

# **The global dimension of US prime MMFs: The unsecured funding for non-US banks and the implications for FX swap markets**

## **Abstract**

The US-Dollar (USD) holds a paramount position in the hierarchy of the International Monetary System (IMS). The significance of this currency has experienced a remarkable surge, leading to non-US banking systems to adopt new strategies for integrating themselves into the USD funding structure. Consequently, non-US banks have turned to new financial instruments and institutions to hedge their balance sheets effectively. While previous research has primarily focused on the Eurodollar market and FX swaps, the role of US banks in providing USD funding liquidity to these markets and instruments has been curtailed due to post-GFC regulations. This funding gap has been filled by US prime MMFs. Therefore, this paper investigates the emerging global dimension of unsecured funding liquidity provided by prime MMFs through wholesale funding instruments, namely commercial papers (CPs) and certificates of deposit (CDs), to the European and Japanese banking systems. Moreover, it examines the implications of this unsecured funding for JPY/USD and EUR/USD FX swaps markets. The paper argues that rates associated with CPs and CDs have become pivotal indicators of liquidity conditions in the offshore USD system. Disruptions in these markets can result in significant vulnerabilities in FX swaps markets, as evidenced during the pandemic crisis. Only through the Fed's backstop strategies, implemented via swap lines and the Money Market Mutual Fund Liquidity Facility (MMLF), have the liquidity conditions of prime MMFs improved, yielding favorable outcomes for non-US banks.

**Keywords:** US prime MMFs; Eurodollar; FX swap; Unsecured funding; Offshore USD system.

## **Introduction**

Scholars assert that the USD occupies the pinnacle of the IMS hierarchy (Kaltenbrunner & Paineira, 2018; Mehrling, 2015), serving as the currency that underpins the recent wave of financial globalization (Murau et al., 2022). Consequently, global banking systems, particularly those in Europe (Beck, 2020) and Japan (Katada, 2008), have become deeply intertwined with the USD funding framework. This integration has led to the Americanization of these banking systems (Dafermos et al., 2022), marked by a significant surge in the usage of institutions and instruments involved in accessing USD funding liquidity. However, this interconnectedness has exposed these banking systems to new cross-border risks, emanating from the existence of a global financial cycle shaped by conditions in USD funding markets (Bauerle et al., 2017).

In light of the increasing importance of the USD over the past few decades, scholars have been motivated to investigate the instruments and institutions used by non-US banks to secure USD funding liquidity. Consequently, extensive research has been conducted on the role of the Eurodollar market (Mehrling, 2015), the role of asset-backed commercial papers (ABCPs) issued by special purpose vehicles (SPVs) sponsored by non-US banks (Haberly & Wojcik, 2017; Bryan et al., 2016), the role of repo markets (Wansleben, 2020), as well as the significance of FX swaps (Murau et al., 2022; Beck, 2021; Dafermos et al., 2022). All these instruments have significant implications as they contribute to an increasingly uneven distribution of dollar assets and liabilities, influencing the power dynamics within global finance (Dafermos et al., 2022). Among these instruments, FX swaps are considered particularly vital as they are extensively used by financial institutions to obtain USD (DeRosa, 2014; Borio et al., 2022). However, this paper contends that FX swaps are inherently linked to unsecured funding, as the rates of FX swaps closely align with unsecured funding rates (Eren et al., 2020a). Therefore, it is crucial to pay closer attention to this relationship and its implications.

As such, it could be argued that the global dimension of unsecured funding provided by US prime MMFs and its implications for global FX swap markets have been overlooked by scholars in the field of international political economy (IPE). Specifically, US prime MMFs play a global

role in providing USD funding liquidity through the acquisition of CPs and CDs issued by non-US banks. While the role of prime MMFs before and during the GFC of 2007-9 has been well-documented (Haberly & Wojcik, 2017; Jank & Wedow, 2015; Bengtsson, 2013), less attention has been given to these institutions after 2008, with some marginal exceptions (e.g. Saeidinezhad, 2022; Beck, 2022).

The theoretical argument is as follows. The rates of unsecured funding instruments, especially CPs and CDs, have become the marginal funding costs for non-US banks (Eren et al., 2020a). As non-US banks heavily rely on these unsecured markets to obtain USD funding liquidity, any disruption in these markets can impact their ability to finance in USD. When unsecured funding dries up, non-US banks resort to the FX swaps market to secure USD funding liquidity, leading to a shortage of USD. Consequently, this shortage has an impact on the cost of these instruments. This phenomenon was evident during the pandemic crisis when prime MMFs reduced their provision of liquidity to non-US banks. To support this argument, two case studies are analyzed: the European and Japanese banking systems during the pandemic crisis, focusing on the diminished acquisition of CPs and CDs issued by these non-US banks. It is worth noting that the Fed recognized the significance of prime MMFs for the distribution of USD assets and liabilities, leading to the implementation of various measures, including public swap lines with other central banks and facilities like the MMLF, which highlights once again the existence of a dynamic institutional backstop process within the financial system (Ulgen, 2014).

Therefore, the main research question addressed in this paper is to what extent have US prime MMFs replaced US banks as the primary providers of USD funding liquidity, and what are the implications of this shift for non-US banks? Additionally, a sub-question explores how changes in wholesale funding instruments, such as CPs and CDs held by prime MMFs, influence offshore USD funding condition costs and the functioning of the FX swaps market.

This paper contributes to the existing literature in several ways. Firstly, it sheds light on the global dimension of unsecured funding provided by US prime MMFs, highlighting their significant role as a funding source for non-US banks. Additionally, the paper recognizes that the transformation of the “geopolitical arrangements underpinning the dollar hegemony” (Dafermos et al., 2022: 950) is not solely influenced by FX swaps, but also by the unsecured funding from prime MMFs. The decisions of these market-based institutions to reduce USD liquidity provision

have implications for the offshore USD system. Building on this observation, the paper examines the risks associated with this unsecured funding for both non-US banks and FX swaps markets. Specifically, another innovative aspect of this paper lies in its exploration of the pivotal role played by unsecured funding from US prime MMFs in shaping the dynamics of FX swaps markets. This crucial connection highlights how changes in unsecured funding conditions can have a ripple effect on the intricate web of global financial systems. By uncovering the intricate relationship between these two critical components, this paper provides fresh insights into the complex dynamics that govern global financial systems.

Lastly, the paper evaluates the Fed's backstop strategy in providing USD funding liquidity. It argues that the Fed's approach to stabilizing the USD's role in global finance extends beyond swap lines and the Foreign and International Monetary Authorities (FIMA) repo facility (Murau et al., 2022), encompassing other public facilities as well. The MMLF, in particular, is highlighted as a facility that has improved funding conditions by facilitating increased capital inflows into prime MMFs, which, in turn, enables them to resume providing USD funding liquidity to non-US banks. This holds even greater significance, as this paper provides evidence that the influence of banks in FX swap markets has relatively waned in contrast to prime MMFs.

In summary, this paper fills gaps in the literature by examining the global dimension of unsecured funding from prime MMFs, exploring their impact on FX swap markets, and assessing the Fed's comprehensive backstop strategy for ensuring USD funding liquidity.

This paper relies on a combination of primary and secondary sources to gather relevant empirical information. Primary sources include research articles from specific research departments of central banks and other supranational institutions such as the Fed, the European Central Bank (ECB), and the Bank of International Settlements (BiS). Additionally, press articles from reputable newspapers are also considered. Secondary sources consist of studies and peer-reviewed papers specifically focused on the analyzed topic, but also book chapters.

The paper is structured as follows to present the argument effectively. The first section examines the global dimension of unsecured funding provided by US prime MMFs. The second section delves into the funding structure of Japanese banks and emphasizes the significance of unsecured funding within this banking system. Following this, the third section analyzes the funding

structure of the European banking system. The fourth section investigates the strain experienced by prime MMFs during the pandemic crisis and explores its adverse effects on unsecured funding and non-US banking system. In the fifth section, the global implications of unsecured funding on FX swaps markets are thoroughly examined. The sixth section discusses the Fed's backstop strategy. Finally, the paper concludes in the seventh section.

## **1. The IMS and the global dimension of unsecured USD funding liquidity provided by US prime MMFs**

The IMS operates on the basis of modern credit money, which has become increasingly prominent in the era of financial globalization. Private forms of money issued by financial institutions play a crucial role in this system (Desan, 2014; Mehrling, 2011; Murau, 2018; Tooze, 2018). However, like any system, it requires a common element to organize around, and that element is represented by the USD. The USD serves as the global unit of account for the credit money issued by various financial institutions. Its global importance grew after the termination of the Bretton Woods Agreement when it began to be used as a ‘key currency’. Consequently, the ‘US monetary jurisdiction’ became the centerpiece of the IMS, with a majority of debt and other financial instruments denominated in USD (Awrey, 2017; Murau, 2020).

A significant component of the IMS is the Eurodollar market, consisting of financial institutions outside the United States that trade in USD. The term *Euro* in Eurodollar refers to the offshore nature of these transactions (Braun et al., 2020). This market facilitates the creation of offshore USD outside the regulatory oversight of the Fed (Snider, 2018). Specifically, non-US banks have the ability to create deposits or issue USD-denominated loans or bonds, contributing to the expansions of the offshore USD supply.

Following the GFC of 2007-9, US banks however reduced their lending to non-US banking systems. The crisis resulted in financial losses for non-US banks due to their exposure to USD-denominated assets and increased uncertainty in their balance sheets. Consequently, US banks shifted their funding away from lending in wholesale USD funding markets (Borio et al., 2016). Additionally, post-crisis regulations also played a significant role in this shift. One such regulation is the standardized approach to counterparty credit risk (SA-CCR). It is estimated that this regulation led US banks to widen bid/offer spreads, impacting uncollateralized FX swaps and forwards. While foreign banks with global activity can still price swaps and forwards as usual, as they are not directly impacted by this regulation, they have limited ability to provide USD funding liquidity and are ultimately forced to turn to US banks that cannot meet this demand without relatively higher costs (Risk Publications, 2022).

US banks have also experienced a reduction in their ability to provide USD funding liquidity to non-US banks due to the Liquidity Coverage Ratio (LCR). This regulation requires US banks to hold highly liquid assets to meet liquidity outflows over a 30-calendar-day stress period. As a result, US banks face constraints in their money market activities, negatively affecting the supply of USD funding liquidity for European and Japanese banks (Brophy et al., 2019). This shift has created a funding gap for non-US banks.

To address this funding gap, US prime MMFs have emerged as a solution. The MMF industry in the United States is broadly categorized into government, prime, and tax-exempt funds, each investing in distinct asset classes. Government MMFs mostly invest in US Treasuries (USTs), US agency securities, and UST-collateralized repos. Tax-exempt funds primarily hold municipal securities. Prime MMFs have a more complex role and these funds will be the subject of this paper.

US prime MMFs are mutual funds that primarily invest in a wide range of corporate and financial fixed income instruments, including corporate or financial CPs, CDs, and repos. These funds can be categorized into two types: (1) retail and (2) institutional. Retail MMFs are limited to natural persons as investors, while institutional MMFs are open to all investors and are typically used by large cash pools, such as corporate treasurers (Baklanova et al., 2021). There are also differences between retail and institutional MMFs in terms of share pricing rules. Prime retail MMFs aim to maintain a constant net asset value (NAV), while prime institutional MMFs mark-to-market their portfolios, resulting in floating NAVs (Avalos & Xia, 2021). Floating NAVs mean that these funds' share prices and transactions are based on a NAV calculated with four-decimal-place precision (e.g. \$1.0000), using a process known as 'basis point rounding' (Fidelity, 2014).

The implementation of floating NAV for prime MMFs took place as part of the reform led by the US Securities and Exchange Commission (SEC) in October 2016. This reform resulted in the fluctuation of daily share prices for prime MMFs. Additionally, it granted prime institutional MMFs the ability to impose redemption fees, leading to a shift of funds from prime MMFs to government MMFs (Shirai, 2017). This reform led to a significant decline of approximately \$1tn in assets under management (AuM) for prime MMFs, impacting the funding costs of both US

and global banks (Anderson et al., 2019) in a period where prime MMFs were crucial for the global banking system.

As such, an argument could be made that prime MMFs play a vital role within the offshore USD system as they primarily invest in short-term obligations issued by financial institutions, particularly non-US banks. However, prime MMFs themselves rarely provide direct funding to banks. Instead, for a prime MMF to provide USD funding liquidity, a bank must issue CPs and CDs, which are subsequently sold to MMFs (Saeidinezhad, 2022). These instruments represent wholesale money market instruments. CPs are unsecured promises to pay a specified amount on a stated maturity date, typically issued in bearer form. On the other hand, CDs are certificates issued by a bank acknowledging a deposit made for a specific period of time at a predetermined interest rate (Darpeix, 2022).

As a result, prime MMFs emerged as the primary providers of USD funding liquidity, gradually replacing US banks in this role. In the United States alone, it is estimated that 80 percent of the total private funding offered by prime MMFs consists of debt and repo financing for US banks (Bouveret, 2022). However, the significance of prime MMFs extends beyond the borders of the United States, as already argued. Given the limited access of non-US banks to constant USD retail deposits, they heavily rely on this type of funding to finance their USD-denominated assets (Eren et al., 2020a). Consequently, non-US banks have become inherently dependent on the unsecured funding provided by MMFs. In fact, a substantial portion of prime MMFs funding, approximately 84 percent, is directed towards non-US banks (Bouveret, 2022). This makes prime MMFs crucial global providers of short-term USD funding for both banks and non-financial corporations (Avalos & Xia, 2021).

However, the increased prominence of prime MMFs has significant implications for the determination of London Interbank Offered Rate (Libor). Specifically, the Libor-overnight index swap (OIS) has become a widely recognized indicator of stress in the Eurodollar market. As CPs and CDs held by prime MMF constitute now the primary source of unsecured wholesale funding for non-US banks, the condition of these markets serves as a crucial gauge for bank funding conditions (Eren et al., 2020b).

Consequently, the traditional role of the Libor-OIS spread in measuring overall USD funding costs is diminishing in relevance. Instead, the CP/CD ratio, which reflects the cost of borrowing



from MMFs, has emerged as the primary indicator of offshore USD funding costs (Saeidinezhad, 2020). This shift highlights the importance of wholesale funding instruments and underscores that USD funding liquidity operations are no longer solely interbank-centric but are inherently linked to the costs of CPs and CDs markets (Eren et al., 2020b).

Furthermore, these wholesale instruments also impact FX swap markets, as a reduction in liquidity within these instruments leads to increased reliance of FX swaps by non-US institutions, potentially resulting in a shortage of USD (Saeidinezhad, 2020). However, there is another issue to consider. Since prime MMFs do not have access to the Fed's balance sheet, they are considered unstable liquidity providers (Saeidinezhad, 2020). Their ability to provide USD funding liquidity diminishes during periods of financial distress, as evidenced during the recent pandemic crisis.

As a result, these institutions possess a global dimension, capable of exerting cross-border impacts. Consequently, thorough research into their functioning and dynamics becomes crucial. The following two sections of this analysis delve into the global dimension of US prime MMFs in their role as providers of funding liquidity to two non-US banking systems, namely the European and Japanese banking systems.

## **2. The cross-border funding of Japanese banks and the global dimension of US prime MMFs**

Global banking systems, including the Japanese banking system, maintain significant exposure to USD-denominated assets and liabilities. Japanese banks have continued to be deeply integrated into the USD funding structure following the GFC. They have substantially expanded their long-term USD positions, making them the largest non-USD borrowers globally, which has created an inelastic demand for USD compared to other banking systems (Aldasoro et al., 2018).

This situation is primarily driven by divergences in the monetary policy between the US and Japan. The Bank of Japan's activities in the government bond market, leading to low yields on these instruments, prompted Japanese banks to seek higher-yielding assets. As a result, they made significant investments in USD-denominated bonds and increased their issuance of USD-denominated loans, expanding their overseas business (Aoki et al., 2021). Consequently, Japanese bank balance sheets are considered to be heavily dollarized. They have invested substantially in USTs, agency bonds, agency mortgage-backed securities (MBSs) (Shirai, 2017), and issued USD-denominated loans. It is estimated that Japanese banks' USD-denominated assets reached \$3.5tn in 2016, representing a doubling of USD borrowing and lending since 2007 (Onaran, 2017). Recognizing this trend, the Japanese Financial Services Agency issued warnings about banks' exposure to holding USDs, concerned that a strengthening USD would make servicing foreign debt more expensive and rollover challenging (The Economist, 2018).

However, the issue extends beyond the strengthening of the USD itself. Japanese banks also face challenges due to their reliance on USD liquidity providers, particularly as they lack a stable base of USD retail deposits. This is significant because the rapid increase in USD assets held by Japanese banks is largely hedged through swap markets (The Economist, 2018). Japanese banks have sought to acquire corporate deposits to enhance the stability of their USD funding base. However, these US deposits account for less than 40 percent of Japanese banks' liabilities, with the remainder being raised through CPs, CDs, or repos (Aoki et al., 2021).

Figure 1 illustrates the foreign currency exposure of Japanese banks up until 2016. On the liability side, the primary sources of funding were interbank funding, FX swaps and repos (Nagai, 2017).

Figure 1 - Foreign currency exposure on liability side

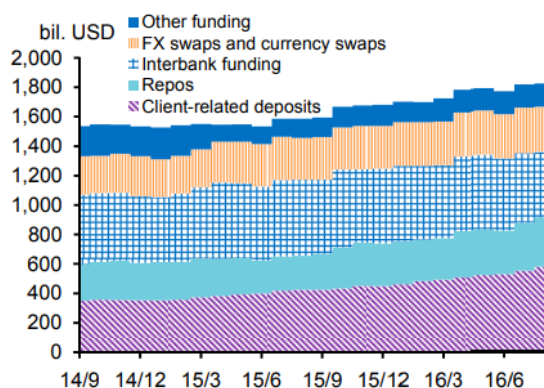
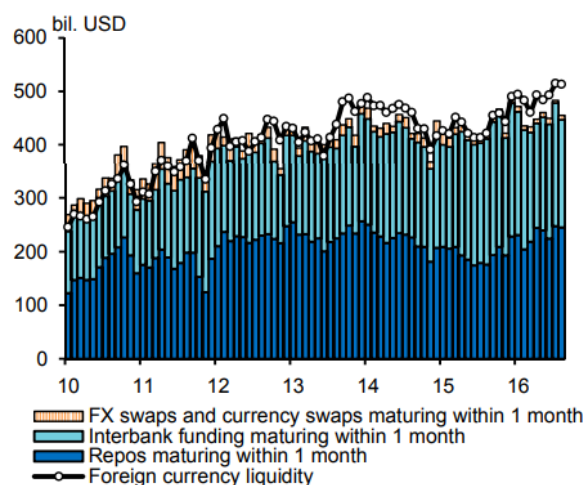


Figure 2 - Maturity of foreign currency exposure on liability side



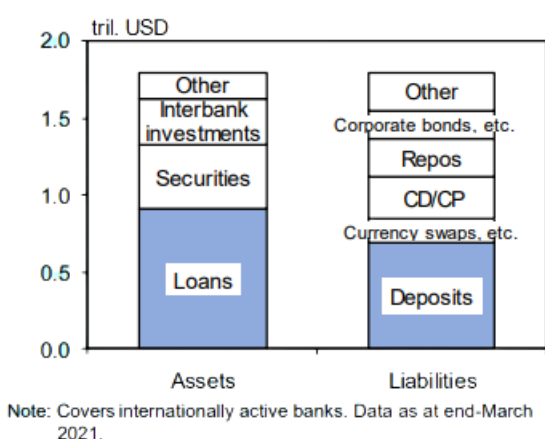
Source: Nagai, 2017

Japanese banks have made efforts to diversify the liability side of their balance sheets in response to post-GFC regulations that affected US banks. This diversification has led to the increased prominence of CPs and CDs in the funding structure of Japanese banks (Aoki et al., 2021), as shown in Figure 2. The significance of prime MMFs in the Japanese banking system has also grown, highlighting the impact of regulatory changes on the involvement of non-bank entities as providers of USD funding liquidity (Davies & Kent, 2020; Saeidinezhad, 2020). However, it was during the pandemic crisis that the importance of CPs and CDs became apparent.

Prior to the pandemic, tensions related to the 2016 US MMFs reform were already observed. This reform resulted in a shift of funds to government MMFs, making it costly for Japanese banks to raise USD using CP and CD funding tools in the US (Shirai, 2017). The announcement of the reform led to an increase in three-month CP rates and seven-year high in three-month dollar LIBOR, the key benchmark for short-term bank borrowing (Yoon, 2016). Japanese banks, heavily reliant on short-term US market funding, were particularly affected by the higher funding

costs and reduced market availability (Yoon, 2016). Despite the increased costs, Japanese banks continued to use CPs and CDs due to the growing importance of USD funding liquidity for their operations. Consequently, global banking systems' USD liquidity need increased while the ability of prime institutions to provide funding to non-US banks was diminished due to the MMFs reform.

Figure 2 provides a simplified overview of the balance sheet of Japanese banks as of the end of 2021



Source: Aoki et al., 2021

The figure illustrates the significant usage of CPs and CDs by Japanese banks, with prime MMFs investing a substantial amount in these instruments. According to the Financial Stability Board (FSB) (2021) data from Q1 2020, prime MMFs had investments of approximately \$228bn in the Japanese USD financial CPs market and exposure of around \$380bn in CDs. While repo markets still hold a larger share in the funding structure, the increased reliance on CPs indicates the importance of this liquidity source for Japanese banks in facilitating their USD-denominated asset and liability activities.

### **3. The role of US prime MMFs in the European banking system**

The European MMFs market has experienced significant growth and plays a crucial role in providing short-term credit to both banks and non-financial corporations (NFCs). As of 2020, the total assets held by European MMFs amounted to EUR 1.26tn, with approximately 78 percent consisting of EUR and USD-denominated assets (Boucinha et al., 2020). These funds primarily engage in acquiring wholesale funding instruments from banks, both in EUR and USD, with the funding amount reaching EUR 300bn in the fourth quarter of 2019 (Boucinha et al., 2020).

In March 2019, the reform of European MMFs was implemented, leading to the categorization of MMFs into three types (Cipriani & La Spada, 2021). These include:

- (1) Constant Net Asset Value (CNAV<sub>s</sub>): These funds maintain a constant net value of shares and primarily invest in public debt;
- (2) Low Volatility Net Asset Value (LVNAV<sub>s</sub>): These funds predominantly invest in private markets, specifically in financial CPs and CDs;
- (3) Variable Net Asset Value (VNAV<sub>s</sub>): VNAV<sub>s</sub> have a variable net value but exhibit LVNAV-like characteristics.

These funds can be either EUR or USD-denominated. However, the LVNAV<sub>s</sub> and USD-denominated VNAV<sub>s</sub> play a significant role in providing USD funding liquidity to the European banking system (Bouveret, 2021). This enables European banks to hedge their USD-denominated balance sheets and manage their funding needs effectively.

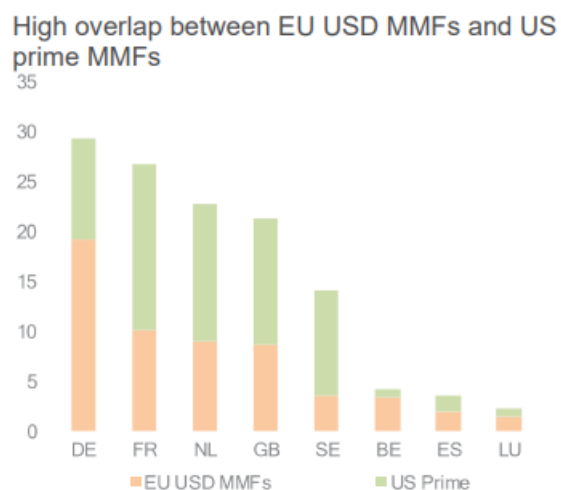
Alongside LVNAV<sub>s</sub> and CNAV<sub>s</sub> (hereafter USD MMFs), US prime MMFs also contribute significantly to the USD funding liquidity provided to the European banking system. US prime MMFs have a longstanding presence in Europe, with the first such MMF established in Ireland in 1993. Prior to that, the earliest USD-denominated MMF in Europe was introduced in 1991, also in Ireland, but as a CNAV fund. These initial MMFs were established by Federated, a US asset management firm (Bouveret, 2022).

Over time, prime MMFs have assumed a crucial role in the short-term USD-denominated funding structure of European banks, primarily driven by the higher yields offered by

instruments issued by European banks compared to those in the US (Ansidei et al., 2012). For instance, prior to the escalation of the Eurocrisis in 2011, prime MMFs had an exposure to European banks that accounted for nearly 50 percent of their total assets. Although this exposure decreased to 32 percent by December 2011, it remained relatively high (Ansidei et al., 2020).

Even after the Eurocrisis, prime MMFs continued to play a significant role in the USD funding structure of the European banking system. [Figure 3](#) illustrates the substantial overlap between USD MMFs and US prime MMFs. US prime MMFs have a greater share compared to USD MMFs in countries such as France, the Netherlands, Great Britain, and Sweden, while Spain demonstrates a roughly equal percentage. On the other hand, USD MMFs have a stronger presence in Germany or Belgium (Bouveret, 2021). As can be seen, the activity of the main prime MMFs is not identical, which is why this paper does not claim that these institutions have an equal impact in every European state. This analysis is following a macro approach, aiming to present the impact of these prime institutions on the European funding model without assuming that this model is identical everywhere..

[Figure 3](#) shows the overlap between EU USD MMFs and US prime MMFs



Source: Bouveret, 2021

However, the portfolio similarity between prime MMFs and USD MMFs is significant, as noted by Bouveret (2021). This indicates that both types of MMFs tend to invest in similar instruments. It has been suggested that the combined exposure of US prime MMFs and USD MMFs to the US global CP market is approximately one third (Bouveret, 2021). According to the Office of

Financial Research (OFR), as of 2018, US prime MMFs had an estimated exposure of \$300bn to European banks, a figure that rose to \$400bn in January 2020, just prior to the onset of the pandemic crisis (OFR, 2020). These findings highlight the ongoing role of prime MMFs as significant providers of USD funding liquidity to the European banking system. Overall, US prime MMFs have become an integral component of the European banking system's USD funding structure, contributing to the liquidity and funding needs of European banks through their investments in short-term USD-denominated instruments.

#### **4. US prime MMFs during the pandemic crisis and implications for unsecured funding**

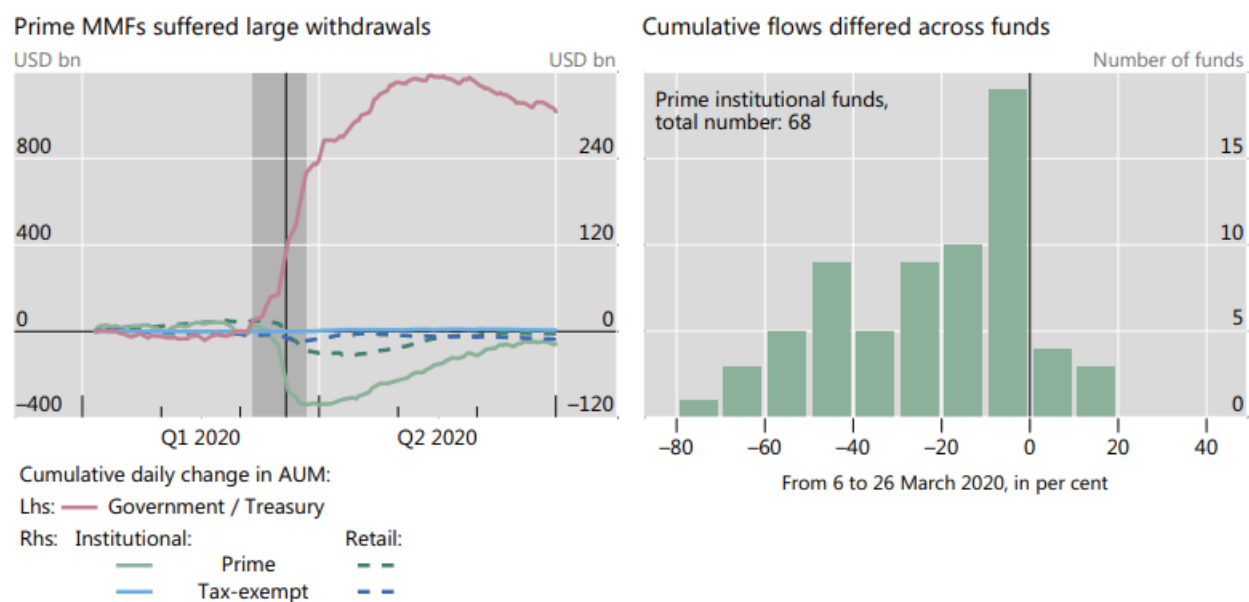
Starting in March 2020, the pandemic crisis became an increasing concern in the US and Europe, resulting in historic outflows for prime MMFs that rapidly accelerated in the following weeks (Anadu et al., 2021). During this period, it is estimated that investors withdrew approximately \$125bn from both institutional and retail prime MMFs. However, institutional prime funds were particularly affected, experiencing a record outflow of \$95bn in March alone, equivalent to 14 percent of their total net assets (Baklanova et al., 2021). This outflow exhibited historical characteristics, comparable to only two previous events: the GFC of 2007-9, during which prime MMFs suffered an outflow of approximately \$200bn, and the 2016 MMF reform, which led to an outflow of \$1tn. The pandemic crisis, however, brought an unanticipated and rapid shock that impacted all funding markets (Eren et al., 2020b). Notably between March 6 and 26, prime MMFs experienced 20 consecutive days of outflows. Furthermore, for eight consecutive trading days, the daily outflow from prime institutional MMFs exceeded 2 percent of the previous-day AuM, marking a historic first (Avalos & Xia, 2021).

However, it has been argued that the sequence of events is closely linked to specific characteristics of the 2016 reform. Particularly, this reform introduced the provision that prime MMFs could impose fees and redemption gates if their weekly liquidity assets (WLA) fell below 30 percent. WLA represents the liquidity buffers comprising assets that can be readily converted into cash within a week (Zhou et al., 2020). The implementation of redemption gates and liquidity fees was intended to mitigate risk and potential impacts on investors and markets (White, 2014). However, this decision had unintended consequences. As the possibility of redemptions emerged during the stressful conditions of March 2020, the NAV of prime MMFs deteriorated rapidly, causing some funds to observe a decline in their WLA below the 30 percent threshold (Eren et al., 2020b). Consequently, investors initiated preemptive redemptions. Specifically, “the potential imposition of a fee or gate when a fund’s WLA drops below 30 percent encouraged institutional investors to redeem before that threshold was crossed” (PWG, 2020: 5). Thus, the 2016 reform is argued to have resulted in a perverse effect known as the first-mover advantage (CFA Institute, 2021), where investors are incentivized to withdraw their funds before others, and the higher the redemption risk, the stronger the motivation of more intensive



withdrawals (Eren et al., 2020b). This phenomenon occurred in March 2020, as many MMFs experienced significant outflows and their WLA buffers approached the regulatory threshold, prompting investors to accelerate their redemptions (Bouveret et al., 2022; Li et al., 2020).

Figure 4 shows the outflow from US prime MMFs



Source: Avalos & Xia, 2021

The figure also illustrates the inflow pattern observed in government MMFs. A similar trend occurred during the GFC of 2007-9. Specifically, in September 2008 and during the pandemic crisis, the outflow from US prime MMFs corresponded to an inflow in government MMFs amounting to \$827bn and \$334bn, respectively (Bouveret et al., 2022).

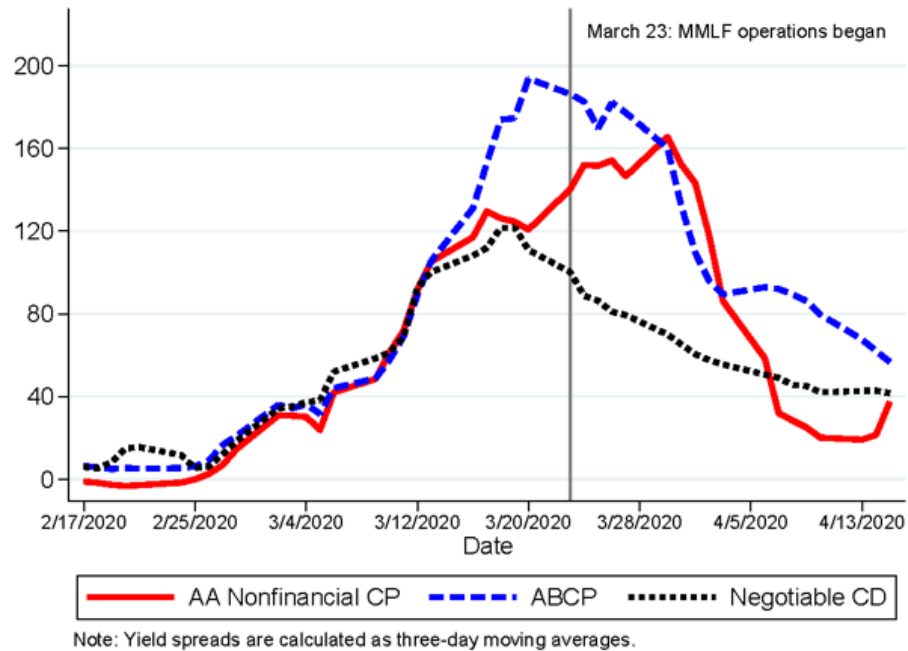
This further underscores the volatile nature of MMFs as a USD funding source for both US and non-US banks (Aldasoro et al., 2021). However, the impact on non-US banks was relatively more pronounced. In March 2020, the ‘dash for cash’ by investors in prime funds resulted in a substantial outflow, thereby diminishing the source of USD funding liquidity for non-US banks. It was estimated that this outflow accounted for 2 percent of non-US banks’ aggregate on-balance-sheet USD funding. Overall, non-US banks experienced a loss of \$300bn between the end of 2019 and the end of 2020, with unsecured bank funding, namely, CPs and CDs, comprising 85 percent of this decline (Aldasoro et al., 2021). Consequently, any run on prime MMFs triggers a liquidity shock for non-US banks.

This scenario unfolded in March 2020, where prime MMFs experienced a significant reduction in their holdings of CPs, CDs, and time deposits, amounting to approximately \$150bn between February and March 2020 (Eren et al., 2020b). Among these holdings, the value of CPs alone was estimated to be \$48bn (PWG, 2020). The outflow from the CP and CD markets led to a financial CP-OIS spread of 210bps, indicating the strains in the CP markets and the pressures faced by specific activities and participants (Davies & Kent, 2020). Additionally, the spreads of AA-rated financial CPs and A2/P2-rated non-financial CPs reached their highest levels since the GFC of 2007-9 (PWG, 2020). Consequently, USDs that would previously “have been available in various others markets (including to non-US entities via commercial paper, certificates of deposit and FX swaps) became scarce” (Davies & Kent, 2020: 49).

As a result, the issuance of financial and non-financial CPs significantly declined by over 70 percent on a weekly average between February and April 2020. AA-rated financial CPs, for instance, experienced an average reduction from \$11.5bn to approximately \$3bn (Eren et al., 2020b). Furthermore, US and non-US banks reached the limits of their balance sheet expansion and were unable to absorb CPs and CDs, leaving many of these instruments off their balance sheets, thereby exacerbating stress in the unsecured funding markets (Eren et al., 2020b).

The impact on CD costs was equally profound. Both negotiable CDs and other types of CDs were heavily affected by the outflow from prime MMFs. As evidence, on March 2018, when the MMLF program was announced by the Fed, the spread of these CDs relative to the deposit rate and IOER ranged between 8 and 9 percent (Bouveret et al., 2020). Consequently, the run on prime MMFs coincided with a substantial increase in yield spreads on one-month CPs and CDs, reaching levels not seen since the GFC of 2007-9.

Figure 5 depicts the CPs and CDs funding costs during the pandemic crisis



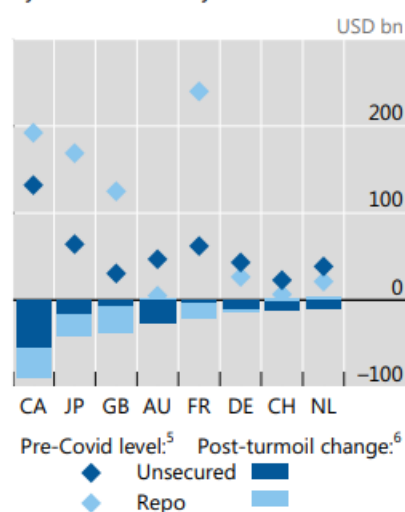
Source: Zhou et al., 2020

This outflow from prime funds has had a significant impact on the funding liquidity source of Japanese banks. These funds notably reduced their acquisition of Japanese banks' USD-denominated CPs and CDs, resulting in a steep increase in the costs of these instruments. The rates for three-month and one CPs surged from 0.75-1 percent prior to March 2020 to 2.6 and 2.3 percent, respectively, after March 2020. Consequently, Japanese banks were observed to refrain from using the CP/CD markets for funding at the onset of the pandemic crisis (Aoki et al., 2021).

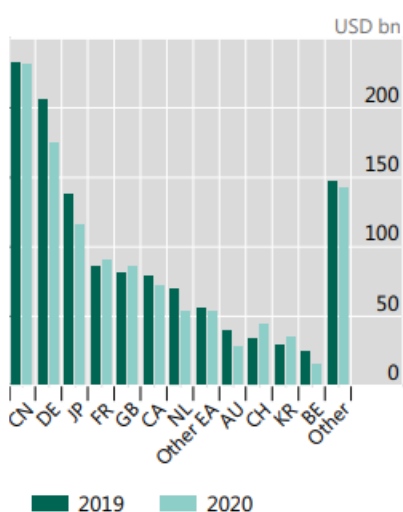
Japanese banks, along with Canadian and Australian banks, experienced the most significant contraction in unsecured funding, with Japanese banks being major recipients of MMFs' unsecured funding through CPs and CDs (Aldasoro et al., 2021). Simultaneously, the gross issuance of USD debt securities by non-US banks decreased by \$100bn in March 2020 compared to the same period in 2019, as can be seen depicted in the [Figure 6](#).

[Figure 6](#) shows the banks' funding before and after the pandemic crisis, but also the gross USD debt securities issuance of non-US banks.

Funding around the March turmoil, by bank nationality<sup>4</sup>



US dollar issuance: 2019 vs 2020



Source: Aldasoro et al., 2021.

The outflow from prime MMFs also had a significant impact on European banks, resulting in notable changes in the portfolios of all MMFs and a subsequent decrease in liquidity within the CPs and CDs markets. The outflows from USD MMFs commenced concurrently with those from US prime MMFs, indicating that the reduced activity of US prime MMFs could not be offset by increased activity in USD MMFs, thereby emphasizing the global repercussions of prime MMFs (Avalos & Xia, 2021). Consequently, the unsecured funding markets experienced a substantial disruption, leading many investors to curtail their investments, refrain from rolling over maturities, and, in some cases, to withdraw from the market entirely (Hill, 2021). This left European banks without a vital funding source.

As a result of the outflows from US prime MMFs, Japanese and European banks were compelled to rely more heavily on FX swaps. Under normal circumstances, unsecured funding rates in CP/CD markets serve as marginal funding costs for banks (Eren et al., 2020a), with FX swap rates closely tracking these unsecured funding rates. However, due to the globalized nature of Japanese and European CPs and CDs markets, any strains experienced in the unsecured markets can spill over to the FX swap markets (Avdjiev et al., 2020). This precisely occurred during the crisis. Consequently, the global activity of US prime MMFs holds significant implications for FX swaps markets, which will be discussed in detail in section five.



## 5. Implications for FX swap markets

Each FX swap contract involves two separate transactions, also known as ‘legs’. In the first leg, one currency (let’s say currency A) is exchanged at the prevailing exchange rate for a cash sum held in another currency (currency B). In the second leg, the original transaction is reversed, and each currency provider receives back the currency they initially participated with in the transaction (Dafermos et al., 2022). The first leg is commonly referred to as the spot leg, while the second leg is known as the forward leg. This is why it is often stated that an FX swap involves an “FX spot transaction with a simultaneous FX forward transaction in the opposite direction” (Stenfors, 2007: 79). An FX swap typically matures within a year, making it primarily a money market funding instrument (Borio et al., 2017). However, the key distinction is that these swaps are off-balance-sheet instruments, which means that agents are not required to report the nominal amounts they have committed to exchange on the balance sheet. Instead, they only report the marked-to-market value (Borio et al., 2017).

But the implications of this off-balance-sheet instrument are significant and warrant discussion. FX swaps play a crucial role in linking money markets across different currencies, enabling banks to access US dollars through cross-currency funding markets (Eren et al., 2020a). This mechanism broadens the foreign funding liquidity supply in multiple markets, making it an essential component of global financial systems.

Notably, the use of FX swaps is extensive. The combined value of payment obligations in FX swaps/forwards and currency swaps is estimated to have reached \$97tn in 2022, with USD accounting for 88 percent of outstanding positions, equivalent to \$85tn (Borio et al., 2022). These figures confirm that FX swaps are heavily centered on the USD (DeRosa, 2014), supporting the claim that they serve as a significant source of USD funding and hedging, facilitating trade and investment in USD assets (Davies & Kent, 2020).

In addition, there are specific indicators that reflect the funding costs of financial institutions using FX swaps as a source of foreign currency funding. One such indicator is known as the FX swap basis. This basis represents the difference between the dollar interest rate in the money market and the implied dollar interest rate from the FX swap market, where borrowers pledge

another currency as collateral to borrow dollars (Avdjiev et al., 2020). For example, in the JPY/USD and EUR/USD contexts, a negative basis indicates a scarcity of USD funding liquidity (Avdjiev et al., 2020).

Another indicator of these funding costs is the FX swap-implied USD rate, which represents the total cost, in terms of the USD rate, of raising foreign currencies in the uncollateralized cash market and converting them into USDs through the FX swap market (Baba & Packer, 2009). This indicator serves as a strong signal of market stress in the FX swap market and reflects the sustainability of USD funding liquidity (Ando, 2012).

However, as previously discussed, the FX swaps market is influenced by unsecured funding from US prime MMFs. Disruptions in MMFs have, at times, disrupted the balance of USD supply and demand in the FX swap market (Aldasoro et al., 2020). The reliance of non-US banks on MMFs for USD liquidity exposes the FX swap market to fluctuations in the CPs and CDs markets, as the willingness of prime MMFs to invest in CPs or CDs depends on volatilities in these respective markets (Saeidinezhad, 2022). This willingness impacts the offshore USD system by affecting the distribution and cost of USD liquidity.

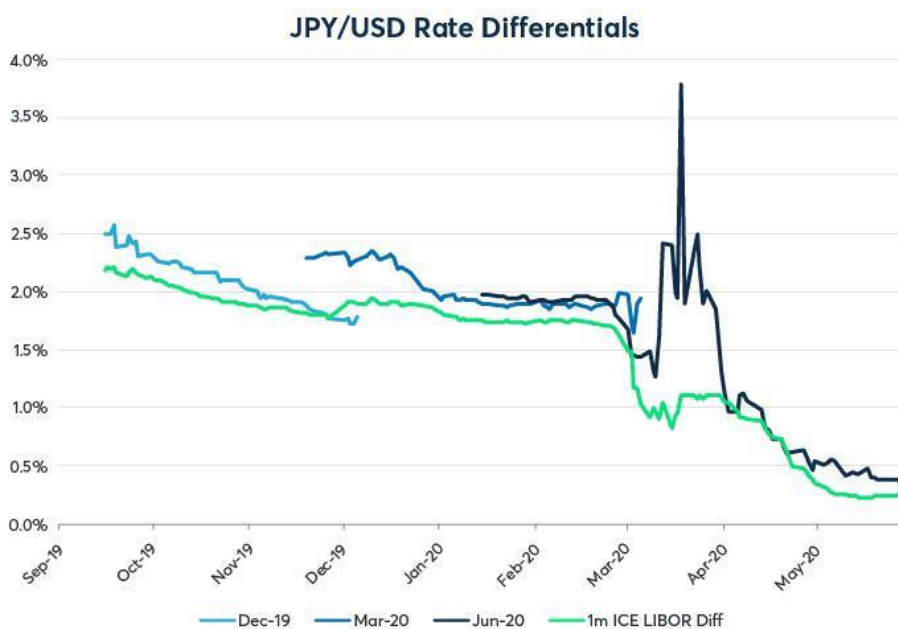
This sequence of events contributed to distress in the FX swap markets, which experienced a shock during the pandemic crisis. USD funding stress for non-US banks caused disruptions in CP/CD markets that reverberated globally through the FX swap markets (Eren et al., 2020b). Specifically, when prime MMFs reduced their USD liquidity provision to non-US banks, a scarcity of USD funding liquidity emerged. This scarcity had global repercussions, leading to significant swings in offshore USD funding costs, as observed in the cross-currency basis (Eren et al., 2020a). It has been repeatedly confirmed that non-US banks were impacted by the substantial outflows from prime MMFs, given that these banks heavily rely on issuing unsecured short-term paper (e.g. three-month CP and CDs) in US money markets due to their lack of a stable US retail deposit base (Eren et al., 2020a). In the following discussion, this paper will explore the implication of this situation for the JPY/USD and EUR/USD FX swap markets.

### *5.1 JPY/USD FX Swap*

As the Japanese banking system's exposure to USD-denominated assets has increased, gaps in USD funding are reflected in the JPY/USD basis spread. This phenomenon was particularly

evident during the pandemic crisis, where non-US banks, especially Japanese banks, faced a shortage of USD funding. The surge in demand for USDs resulted in a scarcity of available funding, leading to significant increases in FX swap-implied USD funding costs (Davies & Kent, 2020). In the case of Japan, the liquidity in the USD FX swap market declined so drastically that some Japanese banks temporarily suspended their USD funding through FX swaps in March 2020 (Aoki et al., 2021). Specifically, the FX swap-implied USD rate from JPY (three-month) rose to 2.5 percent, up from 1.2 percent in March 2020 (Aoki et al., 2021). This shortage of USD funding liquidity is also evident in the JPY/USD rate differential.

Figure 7 shows how JPY/USD rate differentials exhibited significant volatility during the crisis, peaking at 3.8 percent in April



Source: CME Group, 2020

In mid-march 2020, the cost of USD funding through three-month FX swaps, with Japanese yen collateral, exceeded USD LIBOR by 150bps, marking the largest differential among major currencies (Eren et al., 2020a). The significant increase in the JPY/USD differential poses considerable risks, considering that the Japanese yen is the third most widely used foreign currency in USD-denominated FX swaps, following the Euro and the British pound. Japanese



banks, being the largest cross-border USD investors financed via FX swaps, play a crucial role in this market (Dafermos et al., 2022)

Before the pandemic crisis, the total gross notional value of JPY/USD FX swaps stood at around \$2.8tn, with approximately 60 percent of these swaps having a maturity greater than one month (Eren & Wooldridge, 2022). This situation has led to the recognition that the turmoil experienced in March 2020 revealed the vulnerability of foreign currency funding for Japanese banks that heavily relies on short-term market transactions (Aoki et al., 2021).

The tensions in the JPY/USD market can also be observed through the analysis of the JPY/USD basis spread. It is widely acknowledged that since the onset of the pandemic crisis, the basis vis-à-vis the USD has significantly widened across major currencies (Avdjiev et al., 2020). In the case of JPY/USD, this spread reached -144bps by the end of March, with only Korean won exhibiting a wider negative basis (Avdjiev et al., 2020). The evolving dynamics of the JPY/USD FX swaps market reaffirm the notion that the depletion of term funding liquidity in core USD money market compelled numerous non-US institutions to seek USD funding through three-month FX swaps, thus contributing to the widening of the cross-currency basis (Eren et al., 2020a).

## *5.2 EUR/USD FX Swap*

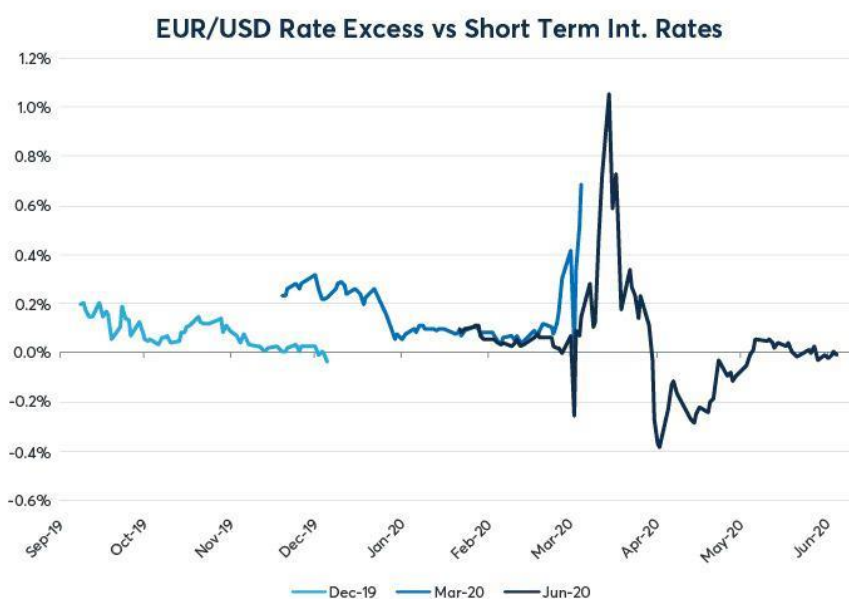
The EUR/USD FX swap market experienced similar challenges during the aforementioned period. The decrease in average weekly issuance of financial CPs (rated AA) from approximately \$11bn to \$3bn between February and April, combined with the overall health of the CPs and CDs markets, served as an indicator of bank funding conditions in USD and beyond. This decline in CPs issuance had a direct impact on the EUR/USD FX swap basis spread.

As European banks sought USD funding liquidity through FX swaps due to the reduced issuance of financial CPs, a shortage of USD liquidity emerged. This shortage resulted in a three-month FX swap basis for EUR/USD reaching -85bps in March 2020 (Avdjiev et al., 2020). Among major currencies, the EUR/USD FX swap basis was the third most affected, following JPY/USD and CHF/USD, which exhibited basis spreads of -144bps and -107bps, respectively.

Another way to observe the stress in the FX swaps market is by examining the excess of the FX swap rate over the interest rate differential between one-month USD ICE LIBOR and one-month EURIBOR. This differential illustrates the higher cost of engaging in an FX swap, primarily due to the shortage of USD funding liquidity.

These developments underline the challenges faced by European banks in obtaining USD funding liquidity and the resulting impact on the EUR/USD FX swap market during the period under consideration.

Figure 8 shows how EUR/USD also experienced notable dynamics in relation to short-term interest rates



Source: CME Group, 2020

This situation further reinforces the significance of unsecured funding in the provision of USD funding liquidity. As discussed in this section, the decline in unsecured funding availability compelled European banks to rely on FX swaps as an alternative. Consequently, the costs associated with these swaps turned negative, indicating a 'dash for cash'. The prevailing tensions experienced in the unsecured funding markets and their subsequent impact on the FX swaps markets were tempered to a certain extent when the Fed made the decision to supply USD

globally. Hence, the Fed's backstop strategy played a crucial role in mitigating the challenges posed by this liquidity squeeze.

## **6. Fed's backstop strategy during the pandemic crisis**

The Federal Reserve has actively pursued a global liquidity provision strategy during the pandemic crisis. This approach aimed to uphold the dominance of the USD while addressing the financial strains arising from the increased global demand for USD funding liquidity (Dafermos et al., 2022). Previous discussions of this strategy focused primarily on the provision of direct liquidity through central bank swap lines as well as the FIMA facility (Murau et al., 2023). However, this paper takes a further step by asserting that the backstop strategy also encompasses the Money Market Mutual Fund Liquidity Facility (MMLF), as outlined by the Fed (Fed, 2020). The MMLF is a publicly available facility with global implications, as its implementation has resulted in an inflow of funds into prime MMFs. By establishing this facility, the Fed acknowledged that the effects of wholesale funding through CPs and CDs extend to the FX swap markets. Moreover, it underscored the inherent connection between the uneven geographical distribution of USD-denominated assets and liabilities and prime MMFs. Therefore, this section examines both the responses of the Fed and their implications.

### *6.1 Swap lines*

During the GFC of 2007-9 it became apparent that interbank funding markets were predominantly USD-denominated, highlighting the need for a backstop for global markets. In response, the Fed made the decision to establish central bank liquidity swap lines with foreign central banks, effectively becoming a lender of last resort of USD funding liquidity and managing cross-border USD liquidity instability (Helleiner, 2014; Dafermos et al., 2022). The initial swap lines emerged in 2007 when non-US banks faced funding pressures due to the need to provide backstop funding for special purpose vehicles (SPVs) (Fleming & Klagge, 2010).

Between December 2007 and September 2008, the Fed started providing and expanding the total amount of USD available to foreign central banks (Fleming & Klagge, 2010). This enabled foreign central banks to address the increased pressures in funding market by expanding USD funding liquidity (Fleming & Klagge, 2010). For instance, the ECB used these swap lines to provide USD funding liquidity to European banks (Grad et al., 2011). Eventually, the ECB became the primary beneficiary of these swap lines, which were later extended to other central

banks such as the Bank of England (BoE) and the Bank of Japan (BoJ) between September 2008 and January 2009.

In October 2013, these swap lines were transformed into a permanent standing arrangement between the Fed, Bank of Canada (BoC), BoE, BoJ, the ECB and the SNB. This arrangement allowed the Fed to once again provide liquidity to global financial systems during the pandemic crisis. The BoJ, in particular, extensively drew from its permanent swap line with the Fed, amounting to approximately \$225bn, to address funding liquidity needs and issues faced by Japanese banks due to reduced unsecured funding from prime MMFs (Aldasoro et al., 2020; Dafermos et al., 2022; Choi et al., 2022). The ECB was the second-largest beneficiary, with a value of \$140bn, together accounting for about 82 percent of the total peak (Choi et al., 2022).

Through these swap lines, the Fed aimed to alleviate the shortage of USD funding liquidity. While it brought some benefits and alleviated USD funding stress in FX swap markets to some extent, stress persisted in the CPs market. With significant foreign participation in the CP market, stress in this market had the potential to spill over into the FX swap markets once again if firms tapped into these markets to acquire USD (Avdjiev et al., 2020). Hence, the Fed's backstop strategy took into account the significance of unsecured funding for the provision of USD liquidity, and these swap lines were accompanied by a facility focused on prime MMFs, known as the MMLF.

## *6.2 MMLF*

The MMLF was introduced by the Fed as a means to provide liquidity support to prime MMFs and banks in response to market strains. Under this program, US banks could borrow from the Fed by pledging various assets purchased from prime and tax-exempt MMFs, including CPs and CDs (Avalos & Xia, 2021). The objective was to incentivize banks to purchase illiquid assets from prime MMFs, indirectly providing liquidity to MMFs and reducing redemptions. The MMLF also aimed to establish a ceiling rate for CPs, enabling dealers in CP markets to re-intermediate these wholesale instruments (Eren et al., 2020b).

Furthermore, the MMLF helped prime MMF managers rebuild their liquidity buffers, resulting in increased volumes above pre-pandemic levels in April 2020 (Avalos & Xia, 2021). Following the activation of the MMLF on March 2023, prime MMFs experienced modest outflows of only

\$28bn, with half occurring in the first two days before CDs could be pledged at the facility. However, by the end of April, inflows to prime MMFs reached \$47bn (Anadu et al., 2021), as depicted in [Figure 4](#).

Although the MMLF was a domestic facility, its impact extended to prime MMFs operating globally. For instance, in the case of Japanese banks, it was noted that they refrained from funding via CP/CD market until it stabilized due to the Fed's policy responses (Aoki et al., 2021).

With the resumption of prime MMF activity and the inflow of funds, money market rates decreased, and the spread between CP rates and interest on excess reserves (IOER) rates returned to pre-crisis levels by April 1, 2020. Negotiable CDs, which could be pledged at the MMLF, also experienced a similar reduction in costs (Anadu et al., 2021).

As CPs and CDs play an active role in providing USD funding liquidity to non-US banks, the decrease in rates resulting from improved conditions in prime MMFs led to a compression of the LOIS spread below 50bps (Eren et al., 2020b). This emphasizes the significant role of the CDs and CPs in the offshore USD system.

Therefore, the Fed employed the MMLF to alleviate financial stress stemming from a decline in unsecured funding. By directly addressing prime MMFs, the Fed aimed to preserve USD hegemony (Dafermos et al., 2022) by enhancing global unsecured funding, recognizing its global impact in the FX swaps market (Davies & Kent, 2020).

## **7. Concluding remarks**

This paper extensively explores the global dimension of US prime MMFs and their significance in the USD funding structure of European and Japanese banking systems. It argues that funding is channeled through the acquisition of CPs and CDs issued by these foreign institutions. While the role of US prime MMFs was acknowledged by scholars following the GFC and the Eurocrisis, particularly due to their activity in the ABCP markets, the study of prime MMFs became less prominent after these events. However, the pandemic crisis revealed that these banking systems still rely on USD funding liquidity provided by prime MMFs, and the growing importance of these institutions introduces greater instability in liquidity provision.

Building upon this observation, the paper also analyzes the role of US prime MMFs in the JPY/USD and EUR/USD FX swap markets. It demonstrates the inherent connection between the FX swaps market and the willingness of prime MMFs to purchase CPs and CDs issued by non-US banks. When prime MMFs reduce their acquisitions of CPs and CDs, these banks are compelled to rely more heavily on FX swaps, resulting in negative effects on the spreads of these instruments and the offshore USD system.

During the pandemic crisis, prime MMFs experienced significant outflows as investors questioned their ability to retain ‘money-like’ characteristics. Consequently, these institutions not only struggled to support new purchases of CPs and CDs, but also began selling the ones already on their balance sheets. This led to price dislocations for USD-denominated CPs and CDs, causing European and Japanese banks to face a USD funding shortage and lose a critical funding source. The ‘dash for cash’ of prime MMFs contributed to stress across financial markets (Avalos & Xia, 2020). As European and Japanese banks turned to FX swaps, negative changes in the JPY/USD and EUR/USD spreads were observed. This situation reaffirmed the importance of unsecured wholesale funding for the offshore USD system and highlighted the role of prime MMFs as a barometer for bank funding conditions. It also underscored the global reach of prime

MMFs and their ability to create new international linkages within the cross-border funding structure, with significant implications for financial stability.

This paper emphasizes the need for ongoing research on the role of prime MMFs in non-US banking systems and, by extension, in FX swap markets, as the decisions of these institutions can have a substantial impact on the offshore USD system. This is particularly crucial considering that these funds have become key liquidity providers for FX swaps markets.



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