

Financial stability

Vulnerabilities in money market funds

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Summary

The acute market stress period of March 2020 showed that EU money market funds remain vulnerable to liquidity risk on their asset and liability sides. This article identifies a series of structural risks. The evidence related to these risks can serve as input to the currently ongoing discussions on MMF regulatory reforms. On the asset side, non-public debt MMFs have very high and concentrated exposures to private money markets that have low liquidity, making MMFs highly vulnerable to a symmetric liquidity shock as in March 2020. Regulatory constraints might also make some MMFs more vulnerable to runs from investors, as a result of concerns related to redemption fees and gates, or of tight constraints on NAV deviations. Finally, MMF ratings also add to the constraints on managers, by restricting their eligible assets and by penalising the use of liquidity management tools provided in the Money Market Fund Regulation (MMFR).

Introduction

MMFs are key intermediaries in the financial system: they provide short-term funding to issuers, mainly banks, and are used as cash management vehicles by investors. MMFs play an important role in short-term funding markets such as commercial paper (CP) or certificates of deposit (CDs).

During the global financial crisis of 2007–2008, US and European MMFs faced acute stress due to their exposures to commercial paper backed by assets related to subprime borrowers (asset-backed commercial paper). In some cases, fund sponsors stepped in to provide support to their MMFs by purchasing instruments directly from the funds (Bengtsson, 2013). As the crisis intensified following Lehman's collapse, MMFs saw a surge in outflows and, in the US, the central bank launched a range of facilities to support MMFs and money markets.

In the aftermath of the crisis, important regulatory reforms took place to reduce vulnerabilities and increase the resilience of MMFs. In the EU, the MMFR provides for a range of regulatory requirements, which entered into force in 2019.

The intense stress experienced by MMFs in March 2020 has shown that, despite regulatory reforms, MMFs remain subject to vulnerabilities. This article focuses on structural risks and vulnerabilities in the MMF industry.

Background

MMFs are collective investment schemes that provide short-term funding to financial institutions, governments and corporates. MMFs invest in short-term instruments such as CP, CDs, short-term government debt, bank deposits or repurchase agreements (repo).

MMFs are used as short-term cash management vehicle by investors. MMFs provide liquidity (daily redemption), diversification and stability of value (low fluctuation of MMF shares); they remunerate investors with market yields. MMF returns are related to the yields on the instruments in the MMF portfolio. Compared with other assets, MMFs offer higher yields than bank deposits, and higher liquidity than short-term bond funds (RA.1). Direct investment in money market instruments such as CP or CDs offers less liquidity and requires an expensive infrastructure

⁹¹ This article was written by Antoine Bouveret and Lorenzo Danieli.

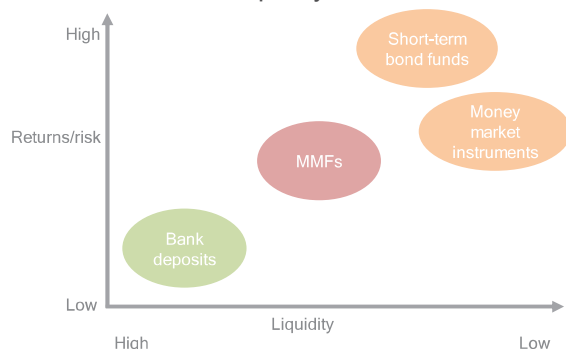
such as internal credit assessment or internal trading desks.

The investor base of MMFs consists almost entirely of corporates (28 %) and institutional investors (insurance companies, investment funds or other financial institutions), while retail participation is very low (RA.2).

RA.1

Cash management vehicle

Trade-offs between liquidity and returns

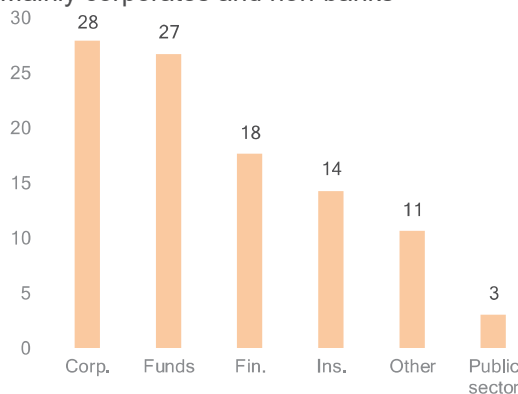


Source: ESMA.

RA.2

MMF investors

Mainly corporates and non-banks



Note: Ownership of EU MMF shares by investor type, in percent. Corp.: Corporates, Fin: Other financial institutions (including banks), Ins.: Insurance companies. The 'Other' category includes MMFs sold through intermediaries (third party). Sources: Fitch, ECB, ESMA.

Different types of MMFs

The MMFR defines two broad types of MMFs: short-term MMFs (investing mainly in assets maturing within 120 days) and standard MMFs (investing mainly in assets maturing within 6 months)⁹².

Within the short-term category, MMFs can be of three types. **Variable Net Asset Value** (VNAV) MMFs can invest in a range of eligible assets (including government debt, CP or CDs) and they mark-to-market their NAV. Hence, VNAV shares can be redeemed at their market value by investors.

Public debt Constant Net Asset Value (CNAV) MMFs must invest at least 99.5 % of their assets in government debt, repo collateralised by government debt or cash. CNAVs offer redemption of their shares at par value, as they are allowed to use the amortised cost method, but they also have to calculate their mark-to-market NAV.

Low Volatility Net Asset Value (LVNAV) MMFs can invest in a broader range of assets (including CP and CDs) than CNAVs. LVNAVs offer a constant NAV; however, if the mark-to-market NAV of LVNAVs deviates more than 20 bps from the constant NAV, LVNAVs have to convert to VNAVs.

MMFs are subject to a range of **regulatory requirements**, including portfolio rules and diversification requirements. Some requirements are specific to the MMF type (RA.3). While all MMFs are subject to daily and weekly liquidity requirements, the levels differ by types⁹³. MMFs providing redeemability at par (CNAVs and LVNAVs) have higher liquidity requirements than VNAVs: 10 % daily liquid assets compared with 7.5 % for VNAVs, and 30 % WLA compared with 15 % for VNAVs. In addition, CNAVs and LVNAVs could be subject to redemption fees and gates, if their WLA go below 30 % and they face

⁹² Short-term MMFs have a 60-day limit on the weighted average maturity (WAM) of their portfolio. The WAM is the average length of time to legal maturity (or to the next interest rate reset, if shorter) of all the underlying assets in the MMF portfolio. The WAM measures the portfolio's sensitivity to changes in interest rates. Short-term MMFs also have a 120-day limit on the weighted average liquidity (WAL) of their portfolio. The WAL is the average length of time to legal maturity of all the underlying assets in the MMF portfolio. The WAL measures the credit risk of the portfolio. Standard MMFs have a WAM limit of 6 months and a WAL limit of 12 months.

⁹³ Daily liquid assets comprise cash and daily maturing assets, including overnight repo and deposits. Weekly liquid assets comprise weekly maturing assets, including repo and deposits maturing within 5 business days for all MMFs. For LVNAVs and CNAVs, government assets with a residual maturity of up to 190 days are also considered WLA up to 17.5 pps of the regulatory requirement. For VNAVs, money market instruments or shares of other MMFs (provided they are able to be redeemed and settled within 5 business days) are also considered WLA up to 7.5 pps.

daily outflows above 10 %, while those provisions do not apply to VNAVs⁹⁴.

RA.3

MMF Regulation

Regulatory requirements for short-term MMFs

MMF type	CNAV	LVNAV	VNAV
	Pricing		
Dealing NAV	Constant NAV	Constant NAV, provided that the market NAV does not deviate more than 20 bps	Variable
Valuation method	Amortised cost	Amortised cost for instruments (i) ≤ 75 days and (ii) where the difference from mark-to-market value is below 10 bps; mark-to-market otherwise	Mark-to-market
	Liquidity requirements (% of NAV)		
Daily liquid assets (min)	10 %	10 %	7.5 %
Weekly liquid assets (min)	30 %, with up to 17.5 % in government assets with a maturity up to 190 days	30 %, with up to 17.5 % in government assets with a maturity up to 190 days	15 %, with up to 7.5 % in money market instruments or shares of other MMFs
	Liquidity fees and gates		
Optionality	If WLA < 30 % and daily outflows > 10 %, MMF may impose fees, gates or suspension of redemptions. No formal limit		N/A
Mandatory activation	If WLA < 10 %, fees or suspension must be enacted		N/A

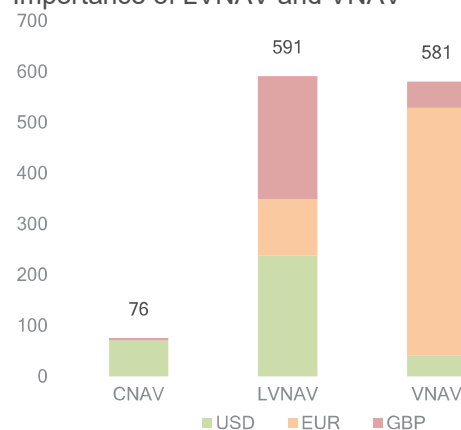
Market overview

The EU MMF industry is diverse across types and currencies. As of November 2020, the size of the EU MMF industry amounted to around EUR 1 400 bn according to the ECB, spread across MMF types (RA.4). LVNAVs and VNAVs each account for 47 % and CNAVs for 6 % of MMFs. Overall, slightly more than half of EU MMFs offer redeemability at par (CNAVs and LVNAVs). EUR MMFs account for 48 % of MMFs, followed by USD (28 %) and GBP (24 %).

RA.4

MMF size

Importance of LVNAV and VNAV



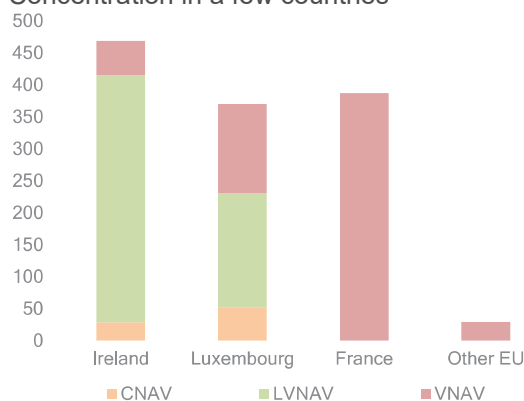
Note: Net asset value of EU MMF by type and currency in EUR bn, as of November 2020. The sample covers around 90% of EU MMFs universe. Sources: Refinitiv Lipper, ESMA.

The EU MMF industry is concentrated mainly in three Member States (RA.5). Ireland accounts for around 37 % of MMFs by size, followed by France (31 %) and Luxembourg (30 %), with other EU countries accounting for around 2 %. By MMF types, there are large differences between countries: LVNAVs are almost all domiciled in Ireland (67 %) and Luxembourg (31 %), while VNAVs are mainly domiciled in France (59 %) and in Luxembourg (26 %). Those differences may partly reflect historical factors such as the prohibition of CNAV MMFs in France, accounting issues (VNAVs are presumed to be cash equivalent in France⁹⁵) or different demands from investors.

⁹⁴ EU and US rules for MMFs are slightly different on a few points. In the United States, redemption fees and gates are to be considered by MMFs only when WLA breach the 30 % level, while, in the EU, daily outflows also need to be above 10 %. In the United States, redemption fees and gates apply to all type of MMFs, except government MMFs, while in the EU they do not apply to VNAVs.

⁹⁵ According to the AMF, shares in VNAVs are presumed to be considered cash equivalent under International Accounting Standard 7, provided that MMFs are used as a short-term cash management vehicle rather than as an investment. The presumption of negligible risk of change in the value of these funds can be refuted based on the events and circumstances relating to market trends, notably in periods of tension (AMF, 2018).

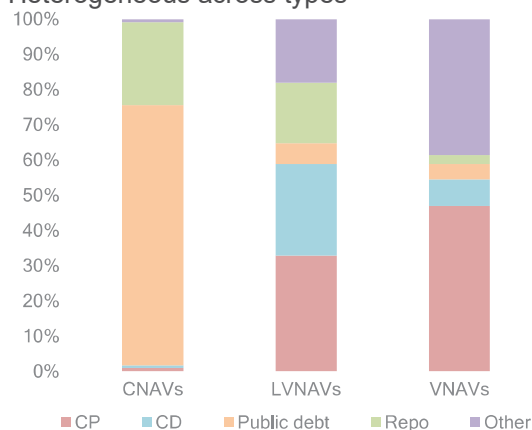
RA.5
MMF by country of domicile
Concentration in a few countries



Note: Net asset value of EU MMFs by domicile and type, in EUR bn, as of September 2020. Data based on a sample of EU MMFs covering around 80% of the EU MMF universe. Sources: Lipper, AMF, ESMA.

MMFs' portfolio compositions reflect their regulatory type: CNAVs invest almost exclusively in public debt and repo, while LVNAVs and VNAVs are predominantly exposed to CP and CD markets (RA.6).

RA.6
MMF portfolio composition
Heterogeneous across types



Note: Portfolio composition of MMFs by types, in % of NAV as of Sep. 2020. Sources: Crane, ESMA.

Role of credit rating agencies

MMF ratings

Most funds typically have MMF ratings from Credit Rating Agencies (CRAs). MMF ratings are different from credit ratings: they assess not credit risk but rather the ability of the MMF to preserve capital and maintain liquidity (see RA.7 on CRA methodologies). Since MMF ratings do not typically meet the definition of a credit rating as set out under the CRA Regulation, they are not considered credit ratings and therefore do not fall within the scope of the regulatory requirements of the CRA Regulation.

RA.7
MMF rating methodologies

Overview of CRA approaches to MMFs

	S&P	Moody's	Fitch
Fund ability to maintain principal value	Fund ability to maintain principal value	Fund ability to meet the dual objectives of providing liquidity and preserving capital	Fund ability to provide principal preservation and liquidity through limiting credit, market and liquidity risks
Rating definition	100 % A-1 or A-1+, 50 % repo limit with A-2 counterparties. Exposures unrated by S&P are not eligible	No formal limit, credit profile based on securities ratings and maturities	100 % F1 or higher (except for repo), 25 % repo limit with F2 counterparties. Unrated exposures not eligible, unless rated by Moody's or S&P
Credit risk exposures	Exposures unrated by S&P are not eligible	Exposures unrated by S&P are not eligible	Exposures unrated by S&P are not eligible, unless rated by Moody's or S&P
NAV deviation limit	25 bps	No formal limit	No formal limit

Using a sample of MMFs domiciled in Ireland and Luxembourg, covering around 60 % of the EU universe, more than 99 % of those MMFs have an MMF rating from at least one of the three CRAs, and more than 80 % of MMFs are rated by at least two CRAs (RA.8). However, in France, very few MMFs are rated, implying that at the EU level the share of rated MMFs is more likely to be around 60 %. All rated MMFs have an AAmmf rating. The use of MMF ratings is related to the predominance of institutional investors, whose investment policy usually restricts them to investing only in MMFs rated AAmmf by at least two CRAs (IMMFA, 2014). According to the European Commission (2013), the use of MMF ratings was also related to the lack of clear rules around MMFs, except in France, leading investors to rely on external assessments provided by CRAs⁹⁶. The importance of AAmmf

⁹⁶ 'Credit ratings have been useful for investors since until recently there was no common definition of MMF in Europe. It was very difficult to perceive the different risk characteristics of MMFs subject to different national legislations which often imposed weak constraints on credit, liquidity and interest rate risk. IMMFA requires its

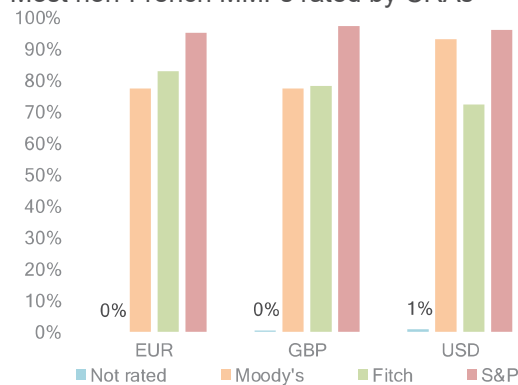
members to be rated due to this situation. To the contrary MMFs domiciled in France are usually not rated because the MMF sector has long been carefully delineated by rules that prescribe the characteristics of a MMF asset.

ratings is also reflected in industry codes of practice⁹⁷. An analysis by the European Commission also shows that, when three UK MMFs were put on negative watch by a CRA, they experienced up to 50 % outflows in 2 weeks (EC, 2013, pp.12–13).

RA.8

MMF ratings

Most non-French MMFs rated by CRAs



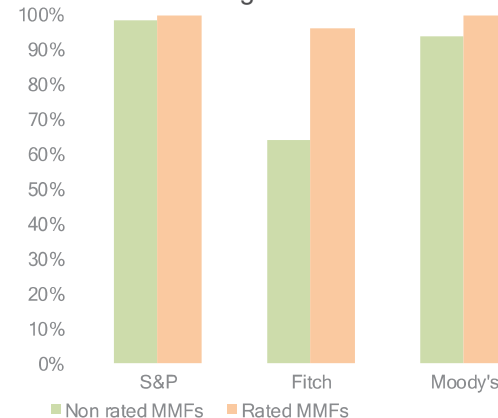
Note: Share of EU MMFs with money market fund ratings, in % of NAV. Based on a sample of MMFs with NAV of EUR 870bn as of October 2020 (60% of EU universe). The sample does not include any French MMF. Sources: Crane, ESMA.

without MMF ratings tend also to invest in high-rated issuers, although their exposures to Fitch-rated issuers are significantly lower than for MMFs with an MMF rating from Fitch (65 % of NAV against 98 %).

RA.9

MMF portfolio exposures

All instruments held by rated MMFs have external credit ratings



Note: Share of rated instruments in MMF portfolio by CRA (in % of NAV). Sources: Crane, ESMA.

Credit ratings

To reduce over-reliance on external ratings, the MMFR requires MMFs to perform internal credit quality assessments. External credit ratings of the assets in their portfolio may be considered, but they cannot be mechanically relied upon. Looking at detailed portfolio holding data, credit ratings continue to play an important role. MMFs that obtain an MMF rating invest only in high-rated instruments and issuers: MMFs rated by S&P invest 100 % in instruments and issuers that have credit ratings from the same CRA (RA.9).

This close relationship can be explained by constraints related to CRAs' MMF-rating methodologies. For some CRAs, their methodologies specify that MMFs can only invest in high-rated issuers, and in most cases any exposure below some credit rating level would not be compatible with an AAmmf rating for the MMF. For one CRA, MMFs are restricted to investing only in instruments rated by the same CRA, while other CRAs might allow ratings from other CRAs to be taken into account. MMFs

Vulnerabilities in the MMF sector

In March 2020, some segments of the US and EU MMF industry experienced very high levels of stress. MMFs exposed to private markets (LVNAV and VNAV in the EU, prime MMFs in the US) recorded very high outflows, while facing challenges in disposing of their assets due to the lack of liquidity in CP and CD markets⁹⁸.

Following actions by central banks to support money markets, redemptions slowed while liquidity improved in money markets. No EU or US MMFs had to implement fees or gates or suspend redemptions. However, this episode shows that MMFs remain subject to a range of vulnerabilities.

Those vulnerabilities can be split across a few dimensions: (i) liquidity of underlying markets, (ii) regulatory requirements, (iii) role of CRAs and (iv) investor behaviour.

Fund ratings were therefore not required to establish investor confidence in France' (European Commission, 2013, p. 49).

⁹⁷ For example, the 2012 code of practice of the International Money Market Funds Association (IMMFA) requires that IMMFA funds be rated AAA (IMMFA, 2012).

Since then, the IMMFA has revised its code of conduct, which no longer refers directly to MMF ratings.

⁹⁸ For further details about how stress affected MMFs in March 2020, see ESMA (2020a), FSB (2020) and IOSCO (2020).

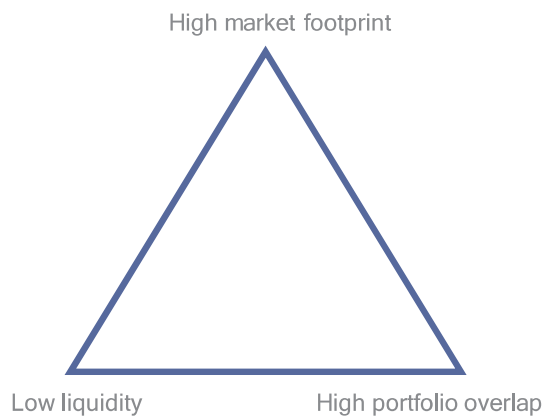
Liquidity in money markets

MMFs are exposed to three intertwined challenges regarding liquidity on their asset side: MMFs have a large market footprint in the asset classes they invest in; those markets are not very liquid even in normal times; and MMFs have a high degree of portfolio overlap (RA.10).

RA.10

MMF asset liquidity

Common vulnerabilities

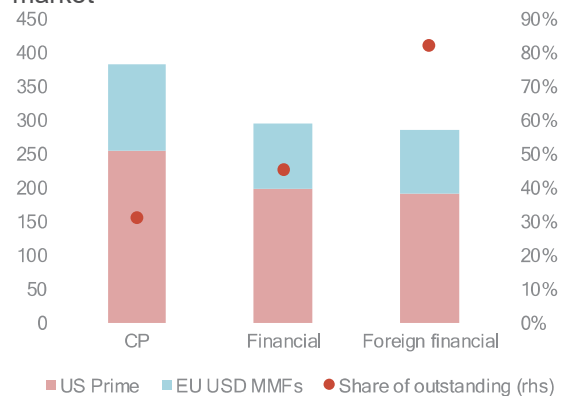


MMFs have a very large **market footprint** in private money markets. As of February 2020, US prime MMF and USD LVNAVs and VNAVs exposures amounted to around one third of the US CP market (RA.11). More importantly, those MMFs held more than half of the CP issued by financial institutions, including 82 % of all CP issued by foreign financial institutions. The footprint is lower in other currencies but still substantial: MMFs hold more than 50 % of the EUR and GBP financial CP markets, although precise estimates are challenging because of limited transparency in some segments of the European CP market.

RA.11

Market footprint

MMFs hold the majority of the USD financial CP market



Note: US Prime and EU USD LVNAV and VNAVs exposures to US Commercial Paper market, in USD bn and % of outstanding, as of end-February 2020.

Sources: Federal Reserve, Banque de France, ECB, Crane, ESMA.

The **market liquidity** of the CP market is low, even in normal times, for a range of reasons. First, investors tend to buy and hold the instruments until maturity, owing to the short maturity of CP, implying low trading volumes on secondary markets. The distribution of CP at issuance also plays a role. Most CP is sold through a group of dealers or banks that agree to sponsor and make markets in the CP issuer's programme in exchange for a fee. Programme members might provide liquidity in the secondary market, but they have no obligation to do so. Non-programme institutions would generally not buy CP they did not help issue, because of reduced information on the issuer or for commercial reasons. Finally, banks need balance sheet capacity to be able to intermediate large amounts of CP. In the US, dealer inventories of CP amounted to around USD 10 bn at end-February, less than 1 % of the market, implying limited capacity to intermediate CP trading (RA.12). Only after the launch of the Fed's Money Market Mutual Fund Liquidity Facility did dealers increase their CP inventories⁹⁹. Limited capacity of banks to act as dealers and intermediate the CP and CD markets seems to result from prudential regulation (IOSCO, 2020).

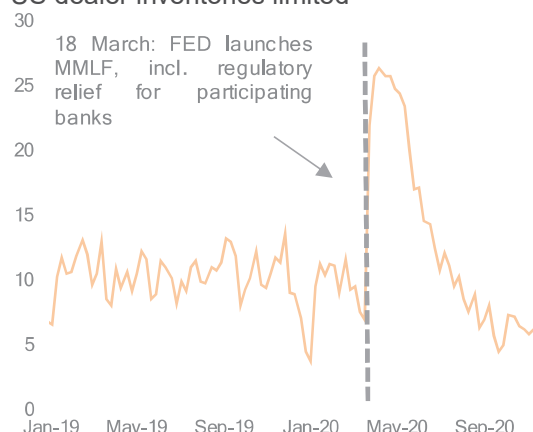
⁹⁹ The facility consists in loans made by the Federal Reserve to banks to fund the purchase of assets from

MMFs. Such loans are collateralised by the assets purchased from MMFs.

RA.12

Absorption capacity

US dealer inventories limited



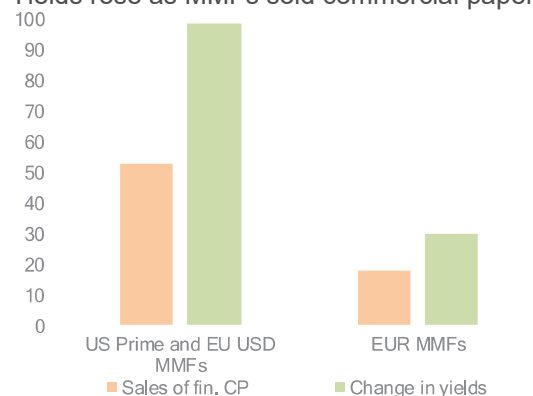
Note: US Primary dealers inventories of CP, in USD bn.
Sources: Federal Reserve, ESMA.

The limited absorption capacity of the CP market was tested in March, as MMFs sold instruments to meet investor redemptions. We estimate that USD MMFs (US prime and EU USD MMFs) sold more than USD 50 bn of financial CP, more than five times average dealer inventories. Over the same period the yield on CP surged by almost 100 bps. Similar patterns were also observed in EUR CP markets, with MMFs selling around EUR 18 bn of CP, while yields rose by 30 bps (RA.13)¹⁰⁰.

RA.13

Volume of sales and yields

Yields rose as MMFs sold commercial paper



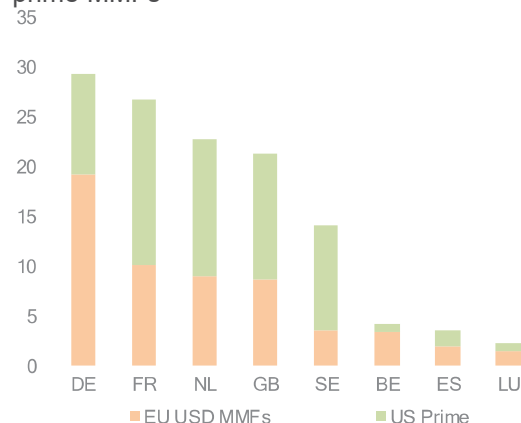
Note: Estimated sales of financial CP by US Prime and EU USD LVNAVs and VNAVs, (in USD bn), and by EUR MMFs (in EUR bn). Change in 3M financial CP yield in basis points. All changes are between end-February and end-March.
Sources: ECB, Federal Reserve, Crane, ESMA.

Finally, MMFs tend to be exposed to the same type of assets and issuers. RA.14 shows a high degree of overlap between US prime and EU USD MMFs in the financial CP market: both types of MMFs have more than USD 10 bn in exposures to CP issued by French and German banks. Such overlap implies that, if one type of fund sells CP, other types of funds will face challenges selling the same instrument due to the low level of liquidity.

RA.14

USD MMFs

High overlap between EU USD MMFs and US prime MMFs



Note: Holdings of financial CP by country of issuer for EU USD LVNAVs and VNAVs, and US Prime MMFs, in USD bn as of end-February 2020.
Sources: Crane, ESMA.

Formally, the degree of portfolio overlap can be assessed by estimating the portfolio similarity of MMFs (RA.15). Using a sample of 65 US prime MMFs and 20 EU USD LVNAVs (with NAVs of USD 1 080 bn and USD 343 bn respectively), we estimate the portfolio similarity as of end-February 2020. The index is based on the holdings of financial CP by issuer. Two MMFs will be very similar if they share exposures to the same issuer for the same relative amount (in % of their NAV).

¹⁰⁰ The volumes of sales of CP are proxied by the change in holdings of CP by MMFs between end-February and end-March for a sample of MMFs accounting for around 70 % of the EU MMF sector. When CPs held at end-February

that matured in March are excluded, the volume of sales is around EUR 11 billion.

RA.15

MMF portfolios

Portfolio similarity

MMFs tend to invest in similar assets, in terms of issuer type, instrument or maturity. A measure of portfolio similarity can be estimated for each MMF, based on the composition of its portfolio. We use a measure based on cosine similarity (Girardi et al., 2016). For each MMF, the share of each issuer in its portfolio is estimated and then the portfolio similarity index is computed as:

$$Similarity_{i,j} = \frac{w_i \cdot w_j}{\|w_i\| \cdot \|w_j\|}$$

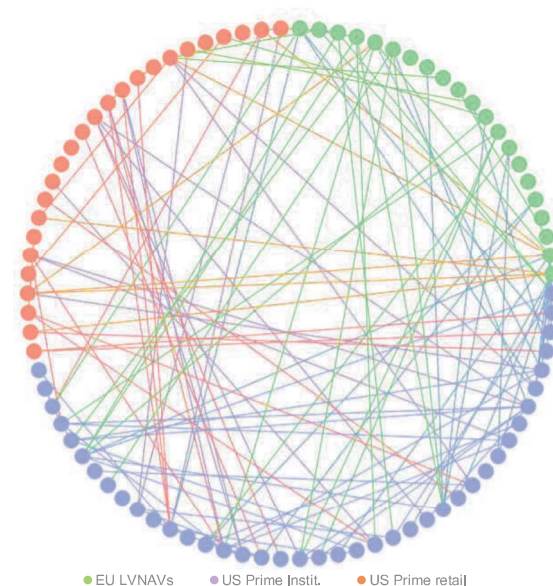
where w_i is the vector asset weights in the portfolio of MMF i and w_j is the vector asset weights in the portfolio of MMF j . This index ranges from 0 (no similarity) to 1 (where each portfolio exactly replicates the other).

RA.16 displays the very high level of portfolio similarity across EU and US MMFs investing in USD CP. The figure only shows edges between MMFs when the portfolio similarity is very high (above 0.76). The network chart is quite dense, implying a high degree of portfolio overlap, when measured by CP exposures, across US prime funds and EU USD LVNAVs. This degree of overlap is common across MMF types and currencies, and remains stable over time (Georg et al., 2018). Overall, US prime funds and USD LVNAVs tend to be very similar on the asset side, even though they cater to different types of investors.

RA.16

USD MMFs

High portfolio similarity across USD MMFs

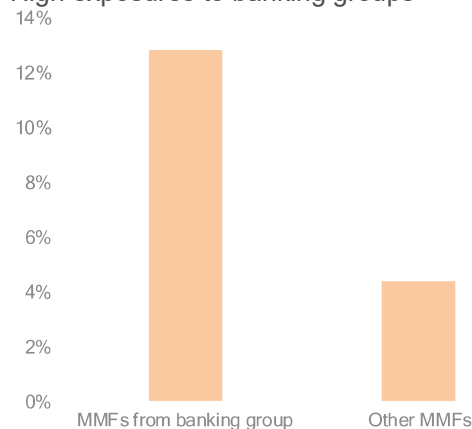


Note: Portfolio similarity index by MMF type. Only values above 0.76 are displayed for readability. Sources: Crane, ESMA.

In addition, some asset management companies selling MMFs belong to banking groups. Based on a sample of funds with EUR 938bn in NAV as of end-February 2020, such MMFs may on average have higher exposures to the banking group (close to 13% of NAV, RA.17) than independent funds (less than 5%). The higher exposure relates to deposits and repo with the banking group, while exposures to financial instruments issued by the banking group (CPs and CDs) are similar to other MMFs. High intragroup exposures imply that, if those MMFs were to reduce their exposures, their provision of liquidity to the banking group would decline.

RA.17

MMFs belonging to banking groups
High exposures to banking groups



Note: Average exposures of EU LVNAVs and VNAVs of MMFs to banking groups), in % of NAV.
Sources: Crane, ESMA.

The combination of those three characteristics (large market footprint, high degree of overlap and low liquidity in underlying markets) makes MMFs particularly vulnerable to symmetric shocks. If several MMFs face large redemptions at the same time, they are likely to try to sell the same type of assets simultaneously. Given the limited absorption capacity of the underlying asset market, such sales will be challenging to execute, thereby creating liquidity issues for MMFs.

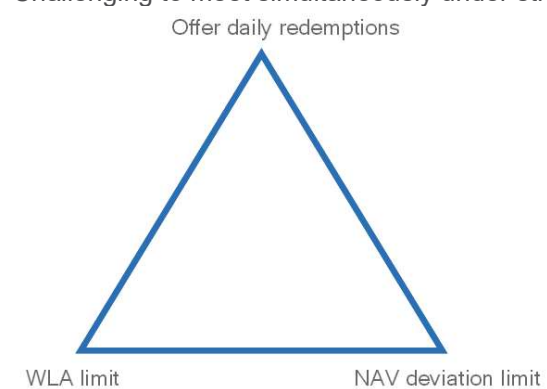
Role of regulatory constraints for LVNAVs

For MMFs providing redeemability at par, the EU regulatory framework provides tighter liquidity requirements. For CNAVs, these constraints might be less binding, since these MMFs invest almost exclusively in government debt, which is more liquid than private debt.

However, for LVNAVs, the largest MMF type in the EU, regulatory constraints can be binding, especially since some of them might be conflicting. To meet daily redemptions, LVNAVs have to liquidate instruments. At the same time, LVNAVs have to keep their WLA above 30 % of NAV, and their NAV deviation below 20 bps (RA.18).

RA.18

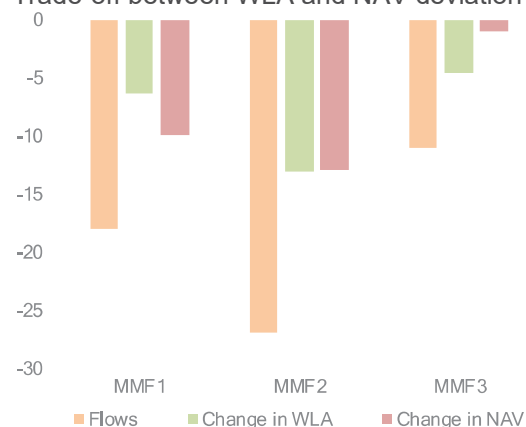
LVNAV regulatory constraints
Challenging to meet simultaneously under stress



During periods of stress, LVNAVs are likely to face challenges to meet all those constraints at the same time. RA.19 shows three MMFs that faced very high outflows in March (more than 10 % in 2 weeks, as indicated by the orange bar). To meet those redemptions, funds can sell their most liquid assets, but that will result in a decline in WLA (green bar) and a risk of breaching the 30 % requirement. Funds can also choose to dispose of less-liquid assets, but in that case the sales could result in mark-to-market losses. Such losses will lead to a deviation between the mark-to-market NAV and the constant NAV. Although no LVNAV breached the 20 bps collar in March, a few funds were close to the threshold, with one fund having an 18 bps deviation.

RA.19

MMF liquidation strategy
Trade-off between WLA and NAV deviation



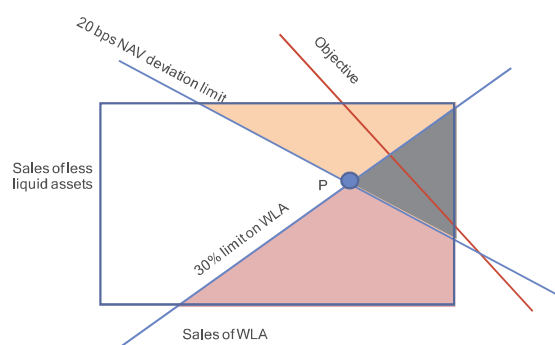
Note: 7D net flows in % of assets and weekly change in WLA (in pp) and NAV deviation (in bps) as of 25 March 2020 for three USD LVNAVs.
Sources: Crane, ESMA.

In that context, we have shown in a recent article (Baes et al., 2021) how the interaction of regulatory constraints and limited liquidity in underlying markets can result in LVNAVs being

unable to maintain a stable NAV and have WLA above the regulatory limit at the same time.

RA.20 illustrates the trade-off faced by LVNAV, by showing the highest level of redemptions an MMF can face. These levels depend on the sale of WLA (x-axis) and of less-liquid assets (y-axis). Given the 30 % WLA constraint, MMFs are limited in the quantity of liquid assets they can sell, shown in the figure by the red triangle (indicating non-feasible sales of WLA). MMFs can sell less-liquid assets, but this will result in deviations between the constant NAV and the mark-to-market NAV, since funds will sell at a discounted price given the low liquidity of the market. Therefore, MMFs cannot sell more than a given amount of less-liquid assets, represented by the orange triangle (the dark grey triangle represents the area where both NAV and WLA constraints apply). The highest level of redemption that could be met is reached at the point P.

RA.20
Money market fund liquidation strategy
Trade-off between WLA and NAV deviation



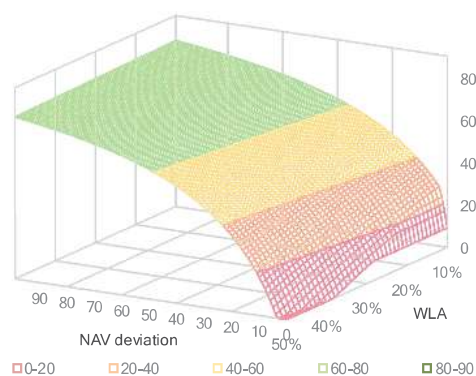
In addition, we can analyse how changes in regulatory requirements (WLA or NAV deviation) or improvement in underlying market liquidity can strengthen the resilience of LVNAVs.

For the purpose of a simulation, we assume that a stylised LVNAV has 35 % of its NAV in WLA and 65 % in other assets, corresponding to aggregate reporting by EU LVNAVs as of February 2020. When the fund sells WLA, we assume that the MMF faces a cost of 10 bps; when it sells other assets, the cost is 40 bps,

reflecting the difference in liquidity¹⁰¹. It is then possible to calculate the maximum level of redemption this MMF can face, depending on the NAV deviation requirement (ranging from 0 to 100 bps) and on the required levels of WLA (ranging from 10 % to 50 %). RA.21 shows the corresponding results: using existing regulatory requirements, the maximum level of redemptions is at 42 % of NAV. In addition, the level of redemptions is the highest when the NAV deviation is the largest and when the WLA are the lowest (since the MMF can sell most of its WLA).

Overall, changing the level of WLA has limited effects – the resulting increase in the maximum level of redemptions would be low. If WLA declined to 10 %, maximum redemptions would only increase by 6 pps to 48 %. On the other hand, increasing the NAV deviation has a large impact on MMFs' ability to meet redemptions: increasing the deviation from 20 bps to 50 bps results in a rise in maximum redemptions of more than 20 pps, to 63 % of NAV¹⁰². In the extreme case where LVNAVs switch to a floating NAV, the constraint vanishes and MMFs can meet any level of redemptions¹⁰³.

RA.21
MMF reforms
Impact of changes in regulatory constraints



Note: Maximum level of redemptions as a function of NAV deviation and weekly liquid asset requirements, in % of NAV.
Sources: Baes et al. (2020).

Finally, increasing the liquidity of the underlying markets has, in that simulation, a very large effect on the resilience of MMFs. If the price impact of WLA declined from 10 bps to 5 bps, and the price impact of other assets from 40 bps to 20 bps, the

¹⁰¹ These values are taken from the liquidity discounts from the ESMA MMF stress test guidelines (10 bps is the average for 3M AA and A sovereign bonds, and 43 bps for 3M A corporate bonds); see ESMA (2020b).

¹⁰² However, based on current CRA methodologies for MMF ratings, a deviation larger than 25 bps would not be

compatible with an AAmmf rating for some CRAs, thereby limiting the additional flexibility for MMF managers.

¹⁰³ This result holds only if MMFs are able to dispose of their assets at a given price. If markets froze, as in March 2020, MMFs might not be able to sell their assets, irrespective of the price they offer.

maximum level of redemptions a fund could face would rise to 58 % (against 42 % previously). By reducing the price impact of trades, such reforms allow MMFs to sell more assets at a lower cost, keeping NAV deviations limited.

Overall, the analysis indicates that, to improve the resilience of LVNAVs (measured by the level of redemption a fund can face), increasing the NAV deviation is more effective than changing WLA requirements. However, potential cliff-edge effects would remain when the NAV deviation approached the collar; a move to floating NAV would remove those effects. Changes to the structure of money markets resulting in higher liquidity of money market instruments would be largely effective in improving MMF resilience as well, although such changes are more of a long-term nature and outside the regulatory perimeter.

The role of redemption fees and gates

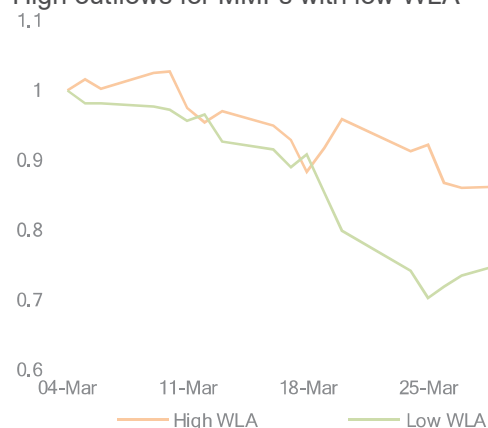
Some market participants have argued that MMF regulatory reforms may have created a first-mover advantage by tying breaches of WLA to the use of redemption fees and gates (Blackrock, 2020).

As the levels of WLA decline towards the regulatory threshold of 30 %, investors might have an incentive to pre-emptively run to avoid being subject to fees and gates. In the US, Li et al. (2020) provide evidence that the US prime funds with the lowest WLA had higher outflows than MMFs with higher levels of liquid assets.

In the EU, rules are slightly different. For fees and gates to be considered, the MMF has to breach the 30 % WLA thresholds **and** record daily outflows higher than 10 %. In that context, EFAMA (2020) considers that existing rules are adequate.

We follow the approach used by Li et al. (2020) by splitting our sample of MMFs into funds with low WLA and funds with high WLA. For each daily observation, MMFs are categorised based on the level of WLA in the previous day. MMFs with low WLAs end up having WLAs below 40% of NAV, while high WLAs MMFs had liquidity above 40%. RA.22 shows the results for 13 US dollar LVNAVs with a NAV of USD 313bn as of March 2020: MMFs that had previously disclosed low WLA recorded higher outflows than other MMF¹⁰⁴.

RA.22
USD LVNAV flows
High outflows for MMFs with low WLA



Note: Cumulated outflows since 4 March for USD LVNAVs, rebased at 1=4 March, in % of NAV. MMFs categorized based on lagged levels of WLAs. Sources: Crane, ESMA.

A similar pattern is observed across currencies for LVNAVs (RA.23 MMFs with low WLAs experienced higher outflows than MMFs with high WLAs).

RA.23
MMF flows
Outflows correlated with low WLAs



Note: Change in assets between 4 March and 30 March, in % of NAV. MMFs are split based on WLA lagged by one day. Sources: Crane, ESMA.

The role of Credit Ratings Agencies

The methodology used by CRAs can have an impact on MMF managers. As explained previously, rated MMFs might be restricted to investing only in instruments rated by CRAs. In addition, CRA methodologies for MMF could potentially limit fund managers' flexibility. For LVNAVs, the MMFR provides that if the NAV

¹⁰⁴ As a robustness check, we also grouped MMFs based on their WLA levels before the COVID-19 crisis (January 2020). The analysis yields similar results.

deviation is higher than 20 bps then the fund must convert to VNAV. Such a conversion might trigger a downgrade from AAmmf. For example, if the NAV deviation were higher than 25 bps, S&P would downgrade the fund from AAmmf. For other CRAs, the switch to VNAV might not trigger a downgrade on its own, but only if it were coupled with outflows and liquidity issues¹⁰⁵. Finally, for the three CRAs, the use of redemption fees or gates would automatically trigger a downgrade.

Investor behaviour

Investors typically use MMFs as cash management vehicles. Excess cash can be invested in MMFs rather than bank deposits, as MMFs offer higher yields thanks to their exposures to short-term instruments. In addition, either because MMFs offer a stable NAV or because VNAV MMFs have had historically very low levels of volatility (Benhami and Le Moign, 2018), investors might still consider MMFs cash-like instruments, despite regulatory reforms.

In that context, when faced with liquidity needs, investors will redeem their MMF shares. When such liquidity shocks are idiosyncratic or temporary because of seasonality factors (end-of-quarter or end-of-year redemptions), MMFs should not face particular challenges. However, when investors are affected by a large symmetric liquidity shock, as witnessed in March 2020, MMFs will face simultaneous large redemptions by multiple investors. In addition, in the EU, MMF shares are almost exclusively held by institutional investors (unlike in the US where retail MMFs are sizeable), and such types of investors tend to redeem more quickly than retail investors (Cipriani and La Spada, 2020), implying higher risks for EU MMFs.

Conclusion

MMFs are an integral part of the EU financial system, as they provide maturity and liquidity transformation. However, despite important regulatory reforms, the COVID-19 crisis has shown that vulnerabilities remain. The evidence related to these vulnerabilities presented in this article can serve as input to the currently ongoing discussions on MMF regulatory reforms.

On the asset side, EU MMFs have a very large market footprint in short-term private markets with limited liquidity. MMFs tend to have similar exposures, implying that, in the event of a wave of redemptions, MMFs would struggle to dispose of their assets.

On the liability side, investors consider MMFs cash-like instruments and expect daily liquidity with very limited risks. Such expectations might make MMFs vulnerable to runs.

In addition, some regulatory provisions regarding liquidity management tools (such as the use of fees and gates) might create incentives for investors to redeem ahead of others, for example to avoid being subject to fees and gates. Methodologies used by CRAs could also reduce managers' flexibility, especially during times of stress, as managers may want to limit the probability of an MMF rating downgrade.

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¹⁰⁵ 'A breach of the NAV corridor would not, in itself, trigger a negative rating action but a downgrade would be likely if

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