20% of the total. Outside of EMEs, more than half of the claims are on financial firms, consistent with chains of intermediation in US dollar credit as discussed in Section 4. Nevertheless, data on claims shed little light on indirect exchange rate exposure.

An analysis of 2014–18 loan-level supervisory data suggests borrowers' unhedged currency exposure has only moderate implications for loan performance, either because borrowers have a fair degree of financial resilience or because their unhedged exposure is moderate in the aggregate. Specifically, a 10% home currency

### Upper bound of US dollar claims of US banks on non-US residents

As a percentage of the total, as of end-December 2019

Graph I1



Based on the sum of cross-border claims and local claims in non-local currencies on an "immediate counterparty" basis, ie based on the country of residence of the borrower, for 74 internationally active US commercial banks with \$18 trillion in total assets. Six jurisdictions make up 95% of the Banking Centres total: Bermuda, Hong Kong SAR, Panama, Singapore, the Cayman Islands and The Bahamas.

<sup>1</sup> Excluding inter-office claims. <sup>2</sup> Comprising public sector, households, and non-profit institutions serving households.

Source: FFIEC E.16 Statistical Release.

<sup>60</sup> Gaps in the statistics preclude an exact measure. The lower figure, which is from the BIS locational banking statistics by nationality, may not fully capture claims held by non-US offices of US banks. The higher figure, which is from the BIS consolidated banking statistics, is fully consolidated and therefore fully captures claims of non-US offices, but it includes some claims that are not in US dollars.



depreciation added only an estimated 0.37 percentage points to the delinquency rates of foreign US dollar borrowers (Niepmann and Schmidt-Eisenlohr (2020)). That the delinquency rate would increase so modestly given a sizeable dollar appreciation suggests that US banks take account of the indirect foreign currency risk of potential borrowers before extending credit. Applying this estimated coefficient to the upper bound of US dollar claims on foreign borrowers implies an increase in credit losses of less than \$7 billion, less than 1% of reporting banks' Tier 1 capital. This is much too small to suggest a threat to the solvency of US banks, but it is possible that the impact of a very large US dollar appreciation in the context of a global recession could be much larger.



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