

# The Offshore Dollar and US Policy

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## Summary:

Dollar borrowing outside the United States has over generations grown to be very large, with US policy providing some inducement and, in critical episodes, support. But in lending dollars through open-ended central bank swaps in 2008 and 2020, the Fed broke new ground as international lender of last resort. By countering dollar runs on non-US banks, the Fed supplied the global public good of financial stability. In addition, it restored domestic US monetary transmission. In 2020 the Fed's last-resort buying of domestic corporate bonds also did double duty, stabilizing the global dollar bond market. Although the Fed has swap lines with relatively few central banks, their banks and currency markets consistently dominate offshore dollar borrowing. Lending through central bank swaps thus enables the Fed to backstop global dollar funding markets at times of severe strain. Questions abound regarding moral hazard, the new benchmark dollar rate, bond-market crisis management, and feasible scale.

## Key findings:

1. In 2008 and 2020, the Fed served as a powerful international lender of last resort, stabilizing the huge offshore dollar market and making its monetary policy effective.
2. The Fed's selective central bank swap lines potentially reach a consistently high share of offshore dollar borrowing.

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**Robert N. McCauley** spent most of his career in central banking at the Bank for International Settlements (BIS) and, before that, at the Federal Reserve Bank of New York. He represented the BIS Monetary and Economic Department on the Markets Committee of central bank market practitioners from 2008 to 2019. He publishes research on international financial markets and the international monetary and financial system. He coauthored the eighth edition of the classic *Manias, Panics, and Crashes*, published in March 2023. He is working on a book titled *The domain of the dollar* for the Cambridge University Press Studies in Macroeconomic History series. He is a nonresident senior fellow with the Global Economic Governance Initiative at the Boston University Global Development Policy Center and a research associate of the Faculty of History at the University of Oxford.

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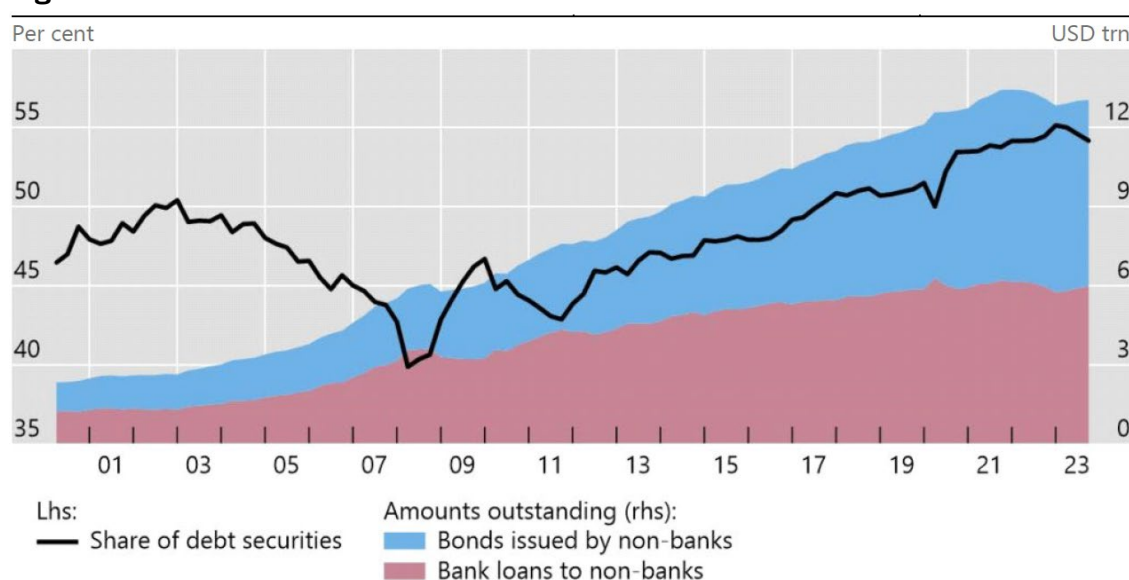
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## Introduction

A large offshore dollar credit market epitomizes the dollar's success as an international currency. Banks and bondholders outside the United States hold dollar claims on borrowers abroad including businesses, governments, and even households.

The dollar's global role requires that non-US residents pay trillions of dollars every day. Nonbanks outside the United States must make repayments on a \$13 trillion stock of dollar debt, mostly held abroad (figure 1). After the Great Financial Crisis, dollar bonds outstanding grew faster than dollar bank loans and now represent more than half of this stock of offshore dollar debt (Hardy and von Peter 2023).

**Figure 1: US Dollar Credit to Nonbanks outside the United States**

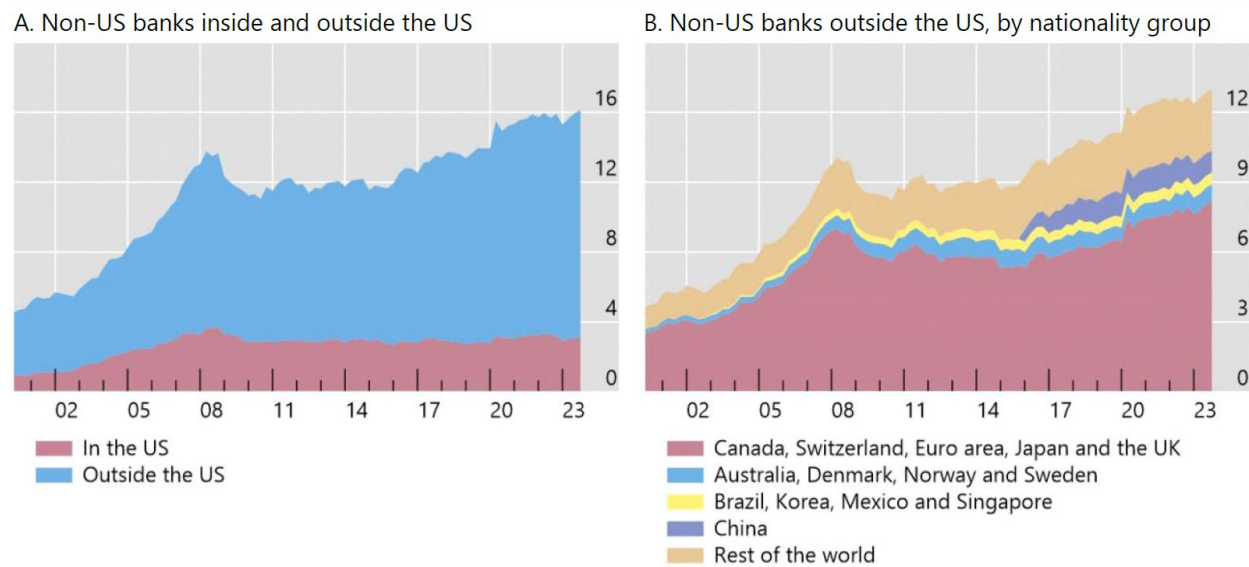


Note: Nonbanks comprise nonbank financial entities, nonfinancial corporations, governments, households, and international organizations.

Source: BIS global liquidity indicators

Banks headquartered outside the United States need to roll over maturing dollar obligations on a \$16 trillion stock of deposits and bonds (figure 2, left-hand panel).<sup>1</sup> About \$3 trillion of these obligations are booked at branches and subsidiaries in the United States. In principle, these foreign bank affiliates in the United States have access to dollar funding at time of need from the Fed's discount window. But banks headquartered outside the United States have another \$13 trillion in dollar obligations booked outside the United States. The Fed's discount window does not provide a direct backstop to these liabilities.

<sup>1</sup> Up from \$13 trillion at end-2019 (Aldasoro et al. 2020). Figure 1 shows debt by residency while figure 2 shows it by nationality. See McGuire et al. (2024).

**Figure 2: Dollar Liabilities of Banks Headquartered outside the United States**

Note: Data depict cross-border and local liabilities in all instruments vis à vis counterparty countries. Data exclude intragroup positions but include liabilities to other (unaffiliated) banks. From the end of 2015, data include positions reported by China and Russia (the latter up to the end of 2021). Data are in trillions of dollars.

Source: BIS consolidated banking statistics, BIS local banking statistics, and author's calculations

On top of these outright debts are large stocks of off-balance sheet obligations to pay dollars arising from foreign exchange (FX) swaps and forwards and longer-term currency swaps. In an FX swap, one counterparty borrows dollars against the collateral of an equivalent amount of another currency. For instance, a Dutch pension fund or a Japanese life insurer may borrow dollars and lend euros or yen in the “spot leg” and later repay the dollars in the “forward leg.” A dollar bond bought with the dollars is thereby hedged back into euro or yen. An investor who seeks to avoid the risk of the dollar must borrow dollars.

It deserves emphasis that FX swaps are not some side bet, settled with a one-way payment by the loser to the winner, as in most derivative transactions. No, in a \$100 million FX swap, that full amount is borrowed and repaid.

These off-balance sheet dollar obligations well exceed the on-balance sheet dollar debts. Nonbanks outside the United States owed an estimated \$26 trillion in these forward deals in mid-2022, about double their on-balance sheet dollar liabilities. Non-US banks owed another \$39 trillion (Borio et al. 2017, 2022), more than double their on-balance sheet liabilities.

The FX swap market is the largest outstanding dollar credit market, but its off-balance sheet nature means that it is often overlooked (unlike dollar borrowing collateralized against securities, namely repo). Dollar FX swaps turned over \$3.5 trillion a day in April 2022, mostly at maturities less than a week (BIS 2022). The dollar predominates in this market like no other,

with the dollar on one side of about 90 percent of all FX swaps. And US banks occupy an outsized and pivotal position in this funding market. European banks swapping euros into yen transact through dollars with US banks, as do Japanese banks swapping yen into euros (Kloks et al. 2023).

These are markets that the US authorities have episodically supported for generations. And these are the markets that the Fed in this century has backstopped as a powerful international lender of last resort. This paper emphasizes three unappreciated aspects.

First, the Fed's central bank swaps in 2008 and 2020 sought to restore not only global financial stability but also its own monetary transmission. Thus, the Fed swaps served not only a global public good but also the Fed's domestic monetary mandate by bringing down the benchmark dollar LIBOR paid by US businesses and households.

Second, while its domestic corporate bond-buying of last resort in 2020 sought to promote liquidity in the US corporate bond market, it also exerted an unrecognized global stabilizing effect. The Fed stopped an incipient run on the global dollar bond market through its intervention in the US corporate bond market.

Third, although the Fed's choice of swap partners has been questioned and dissected, it emerges as remarkably inclusive—cosmopolitan, even—when account is taken of the hierarchy of currencies. The Fed's swap partners oversee the currencies that account for five-sixths of the huge FX swap market.

Questions abound. Have the swaps led to too much dollar financing offshore, or too much short-term dollar financing offshore? After the substitution of a domestic benchmark for LIBOR, should the Fed care about dislocations in offshore dollar funding? How can the Fed stabilize an offshore dollar market dominated by bond financing? Is the offshore dollar market becoming too big for the Fed to stabilize?

Section 2 below highlights salient events in the relationship between the Fed and other US authorities and the offshore dollar market, taking it decade by decade. Section 3 profiles the discontinuity of the central bank swaps in 2008 and 2020, emphasizing their link to domestic policy. Section 4 shows that the effect of the Fed as corporate bond buyer of last resort in 2020 ramified widely, reversing market dynamics in dollar bonds issued by non-US firms and governments. Section 5 reinterprets the Fed's choice of swap partners as closely approximating a global criterion, rather than national criteria. Section 6 addresses the four questions above. Section 7 concludes.

## **The US Authorities and the Eurodollar Market: The 20th Century**

Since the early days of the eurodollar market, US policy has spurred its growth, sometimes but not always as an unintended consequence. And, decade after decade, in critical episodes policy has supported the market.

## **The 1950s**

The eurodollar arose as an end-run around Fed regulation that leveraged the newly permitted London FX forward market. In 1955 Federal Reserve restrictions on interest rates payable on US bank deposits gave the big UK bank Midland an incentive to offer higher-yielding London dollar deposits. These were not just a waystation to stateside US deposits. Instead, Midland swapped them into sterling and bought sterling local government paper. The swap's forward leg sold the sterling for dollars, matching the deposit (Schenk 1998). London banks soon started to extend dollar loans at less than US loan rates (Holmes and Klopstock 1960).

As the Fed subsequently eased its so-called Regulation Q restrictions on interest payments, the Fed's reserve requirements came to serve as the main goad for depositors and banks to shift dollar banking offshore (McCauley et al. 2021). Unremunerated reserves served as a tax on US deposits, and as dollar interest rates trended upward into the 1970s, the tax rate rose. Banks tended to equalize the all-in cost of an onshore and offshore dollar deposit, so the depositor tended to reap the advantage of no reserves offshore. The eurodollar market was to a great extent an unintended consequence of the Fed's monetary control techniques.

The Fed took a permissive approach to the market-led offshore shift of dollar banking. When a pair of economists at the Federal Reserve Bank of New York (FRBNY) surveyed developments in the nascent eurodollar market in 1960, they concluded that the higher rates paid on dollar deposits abroad were bad for New York but good for the dollar, which was then pegged to gold (Holmes and Klopstock 1960).

## **The 1960s**

While the US authorities tolerated the eurodollar deposit market, they knowingly created the eurodollar bond market. As background, President Kennedy was so spooked by the dollar's weakening against gold in October 1960 in the last weeks of the presidential campaign that he appointed President Eisenhower's undersecretary of state for economic affairs, Douglas Dillon, as Treasury secretary. The new administration fell under the spell of economist Robert Triffin, for whom US foreign dollar bond purchases financed with foreign short-term dollar holdings in New York represented a mechanical threat to the dollar-gold link (Bordo and McCauley 2019).<sup>2</sup> Dillon, former chairman of bond underwriter Dillon Reed, knew what he was doing when he personally proposed an unselfish if misguided "solution" to Kennedy: the Interest Equalization Tax (Dillon 1964, p. 153).

With this tax, the US Treasury engineered the export of the US foreign bond market to London in 1963. It imposed a prohibitive disincentive to foreign dollar issues in New York.

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<sup>2</sup> Dillon (1964, p. 162) highlighted the absurdity of the Commerce Department's accounting that took as a threat to the US gold stock the shift of a US deposit from Chase Bank New York to Bank of Montreal in Canada, which in turn had a claim on its affiliate in New York.

European, Commonwealth, and Japanese dollar bond issuance came to a halt in New York (Cooper 1965). Wall Street's loss was London's gain.

In 1966, an incipient funding squeeze in the eurodollar deposit market led the Fed to cooperate with central banks abroad to stabilize it (McCauley and Schenk 2020). US banks had borrowed extensively from their branches in London as Regulation Q ceilings bound earlier in 1966. As the year-end approached, the still-familiar practice of window dressing would drain funding out of the eurodollar market, posing the risk of a spike in rates that would run counter to the Fed's policy stance, which was by then easing. The FRBNY's foreign exchange desk used a special swap with the Bank for International Settlements (BIS) to funnel dollars into the market. Starting on the trading day for which one-month deposits would mature in the next year, dealers at the BIS used dollars swapped in from the FRBNY to make uncollateralized deposits in European banks, mostly in London. The BIS also swapped for dollars with the Swiss National Bank, which had acquired the dollars from Swiss banks that were doing the window dressing to show shareholders Swiss francs, not dollars, in their year-end accounts. The cooperating central bankers judged that the deposits, amounting to about a twentieth of the size of the eurodollar market at the time, succeeded in reversing the incipient rise in eurodollar rates.

FRBNY similarly provided dollars to the BIS to stabilize the eurodollar deposit rate on four other occasions through 1968. Like discount window advances, individual banks received Fed credit (albeit through the BIS as a risk-taking intermediary), but like open market operations, placements were spread widely based on BIS counterparties' rate offers. The resulting more limited funding squeezes in the market must have made it seem less risky both for depositors and borrowers at a time of rapid growth.<sup>3</sup>

The precedent set in the 1960s for the twenty-first century lender of last resort is striking. Fed credit flowed through a central bank swap to the BIS, and on to offshore banks. The Fed's central bank swap partner took onto its own balance sheet the risk of funding non-US banks in the offshore dollar market.

## **The 1970s**

In the fraught year of 1974, the FRBNY provided key support for the eurodollar market in its capacity as domestic lender of last resort. In particular, it enabled Franklin National Bank to borrow at its discount window and to advance the funds to London to meet a run on its branch there. In addition, the Fed pushed in Basel for the leading central banks to weigh in publicly, if

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<sup>3</sup> The operations came to an end when the Fed tightened policy at the end of the decade and came to see the ability of banks to fund themselves offshore as a threat to monetary control (Toniolo 2005, p. 463). The Fed's response was to impose a eurodollar reserve requirement on net funding by banks from their foreign branches in October 1969.

cryptically, on the “problem of the lender of last resort in the Euro-markets” (Goodhart 2011, p. 40).

Franklin National grew quickly in the late 1960s from a modest Long Island bank to the 23rd largest in the United States, relying heavily on short-term borrowing. The Federal Reserve authorized it to open branches first in the Caribbean and then in London, affording it access to interbank funding at market rates. A shadowy Italian financier bought control in the 1972 and controlled its FX book, which grew very rapidly. Revelations of FX losses led to a run in the spring of 1974.

The FRBNY’s discount window advances to Franklin National set two key precedents. First, FRBNY allowed its funding to be transferred to London to pay off depositors there. Second, when the discount window advances had exhausted the domestic collateral, FRBNY lent against assets booked in London. The share of foreign branch assets pledged as collateral at the FRBNY by Franklin reached a quarter (Spero 1980, p. 149). In fact, the Bank of England was happy to serve as custodian of the London collateral to give effect to its long-promoted policy of parental responsibility for any troubled London branch or subsidiary (Goodhart 2011, pp. 34, 42–3). Once again, Federal Reserve credit flowed into banks in London, this time through Franklin’s head office rather than through the balance sheet of the BIS.

In June 1974 revelation of FX losses led the German authorities to close the small Bankhaus Herstatt after it had received deutschemark payments in Frankfurt but before it had made the corresponding dollar payments in New York, which produced distrust in the FX market and contraction of credit in the interbank eurodollar deposit market (Schenk 2014).

The Federal Reserve joined with the Bank of England in pushing the G-10 and Swiss central banks to issue a public statement on the “problem of the lender of last resort in the Euro-markets.” But the German Bundesbank resisted (Kapstein 2008, p. 126). Banks that failed due to managerial incompetence did not deserve official support, the Bundesbank officials argued, and to signal support to troubled affiliates in the euromarket would entail destructive moral hazard.<sup>4</sup> In the event, the central bankers at their September 1974 meeting in Basel put out a cryptic but ultimately reassuring statement (Goodhart 2011, p. 40):

The Governors...recognized that it would not be possible to lay down in advance detailed rules and procedures for the provision of temporary liquidity. But they were satisfied that means are available for that purpose and will be used if and when necessary.

## **The 1980s**

After the setback of 1974, the eurodollar market grew rapidly until the outbreak of the debt crises of Mexico, Brazil, and Argentina in 1982. Many banks had borrowed eurodollars to lend the troubled debtors in amounts exceeding two to three times their shareholders’ funds. Thus,

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<sup>4</sup> Mourlon-Druol (2015) describes how badly information on Herstatt circulated among the German authorities.

apprehension of defaults by the major borrowers lifted deposit rates in London well above the rates on Treasury bills. A three-sided strategy supported the eurodollar market by managing to keep the developing countries paying on their bank debts. Central banks extended swaps as bridges to the International Monetary Fund and other multilateral and bilateral official credit, the debtor countries tightened policy to run trade surpluses, and officials cajoled creditor banks into increasing their exposures (Truman 2014, p. 17). A prolonged multilateral effort to keep countries servicing their dollar debts provided the eurodollar market a fragile stability.

When US losses led eurodollar depositors to run on Continental Illinois in May 1984, Fed discount window loans and a blanket guarantee from the Federal Deposit Insurance Corporation (FDIC) again supported the eurodollar market. In addition to its foreign loans to Mexico and others, the Chicago bank had rapidly expanded its domestic loans in the oil patch, many purchased from a reckless bank in Oklahoma. Not allowed to branch at home, the bank relied on offshore deposits for more than 40 percent of its assets at the end of 1983 (FDIC (2023, p. 255). In a nine-day run in May 1984, the bank lost 30 percent of its deposits, at the time one of the fastest runs in history (Carlson and Rose 2016). Offshore deposits, including those by US money market funds, fell more than domestic deposits.

In a replay of the Franklin National run, credit flowed from the (Chicago) Fed's discount window to the bank and from there to London to pay off its depositors. After guaranteeing all of Continental Illinois's creditors, the FDIC (2023, pp. 250–51) publicly cited the avoidance of losses on interbank deposits in Continental Illinois by smaller US correspondent banks as the rationale. But it would have been risky to test the response to losses of eurodollar depositors or US commercial paper investors at a time when Manufacturers Hanover, First Chicago, and Bank of America remained vulnerable to runs.

The blanket guarantee of Continental Bank's eurodollar deposits and its holding company's commercial paper probably also averted runs on non-US banks' dollar liabilities. Carlson and Rose (2016) argue that support for Continental's uninsured deposits prevented a money market fund from “breaking the buck,” as happened after the Lehman failure in 2008. As in 2008, that would have set off runs on money market funds that could in turn have led to runs on non-US banks' eurodollar deposits and commercial paper.<sup>5</sup>

## **The 1990s<sup>6</sup>**

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<sup>5</sup> See McCauley and Hargreaves (1987) for money market funds' considerable holdings of foreign commercial paper, including that of non-US banks.

<sup>6</sup> Early in the decade the Norwegian and Swedish central banks lent their FX reserves to troubled banks unable to roll over eurodollar deposits. After government equity injections and nationalizations, the Bank of Norway extended limited foreign currency loans in 1991–92 (Borio et al. 2010, p. 31). After a parliamentary blanket guarantee, the Swedish Riksbank deposited “a large part of its foreign reserves” in Swedish banks as they faced difficulty in rolling over dollar deposits (ibid., pp. 35, 38). Whether market

In 1990, US officials avoided losses on eurodollar deposits of a bank without the size or connectedness of Continental. The FDIC kept whole the depositors in the Nassau, Bahamas, branch of a small (\$1.5 billion), failing bank in Washington, DC. These branch deposits of the National Bank of Washington of \$37 million were rolled into an assisted merger, so that the depositors came out whole. Citing the top nine US banks' reliance on foreign deposits for most of their funding, the director of supervision at the FDIC defended the decision in the passive voice: "[I]t was believed that negative repercussions would have been felt by these money-center banks if the Nassau deposits were not included in the NBW transaction, because of the confusion in the international markets that would have been created by such a decision."<sup>7</sup> The chair of the FDIC was quoted as saying that the Federal Reserve had "'urged with great vehemence' that the FDIC maintain its practice of protected [sic] depositors in foreign branches from loss, even though those deposits are not legally insured."<sup>8</sup> Support for NBW's Nassau depositors signaled the desire to avoid even a small loss by eurodollar depositors in a US bank.

To this author's knowledge, no depositor in any troubled US bank's foreign branch suffered losses until the 2023 FDIC rescue of Silicon Valley Bank. While uninsured domestic deposits of the bank were kept whole, more than half of the \$866 million of deposits in the Cayman Islands branch were not, and their holders became unsecured creditors (US Bankruptcy Court, S.D. NY 2024).

When Mexico and Asian countries suffered debt crises in the mid-to-late 1990s, major central banks, multilateral institutions, and governments extended support that again served to support the eurodollar market. In Mexico a "big bazooka" approach of assembling a large official loan package stopped the outflows, though not before many holders of Mexican dollar securities, including US mutual funds, had jumped ship. Much the same approach was tried in dealing with international bank runs on Thailand, Indonesia, and Korea in 1997 (Aliber et al. 2023, p. 315). Eventually in Korea, however, major central banks got involved in encouraging commercial banks to roll over their short-term claims on Korean banks (Kim and Byeon 2002). Official moral suasion, led by the FRBNY, worked as in 1982 to offset each bank's incentive to cut exposure.

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reports of the Japanese authorities similarly placing dollar reserves in Japanese banks in 1997–98 were accurate remains unclear.

<sup>7</sup> Jerry Knight, "FDIC says that it will insure deposits in U.S. branches abroad," *Washington Post*, October 2, 1990.

<sup>8</sup> Michael Quint, "Foreign depositors covered by F.D.I.C. at failed bank," *New York Times*, October 3, 1990, p. D-4.

Looking back, this patchwork of policies had various aims, including monetary control, bank resolution, and country debt crisis management. Taken together, however, they encouraged the eurodollar market to grow and sustained it at critical moments.

## **The Fed and Eurodollar Banking in the 21st Century**

The Fed's support for the eurodollar market in the 2000s broke new ground. 2008 saw the realization of the vision of Charles Kindleberger (1967, p. 6) that central bank swap "lines of credit must be unlimited." The Fed again extended dollar credit without ex ante limits in 2020.

### **2008**

Most analysis of the Fed's open-handed swaps with major central banks frame it as a response to financial instability, as an international extension of the discount window. But the swaps also served to restore the link between the Fed's policy interest rates and benchmark interest rates paid by US firms and households. The Fed's monetary transmission was at stake.

The often overlooked integration of US monetary transmission and the eurodollar market impelled the Fed toward an all-out effort as international lender of last resort. The short-term dollar benchmark in the futures market tipped from Treasury bills or US certificates of deposit in 1984, the year of the run on Continental Illinois.<sup>9</sup> In parallel, banks shifted the pricing of their US corporate loans from prime or domestic certificates of deposit to LIBOR. This shift reflected and facilitated the increasing share of foreign banks in the US commercial and industrial loan market in the 1980s.<sup>10</sup> Twenty years later, the rising share of foreign banks as packagers and holders of US mortgages favored the internationalization of the pricing of US adjustable-rate mortgages (Morgenson 2012). Pricing on these shifted in the 2000s from Treasury bills or an index of domestic bank funding costs to LIBOR.<sup>11</sup> Main Street paid LIBOR.

The August 9, 2007, announcement by BNP Paribas that it could not price a euro-denominated fund that held private-label US mortgage securities set off a slow dollar run on big non-US banks. Who knew how much such paper a big bank held and what it was worth? The European Central Bank (ECB) pumped €95 billion into banks, and the Fed lowered its discount rate on bilateral loans. But the stigma of needing such loans kept banks away.

Starting in the second half of 2007, managers of a large source of dollar funding for non-US banks, official dollar FX reserves, took notice as top-rated banks reported losses on US

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<sup>9</sup> See McCauley (2001). The Treasury bill future finally died in 2004. See Kreicher et al. (2014).

<sup>10</sup> See McCauley and Seth (1992), who describe how an asymmetry in the eurodollar reserve requirement's application to US chartered banks versus foreign banks' US branches at times gave foreign banks a funding advantage over US banks in their US lending.

<sup>11</sup> Schweitzer and Venkatu (2009) showed that LIBOR replaced domestic interest rate benchmarks in most prime ARMs and in all subprime ARMs in Ohio in the 2000s.

mortgage-backed securities. Reserve managers began to reduce their exposure to Swiss and then other European banks (McCauley and Rigaudy 2011).

The Fed ultimately supported the dollar funding of non-US banks in three ways. First, the Fed turned its discount window into a stigma-free source of funding for banks, not least foreign bank branches, and recruited foreign central banks to lend in parallel. Second, after the Lehman Brothers failure set off a run on money market funds, the largest source of dollars for non-US banks, the Fed pumped emergency credit into the funds and the commercial paper market. Finally, breaking the link to the discount window, the Fed extended term credit to non-US banks offshore through unlimited central bank swaps.

Going solo to the discount window brought stigma, but the Fed's auctioning of term discount window loans could exploit strength in numbers. As the Fed planned to broadly auction discount window credit in September 2007, it and the ECB discussed a swap. As later recalled by Nathan Sheets, then head of the International Division of the Board, "The ECB initially sought to strike a posture that it was merely supporting the Fed's efforts to counter US-centric and dollar-centric stresses, rather than embracing its role as the Fed's full partner in fighting a crisis that was centered in the United States but that had truly global dimensions" (Sheets et al. 2018). If the FRBNY were auctioning off 28-day loans, the ECB would be happy to offer Fed-provided dollars for the same term against euro collateral in European time. As the then head of ECB market operations later put it, the ECB would serve as the 13th Federal Reserve Bank (Papadia 2013).

When the Term Auction Facility (TAF) finally got under way in December 2007, foreign banks' US branches were overrepresented among the takers, but they were limited by their US collateral. Swap lines of up to \$20 billion with the ECB and \$4 billion with the Swiss National Bank (SNB) widened the collateral against which European banks could borrow dollars in parallel operations. On the eve of the Lehman Brothers failure, the swap lines, upped to \$55 billion for the ECB and \$6 billion for the SNB, continued to play a supporting role to the discount window auctions, where non-US banks had taken down the bulk of the \$150 billion outstanding (Benmelech 2012).

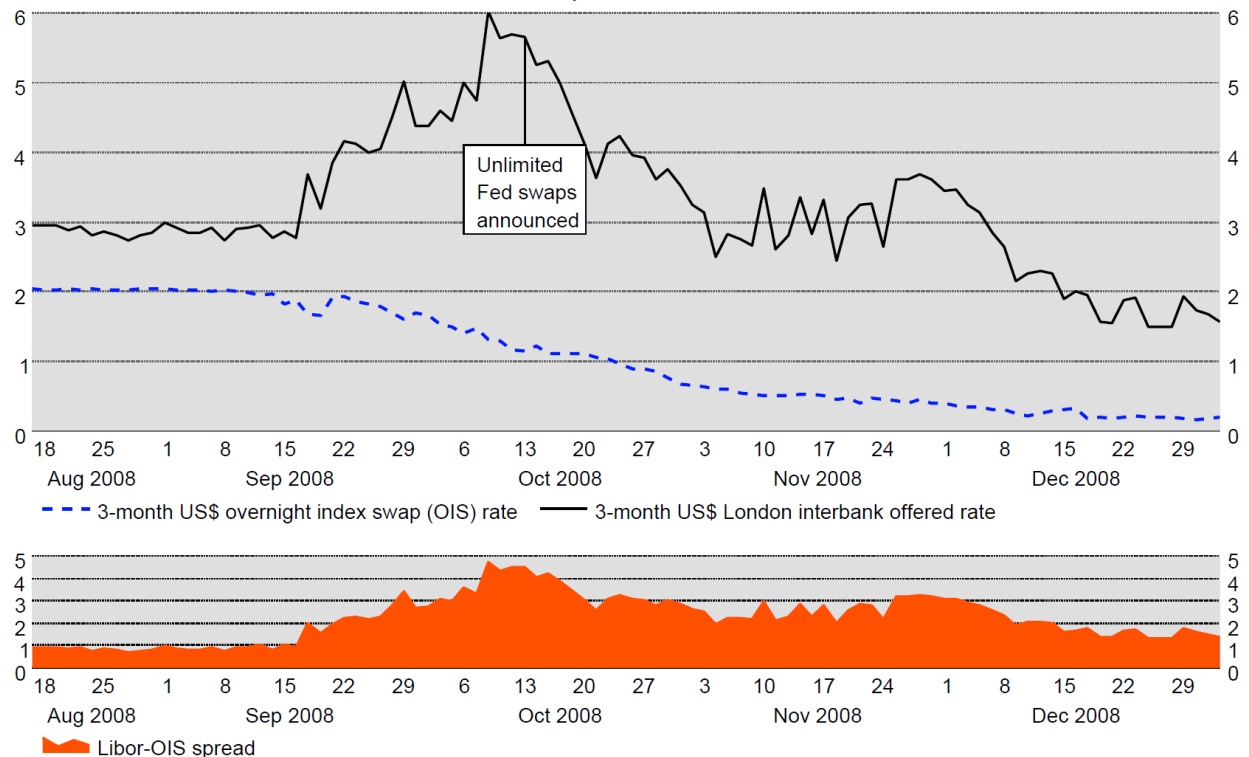
With the September 2008 failure of Lehman Brothers and the "breaking of the buck" at the oldest money market fund, the slow run on big non-US banks turned into a fast one (Baba et al. 2009). As institutional holders of "prime" money market funds shifted into government money market funds, the former funds cashed in eurodollar deposits, domestic deposits, and commercial paper issued by non-US banks.

The Fed and the Treasury stepped in to stop the run on money-market funds by the end of September. A US Treasury guarantee of money-market funds and an emergency Fed program in effect to buy asset-backed commercial paper from money market funds (reinforced in October with a program to underwrite the rollover of commercial paper) helped to arrest the

run on money-market funds. This was a domestic buyer of last resort operation, but it eventually halted the run on non-US banks' borrowing from money market funds and in the commercial paper market. But damage had been done, with non-US banks losing at least \$175 billion in the 11 business days starting September 16 (Baba et al. 2009). As a result, the transmission of the Fed's policy to the rates paid by US corporations and US households with adjustable-rate mortgages broke down.

Figure 3 shows how three-month LIBOR started rising with the Lehman failure in September and continued to rise unevenly into October, despite the stabilization of money market funds. Expected overnight rates over the next three months as captured in overnight index swaps began to decline in mid-September, and the Federal Open Market Committee (FOMC) ratified these expectations by lowering its target fed funds rate by 50 basis points on October 8.

**Figure 3: Central Bank Swaps Lower Three-Month Dollar LIBOR in 2008**



Note: Data are shown in percent.

Source: Refinitiv Datastream and author's calculations

LIBOR rose even as central banks expanded their swap lines to replace the private dollar funding that non-US banks were losing. Initially, the swap line with the ECB was doubled to \$110 billion, and that to the SNB was quadrupled. The Fed agreed to new lines for the Bank of Japan, Bank of England, and the Bank of Canada totaling \$110 billion. On September 29, central banks agreed to at least double all these swap lines. Still the gap between a rising three-month LIBOR and a falling three-month overnight index swap (OIS) topped 4 percent.

On October 13, central banks announced fatefully that “sizes of the reciprocal currency arrangements (swap lines) between the Federal Reserve and the BoE, the ECB, and the SNB [and the Bank of Japan on the following day] will be increased to accommodate whatever quantity of US dollar funding is demanded [at fixed rates].” The agreed price became OIS plus 100 basis points, breaking the link with the TAF pricing (Goldberg et al. 2010). As Jaime Caruana, general manager of the BIS noted later, “the extension of such swaps in unlimited amounts represents a turn in central bank cooperation that the founders of the BIS [in the 1920s] would have found unimaginable.” In mid-September, the Lehman Brothers failure was a Minsky moment; in mid-October came a Kindleberger moment.

At the peak, the Fed had swapped almost \$600 billion, mostly to the ECB, the Bank of Japan, the Bank of England, and the SNB. These in turn distributed the funds to banks that could offer collateral that these central banks found satisfactory. This amount represented 5-6 percent of eurodollar liabilities of banks headquartered outside the United States.

The Fed’s open-handedness worked to lower the short-term dollar rates that mattered most. Over the rest of the month of October, LIBOR fell by about 2.5 percentage points and the spread over expected fed funds rates halved. Three-month LIBOR might well have fallen faster if unlimited swaps at the three-month maturity, not just at the one-month maturity, had been offered before November 2008.<sup>12</sup>

Likewise, the rate premium for borrowing dollars against foreign exchange collateral narrowed in response to the expansion of the swap lines (Baba and Packer 2009). The rate at which non-US banks could borrow dollars against euro, yen, and other currencies fell back toward outright dollar borrowing rates like LIBOR or repurchase rates. Institutional investors outside the United States were able to roll over hedges of US securities holdings, instead of engaging in fire sales. Unlimited swaps effectively backstopped both the offshore deposit market and the FX swap market (Mehrling 2015).

## **2020**

The onset of the Covid-19 pandemic in March 2020 led to financial strains both similar to those in 2008 and entirely different ones in the bond market. This subsection sketches the Fed’s response to the similar strains in short-term funding markets, while the next section sketches the Fed’s response to the bond market strains.

When in March 2020 market participants began to understand the threat of the Covid pandemic, they responded in a dash for cash. Firms worried that revenues would crash to zero, leaving cash flows deeply negative. The “cash” resources of the corporate treasury, often

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<sup>12</sup> Goldberg et al. (2010, p. 10) note the strong demand for the three-month maturity: “The large discrete jumps in outstanding dollar balances coincided with the first two full allotment 84-day dollar auctions on November 6, 2008 and December 4, 2008; together these auctions accounted for an additional \$129 billion and \$114 billion, respectively.”

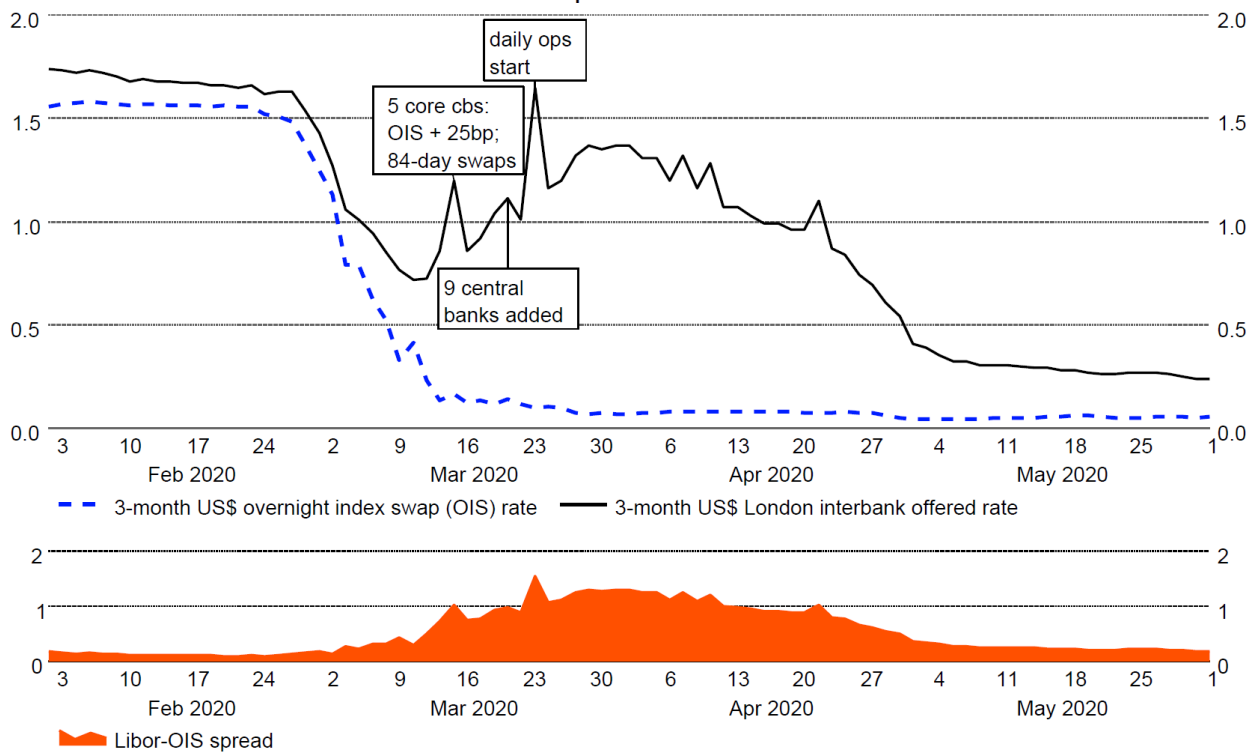
invested more for yield than immediate availability, suddenly needed to be really liquid. And firms drew down credit lines with banks to bulk up on bank deposits. US banks did not suffer runs, as in 2008, but they prepared for large cash calls on committed lines of credit.

As in 2008, the riskier money market funds suffered runs. Investing in bank and corporate IOUs, “prime” money market funds experienced large redemptions in March 2020 (IOSCO 2020, p. 13). This time none broke the buck or impeded liquidations. Still, as money market funds paid out to redeem shares, they did not roll over maturing commercial paper and placements in non-US banks. Onshore and offshore money market fund claims on non-US banks dropped by \$200 billion in February–March 2020 (Aldasoro et al. 2021).

The Fed quickly consulted its playbook from 2008 and stabilized money market funds and their funding of non-US banks. The Fed rolled out emergency facilities to inject its credit into the commercial paper market as buyer of last resort. On March 17 it revived a program to underwrite new issues of commercial paper, reassuring investors that maturing paper could be rolled over. On March 18, the Fed revived a 2008 Federal Reserve Bank of Boston facility in effect to buy outstanding commercial paper (not just asset-backed commercial paper as in 2008) held by money market funds.

To enable non-US banks to access dollars and thereby to replace their lost funding, the Fed reactivated the swap lines. In 2007–08, the Fed had taken a year to widen access to larger amounts for more central banks, for longer maturities, in more frequent operations. Playbook in hand, the Fed took these steps in days in March 2020.

Once again, as non-US banks scrambled for dollars, LIBOR began lifting off from the Fed’s policy interest rate. Even as the Fed lowered its federal fund policy rate, as reflected in the expected overnight rate (the overnight index swap or OIS) in figure 4, the key three-month LIBOR began to rise on March 12.

**Figure 4: Central Bank Swaps Lower Three-Month Dollar LIBOR in 2020**

Note: Data are shown in percent.

Source: Refinitiv Datastream and author's calculations

Swiftly, the Fed acted to keep the transmission of its interest rate policy to the real economy from breaking down. The very next day, the Fed eased its interest rate on central bank swaps from OIS+50 basis points to OIS+25 basis points for five core central banks with standing swaps; it also offered 84-day swaps. LIBOR fell but then began to rise again, and the Fed extended the swaps to the other nine central banks on March 19.<sup>13</sup> The start of daily swap operations on March 23 marked the local maximum of LIBOR, which fell to within 25 basis points of OIS by early May. With these swift moves, Fed credit extended to central banks through swaps rose much more sharply in 2020 than in 2008 but peaked at a lower level at less than \$500 billion. Much faster than in 2008, the Fed brought down the premium on borrowed dollars in the eurodollar market and in the FX swap market (Choi et al. 2022). The Fed's swaps ensured that pandemic did not raise the benchmark rate payable by US firms and households.

## The 2020 Bond Market Crisis and the Fed as Buyer of Last Resort

The dash for cash at the onset of the Covid-19 pandemic also hit the bond market. Extremely heavy selling destabilized both the global benchmark bond market, the market for US

<sup>13</sup> Kekre and Lenel (2023) find large high-frequency responses of three-month LIBOR futures to the Fed announcements of March 19 (nine central banks added) and March 20 (daily operations).

Treasuries, and also the US corporate bond market, the main outside funding source for US corporations.

Hedge funds, foreign central banks, and bond mutual funds for different reasons each sold something like \$250 billion in bonds in weeks starting in March 2020. Hedge funds unwound suddenly loss-making trades that featured highly leveraged cash bond holdings, financed overnight, against short bond futures positions (Vissing-Jørgensen 2021). Central banks sold US Treasuries to raise cash to support their currencies or their dollar-borrowing banks (Weiss 2022a), and bond mutual funds had to sell as investors redeemed their holdings in response to extraordinary losses (Collins 2021). Selling overwhelmed the capacity of dealers to make markets, strained by work from home.

In response to Treasury bond selling and the spike in Treasury rates, the Fed entered the market as a determined, rapid, and heavy buyer. The operating instruction to the open market desk at the New York Fed charged it with buying Treasury and agency securities “in the amounts needed” to restore the proper functioning of the market (Logan 2020). In the three weeks between March 11 and April 2, the Fed bought no less than \$900 billion of Treasury and agency securities. Thus, the Fed more than offset the main sources of domestic and foreign official selling of US Treasuries. For foreign official sellers of US Treasury bonds, Fed buying allowed them to turn securities with wildly fluctuating prices set in suddenly illiquid markets into bank deposits or secured placements with the New York Fed (repos).

Watching central banks selling US Treasuries, only to see them sit on much of the cash at the New York Fed, led the Fed at the end of March to offer overnight advances to central banks using US Treasuries held in custody at FRBNY as collateral at a rate above private repo rates. Appendix A discusses the now standing Foreign and International Monetary Authorities (FIMA) repo facility.

Dislocations were evident in the corporate bond market as well, and the Fed responded speedily. As mutual funds sold corporate bonds, these went to big discounts to prices implied by credit derivatives. Such market dynamics threatened to cut off US firms’ major source of financing of investment and hiring and even to cause defaults if maturing bonds could not be refinanced. On March 17 the Fed announced that it would use its emergency powers to lend to its primary dealers—that is, its bond market counterparties—as it had in 2008. With this assurance of funding, the dealers could make markets and arbitrage cash and derivatives markets. On March 20 the Fed extended the first loans to the primary dealers. They offered corporate bonds as collateral for the Fed advances, suggesting that the Fed credit was getting through the dealers to support the corporate bond market (Martin and McLaughlin 2020).

The Fed then took an unprecedented step as corporate bond buyer of last resort. On March 23, it announced that it would buy investment-grade US corporate bonds. The precedent of the Fed in effect buying short-term corporate commercial paper had been set in 2008 and

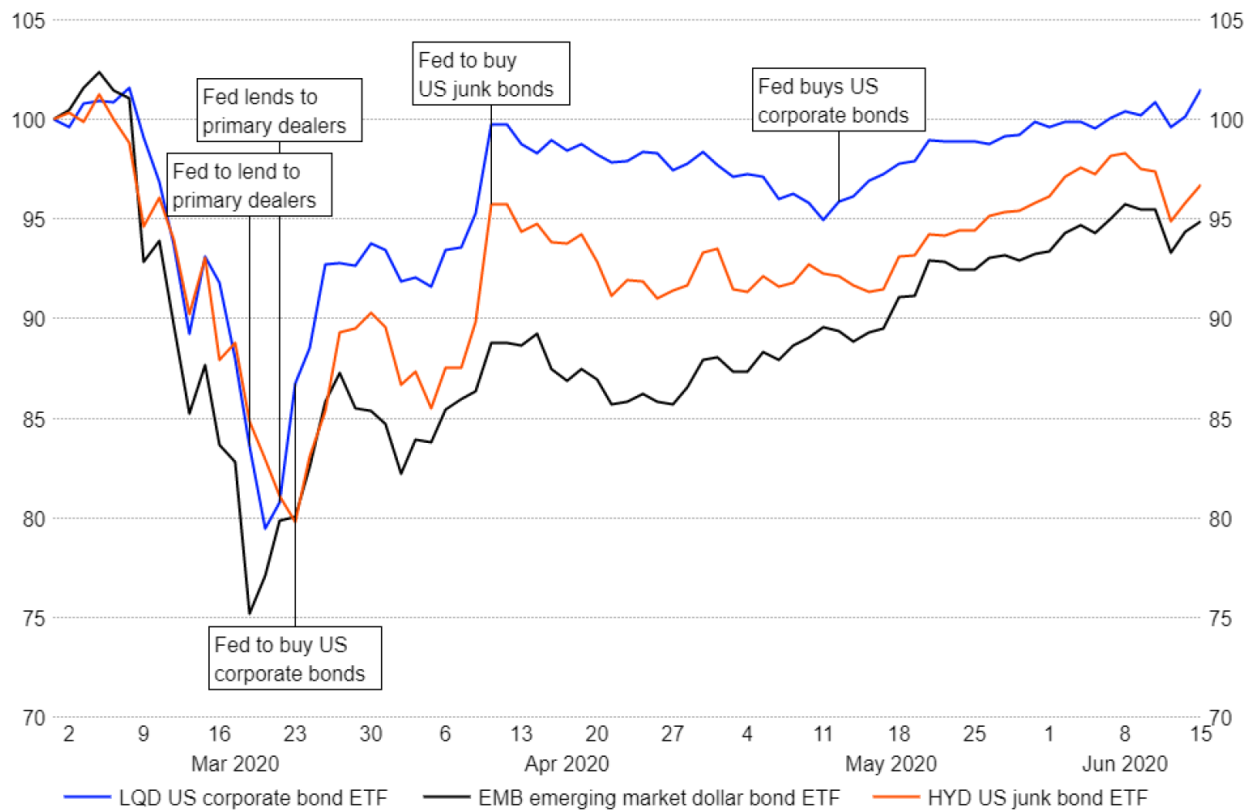
reinforced earlier in March 2020 with the revival of the commercial paper buying program. What was unprecedented was the Fed's backstopping the longer maturity private bonds on which US firms rely most for credit.

One can imagine that the Fed's corporate bond purchases could affect non-Treasury dollar bond prices in one of two ways. The Fed buying could be a thumb on the scale of just those bonds purchased. There was certainly evidence for such: the Fed's announcement highlighted its intention to lower yields on short- to medium-term bonds, and their yields fell more markedly, for instance.

Alternatively, the Fed's buying of US corporate bonds could broadly boost the prices of riskier dollar bonds, including those issued by borrowers abroad. This diffusion could work through portfolio substitution by investors, as they sold into the prospective Fed bid for US corporate bonds and bought relatively cheap bonds not targeted by the Fed.

The flow of Fed credit to the primary dealers and the promised flow into US corporate bond funds had a speedy effect on the prices of a wide spectrum of dollar bonds with credit risk. Prices of the exchange-traded funds (ETFs) for investment grade bonds (LQD) and emerging market bonds (EMB) had both bottomed between the Fed announcement of its lending to the primary dealers late on March 17 and its doing so on March 20 (figure 5). This timing points to funding liquidity more than credit concerns, reinforcing the impression conveyed by the gap between US corporate cash bond prices and those of the corresponding credit derivatives.

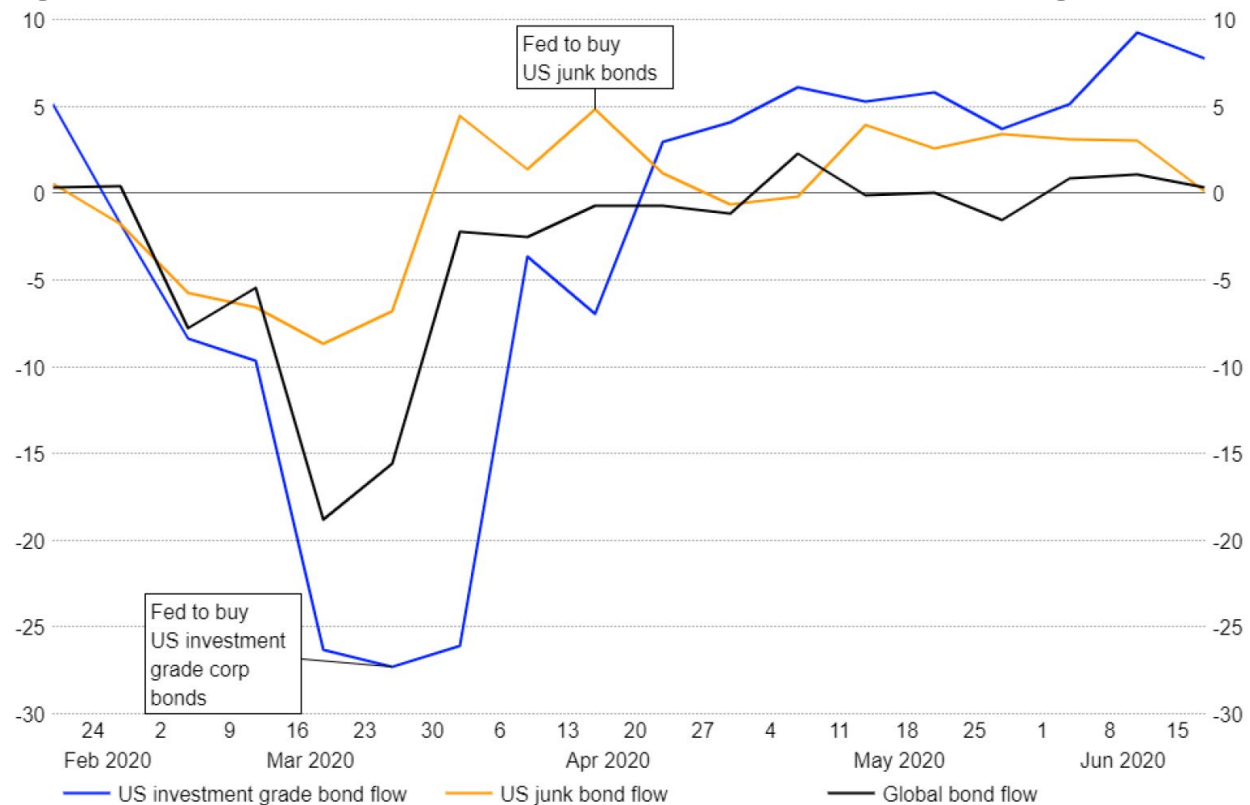
When the Fed announced the buying of investment-grade bonds on March 23, the price of the investment-grade ETF rose for three days. With a one-day lag, both the junk bond and emerging market ETF prices rose for three days as well. When the Fed announced that it would buy junk bonds on April 9 and upped its overall maximum of corporate bond purchases, the prices of all three ETFs jumped the same day. By mid-June 2020, the prices of all three ETFs had recovered substantially. Although the Fed bought corporate bonds and did not buy any emerging market dollar bonds, their price performance did not much differ. The effect of the Fed purchase of US corporate bonds seemed to diffuse widely to dollar bonds issued by borrowers in the rest of the world.

**Figure 5: Emerging Market Bond Prices Rise on Fed US Corporate Bond Buying in 2020**

Note: Data depict indices of ETF prices that are indexed so February 28 = 100.

Source: Refinitiv Datastream, Federal Reserve, and author's calculations

Flows into bond funds point to the conclusion that the Fed's promise to purchase corporate bonds similarly turned around flows into global bond funds. Outflows from global bond funds seemed to respond more quickly to the Fed announcement than did outflows from investment grade bonds (figure 6). But broadly flows into the global dollar bonds that the Fed never bought tracked those of the ones that it did buy. With the flows, as with the prices, the effect of the Fed announcement seemed to diffuse beyond US corporate bonds to dollar bonds from issuers in the rest of the world.

**Figure 6: Global Dollar Bond Outflows Stop on Fed US Corporate Bond Buying in 2020**

Note: Data depict billions of dollars per week.

Source: Investment Company Institute

In sum, in March 2020 the combination of the Fed's last-resort lending to securities dealers and its announcement of last-resort buying of US corporate bonds had a welcome unintended consequence. Not only US corporate bonds but also emerging market dollar bonds bottomed in price between the announcement of the primary dealer lending and the first loans. It appears that Fed credit enabled the primary dealers to make markets in all sorts of dollar bonds embodying credit risk, both domestic and foreign. And after the Fed's announcement that it would buy US corporate bonds, US corporate and emerging market bonds rose in similar fashion. Evidently, investors treat domestic and foreign dollar bonds as close substitutes in their credit portfolios. Lending to bond dealers and buying domestic bonds, the Fed halted an incipient run on funds holding dollar bonds issued by non-US obligors, which in turn prevented fire-sales of dollar bonds issued by borrowers outside the United States. In effect, if not in intention, the Fed backstopped the global dollar bond market.

### The Who's Who of Fed Swaps: High Coverage and Wide Diffusion

In extending swap lines, the Fed has drawn two lines. The Fed has established standing swap lines with the Bank of Canada, the Bank of England, the ECB, the Bank of Japan, and the SNB. These lines have no ex ante fixed limits in terms of the number of dollars extended. Drawing a second line, in 2008 and 2020 the Fed established temporary and limited lines with five

advanced economies—the Nordic countries (Denmark, Norway, and Sweden), Australia, and New Zealand—and four emerging economies (as they were called in 2008)—Brazil, Mexico, Singapore, and South Korea.

As might be readily imagined, such line drawing has led to a great deal of discussion. In the reverse engineering of the Fed’s choices, trade relations, US banking exposure, politico-military relations, and UN voting alignment, among other factors, have attracted attention.<sup>14</sup> Tucker (2022) invokes politics to argue that the Fed should have extended a swap line to the Reserve Bank of India (RBI) in 2008.

From the standpoint of offshore dollar debt, however, the Fed’s choice of swap partners is remarkably inclusive. Recall from the left-hand panel of figure 2 that non-US banks have \$13 trillion in dollar liabilities booked outside the United States. Figure 2’s right-hand panel shows that the banks from the five countries whose central banks have standing swap lines with the Fed account for almost two-thirds of that sum, or about \$8 trillion.<sup>15</sup> Add the dollar debt outside the United States of banks whose central banks had temporary Fed swap lines, and the coverage reaches almost three-quarters, a share that has actually risen since Chinese bank dollar liabilities started to decline in mid-2021. Thus, the Fed’s choice of 14 central banks backstops three-quarters of the offshore dollar debts of banks headquartered outside the United States.

As noted above, the largest offshore dollar market is FX swaps, so they provide a more apt measure of the Fed’s breadth of swap partners. Providing dollars through central bank swaps relieves shortages of dollars on loan in the FX market and reduces the premium on yield on dollars borrowed through FX swaps, with knock-on effects on other dollar lending markets.

To maximize the effect on dollar rates payable in FX swaps, the Fed could have partnered with the 14 central banks whose currencies are used as collateral for the most dollar borrowing. Such a criterion respects the hierarchical nature of the FX market, as emphasized by the “key currency” view from the 1930s to today (Mehrling 2022).

This criterion might be termed the *cosmopolitan criterion*, since it makes no reference to US trade, investment, or bank lending on the one hand, or alliance politics or UN voting record on the other. It is related to the criteria of “economic and financial mass” as cited by the Federal Reserve (2008) officials in the October 28, 2008, FOMC meeting in proposing the

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<sup>14</sup> Aizenman and Pasricha (2010) and Aizenman et al. (2022) find US military alliances affect the Fed’s choice of swap partners, while Cassetta (2022) finds that UN voting alignment makes a difference, though it is not clear how big a difference.

<sup>15</sup> Das et al. (2023) posit dollar FX reserves backstopping dollar corporate liabilities in the home country. Here dollar swaps backstop dollar bank liabilities by nationality on a global basis.

emerging market swap partners, of course, but it is more precise. The criterion is not the Fed’s “logic in use,” but rather a “reconstructed logic.”

What if the Fed had decided to do swaps with the central banks with the top 14 currencies against which the dollar was borrowed in FX swaps as reported in the April 2007 Triennial Survey of FX turnover?<sup>16</sup> This simple decision rule matches the Fed’s choices very well (table 1). Out of the 27 currencies profiled by the Triennial Survey, the “Top 14” rule would have predicted 85.2 percent of the Fed’s choices of central bank swap partners.<sup>17</sup> Dollar/rupee FX swap turnover, quite apart from politics, pointed to the Reserve Bank of India as a possible swap partner. Indeed, in the FOMC meeting that approved the extension of swaps to 14 central banks, senior Board staffer Nathan Sheets identified India as the next candidate for a swap: number 15, as it were (Federal Reserve 2008, p. 29).

**Table 1: FX Swap Turnover in April 2007 and Fed Swap Lines, 2008**

		Fed swap?		Total
		Yes	No	
FX swap turnover, April 2007	Top 14	12	HKMA, RBI	14
	Bottom 13	CB of Brazil, RBNZ	11	13
	Total	14	13	27

Note: HKMA = Hong Kong Monetary Authority; RBI = Reserve Bank of India; RBNZ = Reserve Bank of New Zealand. Chi-squared statistic with Yatesman correction is 10.69, p-value of <.0011, allowing the rejection of the hypothesis of independence of April 2007 FX swap turnover and Fed 2008 swap lines. The top 14 decision rule correctly predicts 85.2 percent of choices.

Source: BIS, *Triennial Central Bank Survey of Foreign Exchange and Over-the-Counter (OTC) Derivatives Markets*, 2007, statistical annex tables, table E.2, December 19, 2007, pp. 62–63; Federal Reserve

However one interprets the misses given this simple criterion,<sup>18</sup> they were not consequential by the measure of FX swap turnover. In particular, including the HKMA and the RBI among the swap partners, and dropping the RBNZ and the Central Bank of Brazil, would have raised the coverage of global dollar swaps from 82.1 percent of turnover in April 2007 to

<sup>16</sup> The published data detail FX swaps against dollars for 21 currencies only, so dollar swaps for the Thai baht, Hungarian forint, Czech crown, Philippine peso, and Indonesian rupiah are estimated as the product of domestic currency swaps against all currencies times the share of dollar trading against the domestic currency in the home market. FX swaps against dollars in April 2007 were 92.2 percent of all FX swaps.

<sup>17</sup> The Brazilian authorities have prevented dollar borrowing against the real. The real trades forward as an exchange-traded futures at home and a nondeliverable forward abroad. See McCauley et al. (2014) and McCauley and Shu (2016), especially graph 3 on p. 84.

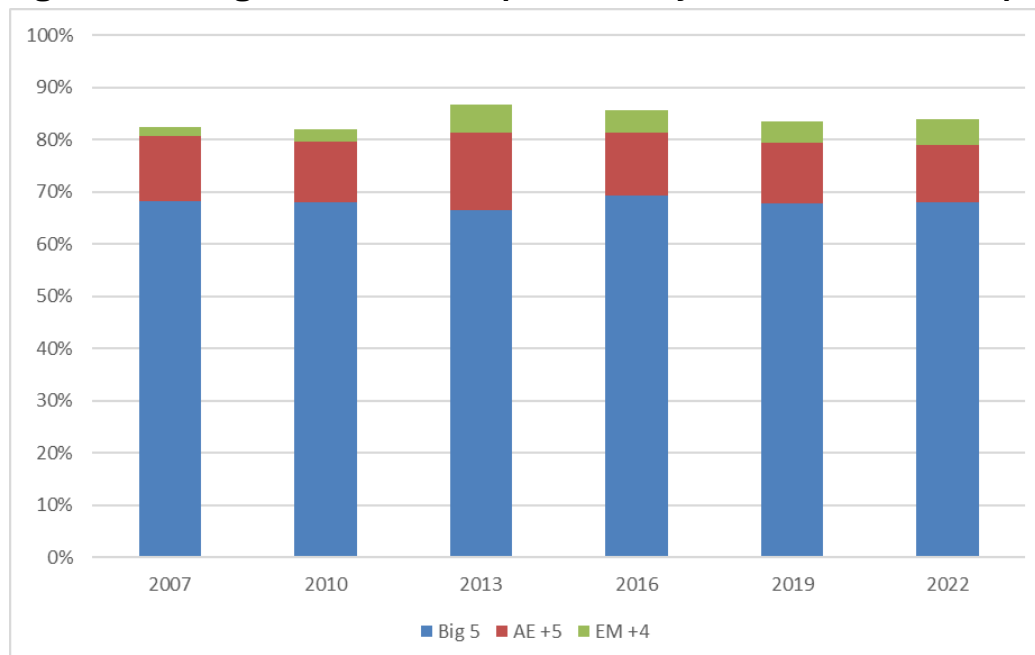
<sup>18</sup> According to Federal Financial Institutions Examination Council (2008), in March 2008, US bank exposure to India (\$51.0 billion) and Brazil (\$49.2 billion) well exceeded that to Hong Kong, SAR (\$30.6 billion) and to New Zealand (\$3.4 billion). Weiss (2022b) categorizes New Zealand and Brazil as closer geopolitically to the United States than India or Hong Kong.

85.0 percent. On this showing, the Fed’s choices covered turnover equal to 96.6 percent of the maximum achievable on the 2007 turnover data with 14 swap partners. This merits an A.

What is more, the currencies of the Fed’s swap partners in 2008 have held their share in FX swap trading since. Figure 7 shows that the FX swap share of the 14 broken down by the big 5, advanced economy 5, and emerging market 4. In the 2007 survey, the 14 accounted for 82.4 percent of all the dollars borrowed and lent in FX swaps. By 2022, the share had edged up to 83.8 percent, which occurred despite turnover in the renminbi FX swaps rising from nothing to between those in the Swiss franc and the Canadian dollar.

Using the 2022 Triennial Survey results, the Fed’s 14 choices still hit 12 of the top FX swap currencies. The misses became the renminbi and the Hong Kong dollar (table B.2).

**Figure 7: Coverage of Dollar FX Swap Turnover by Fed Central Bank Swaps, 2007–22**



Note: The Big 5 comprises the European Central Bank, Bank of Japan, Bank of England, Bank of Canada, and Swiss National Bank. Advanced economy (AE) 5 comprises the Reserve Bank of Australia, Riksbank, Norges Bank, Danmarks Nationalbank, and Reserve Bank of New Zealand. Emerging market (EM) 4 comprises the Monetary Authority of Singapore, Banco de Mexico, Bank of Korea, and Central Bank of Brazil.

Source: BIS (2007, 2010, 2013, 2016, 2019, and 2022), author’s estimates for Danish krone, and author’s calculations

In sum, the seeming narrowness of the Fed’s choices of swap partners belies their wide coverage of dollar borrowing abroad, both by non-US banks and in the FX market. And it is remarkable how closely the Fed’s choices corresponded to a global criterion of extending the swaps to the central banks with currencies that are most used to borrow dollars in FX swaps.

Even this way of looking at the matter is too narrow. Just because the Fed swaps dollars to a given central bank does not mean that the banks that borrow the dollars turn around and lend the dollars against that central bank’s currency. Banks can deploy the dollars elsewhere, and the effect can diffuse more widely (Aizenman et al. 2022).

This is borne out by analysis at the ECB. In March 2020, when the ECB swapped in dollars from the Fed and lent them out to banks in the euro area, transaction-by-transaction ECB data on the 50 largest euro area banks showed that much, but by no means all, of the proceeds were indeed lent in the FX swap market against euros (Persi 2020).<sup>19</sup> While the ECB lent out \$140 billion obtained from the Fed, the banks that borrowed from the ECB upped their lending of dollars in the FX swap market against euros by \$79 billion.

Where did the remaining \$61 billion go? The decline of the premium on borrowing dollars against Swedish kroner in parallel with that on borrowing dollars against euro points to one use of it. As the ECB drew on the daily swaps with the Fed starting March 18 to lend dollars to banks in the euro area, dollar rates in euro and kroner swaps fell. This occurred days before the Riksbank agreed to a swap with the FRBNY and weeks before the Riksbank's first dollar lending operation. A Riksbank analysis concluded: "The foreign exchange swap market in Europe, including Sweden, started to function better particularly once the ECB commenced its extensive dollar auctions" (Gislén et al. 2021).

How could this have happened? Economists who have analyzed the effect of the central bank swaps on FX swap pricing have approached this case as if it were a drug trial, in which the euro/dollar rate was treated and the kroner/dollar got the placebo. But the dollars that the ECB lends out to banks do not carry instructions. Among the dollar takers from the ECB could have been affiliates of Swedish banks in Frankfurt that used the dollars to lend against Swedish kroner in the swap market. Or a French bank might have seen more return in lending dollars obtained from the ECB against kroner than against the euro. Or a French bank might have swapped the dollars with a US bank against yen, and the US bank might have swapped the dollars for kroner.<sup>20</sup> In any case, a Swedish pension fund could have been the counterparty, rolling over its dollar borrowing through a swap in order to maintain a currency hedge on a US dollar bond holding. Whatever the pathway, as the Fed provided dollars to the ECB, the cost of the dollar hedge paid by the Swedish pension fund normalized.

In general, what starts as an official swap of dollars against euros can ultimately end up funding a private swap of dollars against any currency. Dollar borrowing costs in the currency of the central bank that lends the dollars obtained from the Fed might be the first to show the effect. But the effect of the Fed's swaps with the selected central banks can diffuse and lower

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<sup>19</sup> See Bahaj and Reis (2022) for a discussion of the use of swap proceeds to replace dollar funding, to lend dollars in the swap market or to buy US dollar assets, or, one might add, to increase liquid dollar holdings, including at the Fed—the "hoarding" case.

<sup>20</sup> Klocks et al. (2023) find that US banks are, counterintuitively, net borrowers of dollars in FX swaps from other banks, including those in the euro area, and net lenders of dollars to nonbanks in FX swaps.

dollar borrowing costs against other currencies whose central banks are not swap counterparties with the Fed.<sup>21</sup>

With its central bank swap lines the Fed has constructed channels that carry its credit to banks in the larger offshore dollar markets. There, market participants decide how broadly to spread the dollars.

## Four Questions

### **Do the swaps lead non-US banks to overextend dollar credit?**

In a world in which non-US banks depend on wholesale dollar funding to extend dollar credit, Fed swap lines can control benchmark dollar rates, counter bank runs, and reduce fire sales of US assets. But by lowering the risk of depending on volatile dollar funding, could they also lead to unwelcome changes in behavior, that is, moral hazard? Might non-US banks overextend dollar credit, from the standpoint of global or US interests (Bahaj and Reis 2022, 2023)?

This question as posed is too narrow. Central banks swaps stabilize bank funding in both cash markets and in the FX swap market. And nonbank financial firms heavily rely on the FX swap market to hedge holdings of dollar securities. Thus any asserted moral hazard must involve not only too many dollar loans but also too many dollar securities holdings with short-term hedges.

It should be noted at the outset that the Fed's uncertain mobilization of central bank swaps in terms of pricing, maturity, and frequency of operations limits bank overreliance on them. Banks cannot plan their liquidity management in stressed markets around swaps.

Nonbanks pose more moral hazard than banks. The potential for banks to act imprudently in the presence of a lender of last resort is familiar in the domestic context, as are the supervisory responses. The difference introduced by the central bank swaps is that the ultimate provider of the last-resort credit, the Fed, is not directly involved in the consolidated supervision of the ultimate borrowers, the non-US banks. Instead, the Fed relies on the home country supervisor to see to it that its banks fund their global dollar books in a prudent manner.<sup>22</sup> In this reliance, the Fed takes comfort from the central bank swap partners'

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<sup>21</sup> Such diffusion may have worked better in 2020 than it did in 2008, when big banks were not well capitalized, and possible credit losses inhibited transactions.

<sup>22</sup> A subtlety arises in the Basel liquidity standard's treatment of prospective inflows and outflows of funds in different currencies. As written, the quantitative standards allow outflows in one currency to be offset by inflows in another currency. But in supervisory practice including stress tests, banks would not be allowed to assume that a stressed FX swap market would frictionlessly transform liquidity from one currency to another. The Swedish bank supervisory authority has gone so far as to impose the liquidity standard separately for the dollar and euro, given Swedish banks' foreign currency funding approaching twice Swedish GDP (Sveriges Riksbank 2017, p. 34). For their part, the Japanese bank supervisors have urged Japanese banks to increase sticky dollar deposits and to rely less on short-term FX swaps and more on medium-term currency swaps to borrow dollars against yen. IMF (2019, p. 65) constructs

embrace of an international standard under Basel III that limits banks' volatile funding and that requires liquid assets to be held against potential outflows.

Among nonbank financial firms, money-market funds pose persistent moral hazard. Events in 2008 and 2020 amply demonstrated the financial fragility of the “prime” funds that provide short-term dollar funding to non-US banks. They suffered investor runs, with knock-on effects to non-US bank funding through bank deposits and commercial paper. The Fed twice both used its emergency powers to extend, both directly and indirectly, its credit to these nonbanks, and swapped dollars to replace their funding of non-US banks. Yet the fragility remains. As Bouveret et al. (2022) noted:

...reforms put in place in the prior decade in the United States and Europe proved insufficient to contain the runs in March 2020. The difficulty of implementing effective reforms reflects, at least in part, the benefits of MMFs [money market funds] as they are currently structured for broad constituencies of investors, issuers, and asset managers and the implicit subsidies they receive from central bank support when MMF runs occur. Indeed, recent comment letters from the MMF industry express near-universal opposition to all structural reform options, including swing pricing and capital buffers.

Despite such opposition, incoming SEC rules require US money market funds to levy fees on daily redemptions in excess of 5 percent of assets, and this requirement might limit moral hazard. Fund families may convert the remaining US “prime” funds most subject to runs into less fragile government funds.<sup>23</sup> Such a shift would make it less likely that instability in money funds' still sizeable funding of banks (Aldasoro and Doerr 2023) will lead the Fed to use central bank swaps to provide funding to non-US banks.

Non-US pension funds, insurers and investment funds that run big dollar maturity mismatches also pose moral hazard. It is not unusual for such nonbanks to roll over three-month swaps to hedge 10-year dollar bond holdings, although data to assess such mismatches are lacking (CGFS 2020). Thus, sustained disruption of dollar funding markets can face these long-term investors with a choice between letting their hedges run off (by buying dollar spot) or selling their dollar securities. Central bank swaps allow these institutional investors to roll over

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liquidity measures that suggest that dollar liquidity improved in 2010–18 across 14 national banking systems but remained generally lower than all-currency liquidity. CGFS (2020, p. 31) shows improved regulatory dollar liquidity risk measures up to 2017 or 2019.

<sup>23</sup> Harriet Clarfelt and Brooke Masters, “Managers to shut or convert \$220 bn of US money market funds before rule change,” *Financial Times*, April 11, 2024.

their dollar borrowing in FX swaps (McGuire et al. 2021) and thereby prevent a cascade of dollar buying<sup>24</sup> or a firesale of dollar securities.

But just as money market fund managers have resisted reforms, many long-term investors continue to rely on short-term hedges. The moral hazard problem is most acute among nonbanks on whom central banks have least influence.

### **With LIBOR gone, should the Fed still care about offshore dollar funding strains?**

When the pandemic hit in March 2020, the cash flows of US firms and households remained immediately exposed to offshore dollar funding strains. Corporate loans and adjustable-rate mortgages were still priced at spreads over LIBOR. As of April 2023, the last LIBOR futures became SOFR (secured overnight financing rate) futures, a rate set in domestically cleared repo transactions against US Treasury securities and published by FRBNY. Loan and mortgage contracts now reference SOFR, not LIBOR. US monetary transmission no longer runs through rates posted by non-US banks in London at the crack of dawn in New York.

Yet strains in the largely offshore market for dollar loans secured by other currencies could still matter for the transmission of US monetary policy to the US economy. While non-US banks dominate the offshore dollar loan market, US banks play a large and pivotal role in the center of the FX swap market (Kloks et al. 2023). In dollar funding squeezes, big US banks can supply dollars to the FX swap market or the repo market. Thus, through the balance sheets of big US banks, acute strains in the FX swap market would tend to put upward pressure on US repo rates and SOFR (Correa et al. 2020, p. 7). It would not be safe to assume that the new domestic benchmark is immune to dislocations in the huge FX swap market.

That said, the Fed’s standing repo facility, adopted in 2021, might cap rises in US repo rates in the face of high rates on dollars lent in the FX swap market. This facility allows the Fed’s primary dealers and eligible bank counterparties to obtain overnight loans against US Treasury, agency, and agency mortgage-backed securities at a rate above normal market rates (the top of the Fed’s target range for federal funds). The stated purpose of this backstop facility is to prevent spillover of high repo rates to the Fed’s targeted federal funds rate (Afonso et al. 2022). However, it also could limit the rise in the benchmark SOFR. Given the access to the standing repo facility and balance-sheet constraints, it is not clear how tight that limit might prove to be.<sup>25</sup>

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<sup>24</sup> When the FX swap market suffered from a “dollar shortage” in late 2008, some institutional investors bought dollars spot to settle their maturing dollar hedges (forward dollar sales) instead of rolling the hedges, which contributed to a sharp dollar appreciation (McCauley and McGuire 2009).

<sup>25</sup> The standing repo facility is cleared and settled through triparty repo at Bank of New York Mellon, while SOFR is based on a wider set of repo trades, including bilateral repo settled through the Fixed Income Clearing Corporation. SOFR may not be capped by the standing repo facility rate.

High dollar rates and dislocations in FX swaps could destabilize US financial markets even if they had a limited impact on SOFR. As noted, much of the customer demand for dollars borrowed through FX swaps arises from pension funds and insurance companies outside the United States that hedge the currency risk of dollar bond holdings. As a result, persistent dislocations in the FX swap market could lead such investors to sell their dollar bonds, possibly at fire-sale prices. In this case, the Fed would do well to pay heed to dollar funding strains abroad.

### **Could central bank swaps fund concerted dollar bond buying of last resort?**

In March and April 2020, the Fed bought US Treasuries hand over fist and also invoked its emergency powers to buy US corporate bonds. The latter succeeded not only in narrowing spreads on US corporate bonds and reversing outflows from corporate bond funds. In addition, the buyer of last resort for US corporate credit also lifted prices and reversed outflows for dollar bonds issued by borrowers outside the United States. This mattered because nonbanks outside the United States now have more dollar bonds outstanding than dollar bank loans (figure 1).

This result was not inevitable, and fire sales of dollar bonds issued abroad could spill back to US credit markets. US corporate bonds amount to about \$12 trillion, while international dollar bonds amount to \$11 trillion.<sup>26</sup> How would a broader bond-buying of last resort operation work?

The division of labor between the Fed and partner central banks in swaps in providing funding to banks could be extended to concerted dollar bond-buying of last resort. In particular, the Fed could swap dollars to its partners, and they could use the dollars to buy bonds issued in dollars by their residents or nationals. Just as with the central bank swaps to date in which the partner central bank accepts the credit risk of (collateralized) lending to its banks, the partner central bank would take the price and credit risk of the bond buying.

Perhaps events would never call for such an operation. Still, it is worth considering how bond buying of last resort could work on a global basis.

### **Is the dollar international lending of last resort getting too large for the Fed?**

If offshore dollar markets grow faster than the US economy, then at some stage they could outgrow the Fed's capacity to provide a backstop (Foulis 2015). This argument a bit resembles Triffin's 1960 claim that the growth of US short-term liabilities in relation to the US gold stock would inevitably lead to instability in the system. Here the growth of offshore dollars in relation to US GDP, taken as the ultimate backing for the Fed's role as international lender of last resort,

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<sup>26</sup> Federal Reserve Financial Accounts of the United States, table L.213, and BIS international debt securities, [https://data.bis.org/topics/IDS/tables-and-dashboards/BIS\\_SEC\\_C3,1.0](https://data.bis.org/topics/IDS/tables-and-dashboards/BIS_SEC_C3,1.0).

is said to undermine its capacity to fulfill the role of stabilizing backstop for offshore dollar markets.

Events in 2020 suggest that this concern is overstated. What is remarkable is how limited were the drawings on the swap lines in relation to the tens of trillions of dollar obligations offshore, much of short maturity, and how quickly the drawings were repaid.<sup>27</sup> The Fed used much more balance sheet in stabilizing the US Treasury market in the spring of 2020 than it did stabilizing the offshore dollar market. A well-designed backstop restored market functioning with relatively limited credit extension (Hauser and Logan 2022).

What is more, it is not even clear that offshore dollars are nowadays growing faster than the US economy. After the Great Financial Crisis, European banks retrenched massively from global dollar intermediation (McCauley et al. 2019). More recently, the cyclical effect of a strong dollar in restraining offshore dollar credit growth makes it hard to discern the secular growth of the offshore dollar (Hardy and von Peter 2023).

There is little reason to suppose that offshore dollars have gotten too big for the Fed to stabilize the market. Geopolitics rather than scale could prove a constraint.

Sino-American relations are evolving in the context of China's substantial engagement with the dollar. Chinese banks have in recent years borrowed over a trillion dollars at home and abroad (figure 2, right-hand panel; Aldasoro et al. 2020). In the renminbi FX swap market, more than \$200 billion is borrowed every day, putting such borrowing between that against the Canadian dollar and the Swiss franc (table B-2). Chinese banks' dollar liabilities outside the United States have shrunk somewhat since 2021 as monetary policies have diverged, but still exceeded \$0.9 trillion in the third quarter of 2023.

China's own official dollar holdings reduce the tension between China's engagement with the dollar and politics. China has self-insured against dollar liquidity strains. The Chinese authorities hold some \$1.5 trillion to \$1.9 trillion in dollar reserves that can backstop both off- and on-balance sheet dollar borrowing.<sup>28</sup> Kodres et al. (2023) find little evidence that official Chinese dollars funded Chinese banks when they experienced stresses in their dollar funding in March 2020.

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<sup>27</sup> Adding the amounts that the Fed spent stabilizing US money market funds and their funding of non-US banks would not alter this judgement.

<sup>28</sup> Weiss (2022b) estimates smaller official Chinese holdings of dollars of \$1.1 trillion based on all Chinese claims on the United States as reported in the Treasury International Capital data, neglecting offshore dollar holdings. Including such holdings, Setser (2023) puts China's holdings at between \$1.8 trillion and \$1.9 trillion. Kodres et al. (2023) assume that the dollar share of China's reserves matches the global share of about 60 percent to get \$1.8 trillion. Dated observations in Ito and McCauley (2020) suggest a range close to the latter sum.

So far, geopolitics have not kept the international lender of last resort in dollars from doing its job. Central banks have the tough job of reconciling the economically stabilizing and the politically possible in a fracturing world.

## **Conclusion**

Large dollar borrowing outside the United States left non-US banks particularly vulnerable to dollar runs in 2008 and 2020. Home central banks could not create dollars to lend to their banks. The Fed's swap lines provided dollars to its partner central banks to lend to banks offshore to withstand the runs.

The Fed's open-ended international lending of last resort in dollars not only supplied the public good of global financial stability. In addition, its lending reduced the benchmark lending rate, LIBOR, thereby maintaining the transmission of the Fed's domestic monetary policy to households and businesses.

Looking forward, central bank cooperation along familiar lines would enable the Fed to backstop offshore dollar funding. In particular, dollars extended to the Fed's swap partners of 2008 could continue to reach a high share of offshore dollar borrowing.

Questions remain about the impact of impending US money market fund reform and the impact of offshore dollar funding strains on US monetary transmission with the new benchmark, SOFR. It might be useful to work through the contingency of last-resort buying of dollar bonds issued by non-US firms by the home central bank.

In closing, perhaps the large offshore dollar funding markets, particularly dollar borrowing in the FX swap markets against key currencies, should be considered to lie at the core of the dollar financial system, like the US Treasury and repo markets (Hauser and Logan 2022). Dysfunction in these markets can impinge on financial stability and monetary transmission. The suggestion here is to adopt a new perspective, not a new tool. Central bank swaps stand ready to enable the Fed to backstop offshore dollar funding markets at times of severe strain.

## Appendix A: The FIMA Repo Facility

In March 2020, during the “dash for cash,” central banks simultaneously sold US Treasuries and parked the proceeds in overnight repos at the New York Fed. In response, the Fed at the end of March offered to agree to provide overnight advances to central banks using US Treasuries held in custody at the New York Fed as collateral at a rate above private repo rates. Such advances would allow central banks to raise cash without forcing outright sales in an already strained Treasury market. Holders of a “large share” of officially held US Treasury securities enrolled in the Foreign and International Monetary Authorities (FIMA) repo facility, which became a standing facility in July 2021 (Kelly 2023, pp. 567–8).

It has remained little used, except in March and April 2023. On March 22, it showed a maximum outstanding amount of \$60 billion, which is the limit for a single user. The Swiss National Bank (2024, pp. 69, 108) reported using \$75 billion in US Treasury collateral at the FIMA repo facility in order to obtain dollars to advance to Credit Suisse.

Observers have welcomed the FIMA repo facility as offering a more inclusive international lender of last resort than the central bank swaps on grounds both economic (Mehrling 2021) and geopolitical (Tucker 2022). FOMC members had discussed repos as a possible substitute for swaps in the October 2008 meeting that approved swaps for four emerging market central banks (Federal Reserve 2008, p. 22). The Swedish and Korean central banks let it be known that they had signed up for the FIMA repo as their temporary Fed swaps expired in 2021, as if they were substitutes (Kelly 2023, p. 567).<sup>29</sup>

It is helpful to put the Fed’s facility into perspective. About 60 percent of FX reserves are invested in the dollar, about half of dollar FX reserves are invested in US Treasury securities, and about 75 percent of official holdings of Treasuries are held in custody at the FRBNY.<sup>30</sup> Taking it altogether, less than a quarter of global FX reserves stand to benefit from the enhanced liquidity under stress of the FRBNY repo offer. This leaves considerable scope for expansion.

If the repo facility proves a very attractive offer one might expect to see:

- The share of US Treasury reserves held in custody at FRBNY rise. The recent trend is hard to discern because of FRBNY holdings are reported at par while the annual surveys are reported at market value.

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<sup>29</sup> Aizenman et al. (2022) treat the swaps and FIMA repo as substitutes.

<sup>30</sup> Potter et al. (2020, p. 369) report, “the New York Fed’s custodial holdings footprint is approximately 75% of total foreign official holdings of US Treasuries...”

- The share of US Treasury securities in US dollar reserves rise.<sup>31</sup> This does not seem to have happened since 2020, although the recent trend could reflect price declines on long-term US Treasuries, which tend to form the longer-duration portion of official FX reserves.
- The share of the dollar in FX reserves rise. The dollar share has continued to trend downward since 2020 as it has for a generation (Arslanalp et al. 2022), rising and falling the dollar strengthens or weakens against the euro and other reserve currencies (Chinn et al. (2022), owing to partial rebalancing of their currency shares.

In short, the FIMA repo facility may turn out to make US Treasury securities held at FRBNY more attractive for FX reserve holdings. But thus far, FX reserve managers in aggregate do not seem to have restructured their portfolios to capitalize on it.

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<sup>31</sup> Choi et al. (2022, p. 109) suggest that “the capacity to convert U.S. Treasury holdings into cash overnight, if needed... may ...make U.S. Treasury assets more attractive to reserve managers by reducing holding costs (reflected in a reduction of liquidity premiums or convenience yields).” This would be a case of benign moral hazard, where insurance changes behavior in a manner that makes the system more resilient.

## Appendix B: Dollar Swap Daily Turnover, 2007 and 2022

**Table B1: Dollar swap turnover by currency, April 2007, in billions of dollars**

Currency	\$ FX swaps
Euro	484.8
Pound	228.4
Yen	214.5
Australian \$	121.4
Swiss franc	81.5
Canadian \$	69.6
Swedish kroner	46.7
<b>Hong Kong \$</b>	<b>43.5</b>
Danish krone*	14.1
Singapore \$	12.1
Norwegian krone	9.2
Korean won	8.4
Mexican peso	7.3
<b>Indian rupee</b>	<b>6.0</b>
South African rand	5.3
Russian ruble	4.8
<b>New Zealand \$</b>	<b>4.2</b>
Thai baht**	4.1
Hungarian forint**	3.3
Polish zloty	2.8
Czech crown**	2.6
New Taiwan dollar	1.3
Philippine peso**	1.1
Chinese yuan	0.9
Turkish lira	0.6
Indonesian rupiah**	0.5
<b>Brazilian real</b>	<b>0.0</b>

Note: \*Estimated as 75 percent of all Danish krone FX swaps, the share of such FX swaps in 2013 and 2016 not against the euro.

\*\*Estimated as the product of the respective currency's FX swaps against all currencies and the fraction of dollar transactions against local currency in the local market.

Source: BIS (2007) and author's calculations

**Table B2: Dollar swap turnover by currency, April 2022, in billions of dollars**

Currency	\$ FX swaps
Euro	1,001.7
Yen	475.6
Pound	438.6
Canadian \$	237.5
<b>Chinese yuan</b>	<b>223.8</b>
Swiss franc	193.5
Australian \$	185.3
<b>Hong Kong \$</b>	<b>118.1</b>
Singapore \$	96.2
Swedish kroner	63.0
Norwegian krone	55.4
New Zealand \$	49.0
Mexican peso	40.7
Danish krone*	32.5
South African rand	29.2
<b>Korean won</b>	<b>27.2</b>
Polish zloty	23.0
Indian rupee	18.8
New Taiwan dollar	9.8
Turkish lira	9.3
Russian rouble	5.8
<b>Brazilian real</b>	<b>2.0</b>

Note: \*Estimated as all Danish krone FX swaps less those against the euro.

Source: BIS (2022) and author's calculations

## References

- Afonso, Gara, Lorie Logan, Antoine Martin, William Riordan, and Patricia Zobel. 2022. The Fed's latest tool: a standing repo facility. *Liberty Street Economics*, January 13.
- Aizenman, Joshua, Hiroyuki Ito, and Gurnain Pasricha. 2022. Central bank swap arrangements in the COVID-19 Crisis. *Journal of International Money and Finance*, vol. 122, 102555.
- Aizenman, Joshua, and Gurnain Pasricha. 2010. Selective swap arrangements and the Global Financial Crisis: analysis and interpretation. *International Review of Economics & Finance*, vol. 19, issue 3: 353–65.
- Aldasoro, Iñaki, Torsten Ehlers, Patrick McGuire, and Goetz von Peter. 2020. Global banks' dollar funding needs and central bank swap lines. *BIS Bulletin*, no. 27, July 16.
- Aldasoro, Iñaki, Egemen Eren, and Wenqian Huang (2021): Dollar funding of non-US banks through Covid-19. *BIS Quarterly Review*, March: 31–40.
- Aldasoro, Iñaki, and Sebastian Doerr. 2023. Who borrows from money market funds?, *BIS Quarterly Review*, December: 47–59.
- Aliber, Robert Z., Charles P. Kindleberger, and Robert N. McCauley. 2023. *Manias, Panics, and Crashes: A History of Financial Crises, 8th edition*. Cham, Switzerland: Springer Nature.
- Arslenalp, Serkan, Barry Eichengreen, and Chima Simpson-Bell. 2022. The stealth erosion of dollar dominance and the rise of nontraditional reserve currencies. *Journal of International Economics*, vol. 138, September, 103656.
- Baba, Naohiko, Robert N. McCauley, and Srichander Ramaswamy. 2009. US dollar money market funds and non-US banks. *BIS Quarterly Review*, March: 65–81.
- Baba, Naohiko, and Frank Packer. 2009. From turmoil to crisis: Dislocations in the FX swap market before and after the failure of Lehman Brothers. *Journal of International Money and Finance*, vol. 28, no. 8 (December): 1350–74.
- Bahaj, Saleem, and Ricardo Reis. 2022. Central bank swap lines: Evidence on the effects of the lender of last resort. *Review of Economic Studies*, vol 89, no. 4, July: 1654–93.
- . 2023. The workings of liquidity lines between central banks. In Refet Gurkaynak and Jonathan Wright, eds., *Research Handbook of Financial Markets*. Cheltenham: Edgar Elgar: 102–24.
- Bank for International Settlements. 2007. *Triennial central bank survey of foreign exchange and over-the-counter (OTC) derivatives markets, 2007, Statistical annex tables*, December 19.
- . 2010, 2013, 2016, 2019, 2022. *Triennial central bank survey of foreign exchange and over-the-counter (OTC) derivatives markets*.
- Benmelech, Efraim. 2012. An empirical analysis of the Fed's Term Auction Facility, *CATO Papers on Public Policy*, 2: 57–91.
- Bordo, Michael, and Robert N. McCauley. 2019. Triffin: Dilemma or myth. *IMF Economic Review*, vol. 67, no. 4, December: 824–51.

- Borio, Claudio, Robert N. McCauley, and Patrick G. McGuire. 2017. FX swaps and forwards: Missing global debt?, *BIS Quarterly Review*, September: 37–54.
- . 2022. Dollar debt in FX swaps and forwards: huge, missing and growing. *BIS Quarterly Review*, December: 67–73.
- Borio, Claudio, Bent Vale, and Goetz von Peter. 2010. Resolving the financial crisis: Are we heeding the lessons from the Nordics? BIS working paper no. 311, June.
- Bouveret, Antoine, Antoine Martin, and Patrick McCabe. 2022. Money market fund vulnerabilities: A global perspective. FEDS working paper no. 2022-12, March 1.
- Carlson, Mark A., and Jonathan D. Rose. 2016. Can a bank run be stopped? Government guarantees and the run on Continental Illinois. Board of Governors of the Federal Reserve System *Finance and Economics Discussion Series* 2016-003, January.
- Cassetta, John Michael. 2022. The geopolitics of swap lines. Harvard Kennedy School of Government Mossavar-Rahmani Center for Business & Government associate working paper series no. 181, March.
- Chinn, Menzie, Hiro Ito, and Robert N. McCauley. 2022. Do central banks rebalance their reserves?, *Journal of International Money and Finance*, vol. 122, 102557.
- Choi, Mark, Linda Goldberg, Robert Lerman, and Fabiola Ravazzolo. 2022. The Fed’s central bank swap lines and FIMA Repo Facility, Federal Reserve Bank of New York *Economic Policy Review* vol. 28, no. 1, June: 93–113.
- Collins, Sean. 2021. Bond mutual fund outflows: A measured investor response to a massive shock. *Investment Company Institute Viewpoint*, March 4.
- Committee on the Global Financial System. 2020. US dollar funding: an international perspective. CGFS Papers no. 65. BIS, June.
- Cooper, Richard. 1965. The interest equalization tax: An experiment in the separation of capital markets. *FinanzArchiv / Public Finance Analysis*, new series, bd. 24, H. 3: 447–71.
- Correa, Ricardo, Wenxin Du, and Gordon Liao. 2020. U.S. banks and global liquidity. Board of Governors International Finance Discussion Papers no. 1289, July.
- Das, Mitali, Gita Gopinath, Taehoon Kim, and Jeremy Stein. 2023. Central banks as dollar lenders of last resort: Implications for regulation and reserve holdings. IMF Working Paper no. WP/23/8, January.
- Dillon, Douglas. 1964. Recorded interview by Professor Seymour Harris, August 18, John F. Kennedy Library Oral History Program.
- Federal Deposit Insurance Corporation. 2023. *History of the Eighties—Lessons for the Future—Volume 1, An Examination of the Banking Crises of the 1980s and Early 1990s*. Washington: FDIC.
- Federal Financial Institutions Examination Council. 2008. Country Exposure Lending Survey, March 31, 2008. June 27.

- Federal Reserve. 2008. Transcript of the Meeting of the Federal Open Market Committee on October 28–29.
- Foulis, Patrick. 2015. The sticky superpower. *Economist* special report, October 3.
- Gislén, Marushia, Ida Hansson, and Ola Melander. 2021. Dollar liquidity from the Federal Reserve to other central banks. Sveriges Riksbank *Economic Review*, no. 1.
- Goldberg, Linda, Craig Kennedy, and Jason Miu. 2010. Central bank dollar swap lines and overseas dollar funding costs. Federal Reserve Bank of New York *Staff Reports* no. 429, January.
- Goodhart, Charles. 2011. *The Basel Committee on Banking Supervision: A history of the early years, 1974–1997*. Cambridge: Cambridge University Press.
- Hardy, Brian, and Goetz von Peter. 2023. Global liquidity: a new phase? *BIS Quarterly Review*, December: 21–31.
- Hauser, Andrew, and Lorie Logan. 2022. Market dysfunction and central bank tools, *Markets Committee Papers*, May 11.
- Holmes, Alan R., and Fred H. Klopstock. 1960. The market for dollar deposits in Europe. Federal Reserve Bank of New York *Monthly Review*, November.
- International Monetary Fund. 2019. Banks’ dollar funding: A source of financial instability. *Global Financial Stability Review*, October: 67–79.
- International Organization of Securities Commissions. 2020. Money market funds during the March–April episode: Thematic note, November.
- Ito, Hiro, and Robert N. McCauley. 2020. Currency composition of foreign exchange reserves. *Journal of International Money and Finance*, vol. 102.
- Kapstein, Ethan B. 2008. Architects of stability? International cooperation among financial supervisors. In Claudio Borio, Gianni Toniolo, and Piet Clement, eds, *Past and Present of Central Bank Cooperation*. Cambridge: Cambridge University Press: 113–52.
- Kekre, Rohan, and Moritz Lenel. 2023. The high frequency effects of dollar swap lines. NBER working paper no. 31901, November.
- Kelly, Steven. 2023. United States: FIMA repo facility, 2020. *Journal of Financial Crises*, vol. 5, no. 1: 558–79.
- Kim, Woonchan, and Yangho Byeon. 2002. Restructuring Korean banks’ short-term debts. In David Coe and Se-Jik Kim, eds., *Korea Crisis and Recovery*. Washington: IMF and Korea Institute for International Economic Policy: 405–48.
- Kindleberger, Charles. 1967. *The Politics of International Money and World Language*, Princeton Essays in international Finance, no. 61. Princeton, N.J.: International Finance Section, August.
- Kloks, Pēteris, Patrick McGuire, Angelo Rinaldo, and Vladyslav Sushko. 2023. Bank positions in FX swaps: Insights from CLS. *BIS Quarterly Review*, September 18: 17–31.

- Kodres, Laura, Leslie Sheng Shen, and Darrell Duffie. 2023. Dollar funding stresses in China. In Robert Aliber, Mar Gudmundsson, and Gylfi Zoega, eds, *Fault Lines After COVID-19*. Cham, Switzerland: Palgrave Macmillan: 109–31.
- Kreicher, Lawrence, Robert N. McCauley, and Philip Wooldridge. 2014. Benchmark tipping in the global bond market. *BIS working paper* no. 466, October.
- Logan, Lorie. 2020. Treasury market liquidity and early lessons from the pandemic shock. Remarks at Brookings-Chicago Booth Task Force on Financial Stability (TFFS) meeting, panel on market liquidity, October 23.
- Martin, Antoine, and Susan McLaughlin. 2020. The Primary Dealer Credit Facility. *Liberty Street Economics*, May 27.
- McCauley, Robert N. 2001. Benchmark tipping in the money and bond markets. *BIS Quarterly Review*, March: 39–45.
- McCauley, Robert N., Augustin Benetrix, Patrick McGuire, and Goetz von Peter. 2019. Financial deglobalisation in banking? *Journal of International Money and Finance*, vol. 94: 116–31.
- McCauley, Robert N., and Lauren Hargreaves. 1987. Eurocommercial paper and U.S. commercial paper markets: Converging money markets? *Federal Reserve Bank of New York Quarterly Review*, autumn: 24–35.
- McCauley, Robert N., and Patrick McGuire. 2009. Dollar appreciation in 2008: Safe haven, carry trades, dollar shortage and overhedging. *BIS Quarterly Review*, December: 85–93.
- McCauley, Robert N., Patrick McGuire, and Philip Wooldridge. 2021. Seven decades of international banking. *BIS Quarterly Review*, September: 61–75.
- McCauley, Robert N., and Jean-Francois Rigaudy. 2011. Managing foreign exchange reserves in the Crisis and after. In *Portfolio and Risk Management for Central Banks and Sovereign Wealth Funds*, *BIS Papers* no. 58, October: 19–47.
- McCauley, Robert N., and Catherine R. Schenk. 2020. Central bank swaps then and now: Swaps and dollar liquidity in the 1960s. *BIS working paper* no. 851, April.
- McCauley, Robert N., and Rama Seth. 1992. Foreign bank credit to US corporations: The implications of offshore loans. *Federal Reserve Bank of New York Quarterly Review*, vol. 17, spring: 52–65.
- McCauley, Robert N., and Chang Shu. 2016. Nondeliverable forwards: Impact of currency internationalisation and derivatives reform, *BIS Quarterly Review*, December: 81–93.
- McCauley, Robert N., Chang Shu, and Guonan Ma. 2014. Non-deliverable forwards: 2013 and beyond. *BIS Quarterly Review*, March: 75–88.
- McGuire, Patrick, Ilhyock Shim, Hyun Song Shin, and Vladyslav Sushko. 2021. Outward portfolio investment and dollar funding in emerging Asia. *BIS Quarterly Review*, December: 53–67.
- McGuire, Patrick, Goetz von Peter, and Sonya Zhu. 2024. International finance through the lens of BIS statistics: Residence vs nationality.” *BIS Quarterly Review*, March: 73–88.

- Mehrling, Perry. 2015. Elasticity and discipline in the global swap network. *International Journal of Political Economy* vol. 44, no. 4, October: 317.
- . 2021. “Where’s my swap line?” A money view of international lender of last resort. Global Economic Governance Initiative, Global Development Policy Center, Boston University working paper no. 53, October.
- . 2022. *Money and Empire: Charles P. Kindleberger and the Dollar System*. Cambridge: Cambridge University Press.
- Morgenson, Gretchen. 2012. Changed by Wall Street, for Wall Street. *New York Times*, July 28, p. BU1.
- Mourlon-Druol, Emmanuel. 2015. “Trust is good, control is better”: The 1974 Herstatt Bank crisis and its implications for international regulatory reform. *Business History*, 57(2): 311–34.
- Papadia, Francesco. 2013. Central banking cooperation in the Great Recession. *Bruegel Policy Contribution*, June.
- Persi, Gianluca. 2020. US dollar funding tensions and central bank swap lines during the COVID-19 crisis. *ECB Economic Bulletin*, no. 5.
- Potter, Simon, Matthew Namath, and Mark Choi. 2020. Central banks as bankers to each other, in J BJORHEIM, ed, *Asset management at central banks and monetary authorities*, Cham, Switzerland: Springer Nature: 365–81.
- Schenk, Catherine. 1998. The origins of the eurodollar market in London: 1955–1963. *Explorations in Economic History*, vol. 35: 221–38.
- . 2014. Summer in the City: Banking failures of 1974 and the development of international supervision. *English Historical Review*, vol. 129, no. 540, October: 1129–56.
- Schweitzer, M., and G. Venkatu. 2009. Adjustable-rate mortgages and the Libor surprise. Federal Reserve Bank of Cleveland *Economic Commentary*, January.
- Setser, Brad. 2023. China isn't shifting away from the dollar or dollar bonds, Council on Foreign Relations *Follow the Money* blog, October 3.
- Sheets, Nathan, Ted Truman, and Clay Lowery. 2018. The Fed’s swap lines during the crisis: Lender of last resort on a global scale. Hutchins Center, Brookings Institution and Program on Financial Stability, Yale School of Management, September 11–12.
- Spero, Joan E. 1980. *The Failure of the Franklin National Bank*. New York: Columbia University Press for the Council on Foreign Relations.
- Sveriges Riksbank. 2017. A cross-border banking sector with major assets and liabilities in foreign currency poses risks to financial stability. *Financial Stability Report* 1: 31–7.
- Swiss National Bank. 2024. *116th Annual Report*. Berne and Zurich: SNB, February.
- Toniolo, Gianni. 2005. *Central Bank Cooperation and the Bank for International Settlements, 1930–1973*. Cambridge: Cambridge University Press.

Truman, Edwin. 2014. The Federal Reserve engages the world. Peterson Institute for International Economics working paper no. 14-5, August.

Tucker, Paul. 2022. *Global discord: Values and power in a fractured world order*. Princeton: Princeton University Press.

United States Bankruptcy Court, S.D. New York. 2024. IN RE: SILICON VALLEY BANK (CAYMAN ISLANDS BRANCH) (in Official Liquidation), Debtor in a Foreign Proceeding. Case No. 24-10076 (MG), Decided: February 22, 2024.

Vissing-Jørgensen, Annette. 2021. The Treasury market in Spring 2020 and the response of the Federal Reserve, BIS working paper no. 966, October.

Weis, Collin. 2022a. Foreign demand for U.S. Treasury securities during the Pandemic. *FEDS Notes*, January 28.

———. 2022b. Geopolitics and the U.S. dollar's future as a reserve currency. Federal Reserve Board of Governors international finance discussion paper no. 1359.