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Abstract

This paper aims to inform the debate about the reform of MMF regulation, which is currently a central theme for several prominent policy institutions. Some types of MMFs experienced challenging outflows in March 2020. This, and evidence suggesting that flows are linked with proximity to liquidity thresholds, has led to a reassessment of the adequacy of the post-GFC regulatory architecture. A suggested alternative to mandating the use of ever more complex liquidity management tools, is to require funds to hold assets that remain liquid and valuable during a crisis. Using supervisory data on Irish-domiciled non-public debt MMFs (i.e., LVNAVs and VNAVs), we provide robust graphical and econometric evidence indicating that MMFs voluntarily holding more Public-Debt Assets (PDAs) than required by MMF regulations, experienced lower outflows during the COVID-19 crisis. There is also evidence of resilience effects associated with having deposit buffers above requirements.

1 Introduction

Money market funds play an important role in the intermediation of short term funding. However, when these funds experience – or anticipate – abnormally large redemption requests, they are likely to reduce the rollover of funding to investments characterised by low liquidity or long terms to maturity, and this can have real economic effects. Runs on money market funds (MMFs) are rare, but significant economic shocks can spark flights by investors driven by 'first-mover-advantage' or 'flight-to-safety' motives. The increased fears of withdrawals by fellow investors can be enough to trigger panicked outflows, as described by Schmidt et al. (2016). In addition, regulations that require fund managers to consider the use of redemption gates in stressed scenarios can amplify such fears by altering the perceived liquidity of MMF shares/units. This can generate increased outflows in advance of potential suspensions. Proximity to liquidity thresholds has been evidenced as a likely amplifier of outflows in March 2020 by Li et al. (2020), Cipriani and La Spada (2020) and Dunne and Giuliana (2022).

It is important, however, to acknowledge that proximity to daily and weekly liquidity thresholds mattered little to investors in money market funds that were restricted by their mandates to invest

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only in 'Public Debt Assets' (PDAs). Indeed, it is well-established that public-debt funds (PDCNAVs) experienced cumulative investment inflows at the peak of the COVID-19 crisis, while non-public-debt funds experienced cumulative outflows (see, for example, Cipriani and La Spada (2020), Li et al. (2021) and Dunne and Giuliana (2022)).

Public-debt funds hold mainly bills and short term bonds issued by highly-rated sovereigns, whereas non-public-debt funds (which, in Europe include 'low-volatility' and 'variable-NAV' funds, while in the US include 'prime' funds) primarily invest in commercial paper and short term debt securities issued by banks (MFIs) and non-financial corporates (NFCs). There is a clear contrast in key aspects of the principal assets held by 'public-debt' and 'non-public-debt' funds, especially in terms of liquidity, counter-cyclicality and safety. This likely explains part of the large difference in redemption patterns between the two main categories of MMFs during the COVID-19 crisis. However, given that PDCNAVs differ from other funds in terms of other important characteristics, it is not clear to what extent the level of PDAs itself is a key driver of resilience during crises and whether non-public-debt funds could potentially be made more resilient by requiring a minimum buffer constituted by PDA only.

This paper addresses this question by focusing on Irish non-public-debt funds during the peak of the COVID-19 outflows. Our empirical method compares net-redemptions across different groups of MMFs based on their pre-crisis 'voluntary PDA buffers', defined as the part of PDAs held by MMFs in spite of the fact that they are not necessary at that point in time for the fulfilment of the regulatory requirement of weekly liquid assets.

Empirical evidence shows that outflows from funds with voluntary PDA buffers between 10% and 15% were significantly lower than funds in the 0%-5% category. The coefficient can be considered economically significant since it is at least twice as large as the average outflow during the peak of the crisis and equivalent to a third of its standard deviation.

To our knowledge, there are no published papers specifically addressing the resilience-enhancing effects of public-debt holdings by non-public-debt money market funds. However, the ECB's response to ESMA's "Consultation on EU MMFR – Legislative Review" mentions internal analysis extending the work of Capotă et al., (2021) suggesting that a modest public debt quota "could significantly strengthen the resilience of private debt MMFs." This note provides further insights into the likely effects of mandating such holdings based on the variability in redemptions of money market funds during the peak stresses of March 2020.

2 Policy deliberations

Despite several regulatory changes after the Global Financial Crisis (GFC), money market funds were once again a prominent concern for financial stability when the World Health Organisation declared COVID-19 developments as a pandemic. Similar types of money market funds saw run-like outflows internationally, and short term funding markets across many regions suffered similar contractions in liquidity. Responding to such developments, organisations with a global policy remit such as the FSB and IOSCO, investigated the March 2020 disruptions with a view to making broad proposals for the improvement of relevant regulations. Many of these proposals, as well as the findings from local investigations and academic studies, have been debated at regional level.

In the European context, the ESRB recommendation to the European Commission (ESRB Recommendation (2021)) addresses weaknesses in the regulation of money market funds by proposing – inter alia – a minimum required buffer of public debt assets. In addition, the ESMA opinion on the review of the Money Market Fund Regulation (ESMA (2022)) suggests the use of public debt assets to satisfy minimum liquidity ratios.

If there is evidence that additional holdings of public debt assets can contribute to the resilience of non-public-debt money market funds, then mandating this could improve important aspects of

existing liquidity requirements. It could enable a more meaningful release of liquidity buffers in times of crisis. In contrast, relaxing WLA requirements may not sufficiently improve resilience to redemptions because commercial paper, which makes up most of this category, usually remains illiquid until its maturity and cannot be sold even if this was temporarily possible due to lower overall liquidity requirements in times of stress.

Moreover, allowing funds to hold lower levels of weekly maturing assets could also leave funds less prepared for further daily redemptions and even motivate further 'first mover advantage' exits. In contrast, releasing a public debt requirement would allow the sale of public debt assets, for which there is likely to be a strong demand in a crisis. A number of damaging behaviours and negative spillovers could therefore be avoided. It would further cement the severing of links between money market funds and their sponsoring banks (this had caused widespread contagion during the Global Financial Crisis) and it would reduce expectations of central bank support in a crisis mitigating moral hazard behaviours.

A potential downside to a PD asset holding requirement would be the increased likelihood of lower returns for investors. This could drive investors to short-term debt funds and to less secure and less liquid investments. The effects of such an outcome are difficult to ascertain but these are unlikely to be excessive if the PD asset holding requirement is kept to a reasonable proportion of a fund portfolio. There would also be a slightly higher likelihood of a fund experiencing negative returns, which could potentially create problems for some MMFs. Such issues are, however, already a feature of the European money market fund environment. Rates of return on public debt in the euro area have been significantly negative for several years now and, while this has been challenging for CNAV funds, they have found ways of passing on the negative rates to their investors while preserving significant market share. Assessing the potential negative side-effects in detail is beyond the focus of this note but they deserve further analysis if the idea of a PD holding requirement gains sufficient support among policy makers.

3 Data and methods

In this note we analyse the redemption dynamics of Irish-domiciled 'non-public-debt' MMFs depending on their public-debt holdings. We focus on the behaviour of Irish-domiciled MMFs because this allows us to examine high-quality asset information verified by fund supervisors within the Central Bank of Ireland.

As described in the FSB's recent policy proposals paper (October 2021, Figure 1), at the end of 2020, the Assets Under Management (AUM) of 'non-public-debt' Irish-domiciled MMFs accounted for 12.8% of the assets of 'non-public-debt' MMFs globally. The assets of 'non-public-debt' MMFs accounted for about 85% of the entire MMFs sector in the Euro Area, which amounted to approximately 1.445 trillion euro at the end of 2020 (this estimate is based on data reported to the Irish Central Banks and information in the FSB's NBFI Global Monitoring Report (2021)). At the end of 2020 (in terms of asset holdings) Irish non-public-debt MMFs represent roughly 40% of Euro Area non-public-debt MMFs (the other main countries in which non-public-debt MMFs reside are France and Luxembourg with each having non-public-debt MMF sectors with asset holding proportions above 25%). Irish non-public-debt money market funds are predominantly Low-Volatility funds (about 95% as at the end of 2020). We consider only LVNAV and VNAV funds reporting in the three main currencies (with 41% reporting in USD, 39% in GBP and 19% in EUR).

Supervision data is compiled from monthly reporting by funds in conjunction with daily observations of funds' redemptions. To assess the effects of liquidity levels, we supplement the supervision data with daily records of Weekly Liquid Assets (WLA) from the Crane dataset where available (the Crane data source covers approximately half of all the Irish-domiciled funds). Where WLA data is unavailable from the Crane dataset, we make use of an end-of-month estimate of WLA from the monthly supervision data. We double-check the reliability of the monthly WLA

supervisory information by comparing it with daily data in the post-March period (during which supervisory information includes daily WLA). For one fund we found a very low correlation between the monthly and daily WLA data in the post-March period and we decided to drop this fund from the analysis. In addition, as the analyses focus on MMFs with voluntary PDA buffers, the final sample consists of 34 funds in the non-public-debt category over the run-period sample (9 VNAVs and 25 LVNAVs).

The first stage of our analysis is descriptive. We show with descriptive statistics, and graphically, that relatively high proportional holdings of public debt assets enhanced resilience among non-public-debt funds. The descriptive analysis does not permit statistical significance to be determined and we therefore conduct appropriate regression analysis to determine whether differences in public debt holdings can be identified as improving resilience.

4 Descriptive Analysis

We explore whether the variation in the holdings of public debt assets of non-public-debt MMFs (LVNAVs and VNAVs) had a role in explaining the differential resilience of such funds during the peak of the COVID-19 crisis. Specifically, we examine if outflows were lower among MMFs with a greater proportion of 'public debt assets' as of February 29th 2020, i.e., the latest monthly observation before the widespread outflows in March 2020.

The Money Market Fund Regulation mandates MMFs to hold a minimum level of weekly liquid assets, which includes the following asset categories: public debt assets, private debt assets, deposits and reverse-repos backed by sovereign debt securities, provided that assets in these categories fulfil specific conditions especially in terms of time-to-maturity. Thus, public debt securities can already be part of the WLA liquidity requirements as they are accounted for in the accrual of the current minimum weekly liquid assets, which is 30% for LVNAVs and 15% for VNAVs. Our analysis seeks to shed light on the effects of a possible future regulatory requirement to hold a buffer exclusively constituted by PDAs (referred to as the 'PDA buffer', in this paper) on top of the current broader WLA requirement. In February 2020, many LVNAVs and VNAVs were already holding a positive voluntary PDA buffer, defined as the part of PDA that is not necessary for the fulfilment of the minimum WLA requirement. It includes:

(i) PDAs that are not eligible as WLA, which typically occurs when a PDA has a time-to-maturity greater than 190 days, or when the overall percentage of PDAs exceeds the maximum PDA holdings allowed by the MMFR for the calculation of WLA (i.e., 7.5% for VNAVs and 17.5% for LVNAVs).

(ii) PDAs that are eligible as WLA but redundant for the fulfilment of the WLA requirement since the MMF can fulfil it through sufficient alternative WLA-eligible asset categories (i.e., deposits, reverse-repos, private debt assets or non-redundant PDA).

This paper aims at shedding some light on the resilience effect of such a possible PDA buffer requirement by examining whether MMFs that were already holding relatively large voluntary PDA buffers right before the COVID-19 crisis outperformed comparable MMFs during the crisis.

Figure 1 depicts the Assets Under Management (as an index set equal to 100 at the beginning of February) of four groups of MMFs based on categories of voluntary PDA buffers (0%-5%, 5%-10%, 10%-15% and 15%-100%). The vertical line denotes the period between March 6 and March 26, 2020, in which the COVID-19 crisis caused widespread outflows. The category with the least voluntary PDA buffer – i.e., from 0% to 5% – was the most negatively affected by the COVID-19 crisis. Its fund-weighted AUM index declined from approximately 100 (on March 6) to 85 (on March 26). MMFs with voluntary PDA buffers between 5% and 10% experienced a slightly lower reduction

on average. Its trend was even slightly positive in the first four days after March 6 but later switched into a remarkably negative pattern, which brought its fund-weighted AUM index to 85 on March 26. The 10%-15% category experienced evident inflows, with its AUM index rising to 112. MMFs with voluntary PDA buffers beyond 15% saw a minor decrease. The resilience improvement seems minimal when we pass from the 0%-5% category to the 5%-10% one, and it is maximal when we pass from the 5%-10% to the 10%-15% category.

An important caveat in this descriptive graphical analysis is that it cannot control for confounding factors such as MMF business models and other characteristics (e.g., size, WLA, etc.). The empirical analysis addresses this problem by including several relevant control variables and fixed effects. In general, Figure 1 is suggestive of investors believing that funds with greater voluntary PDA buffers were more resilient, although we observe an apparently divergent behaviour among funds in the fourth category, as they experienced an overall redemption flow during the crisis. This incongruence could be explained by two mutually reinforcing factors. First, funds with a PDA buffer in the 15%-100% range can be considered as outliers, as shown by Figure 2.[2] Second, the fourth category might be different from others in terms of key characteristics, such as fund size, which may generate different flow dynamics during the crisis. For instance, Table 1 indicates that the difference in size between the third and fourth categories is greater than two standard deviations of AUM.

5 Regression analysis

To further examine the possible resilience effect induced by voluntary PDA buffers during the COVID-19 crisis, we employ a panel regression approach examining whether MMFs with lower PDA buffers (referred to as $PDAbuffer$ in the specification) experienced comparatively greater outflows in the period from March 6th to March 26th. The specification is as follows:

$$\begin{aligned} CrisisOutflow_{it} &= \alpha + \beta_1(PDAbuffer\_5\%10\%_i) + \beta_2(PDAbuffer\_10\%15\%_i) \\ &+ \beta_3(PDAbuffer\_15\%100\%_i) + \alpha_1(DepositBuffer_i) + \alpha_2(RepoBuffer_i) \\ &+ \alpha_3(PrivateBuffer_i) + \alpha_4(WLA_i) + (day_t) + \varepsilon_{ijt} \end{aligned}$$

The dependent variable is the crisis outflows of fund i and day t, between March 6th to March 26th. They are measured as the differences between each value of a fund's AUM (for each day after March 6th) and its average pre-crisis AUM. The model attempts to explain the crisis outflows by means of the three regressors of interest: $PDAbuffer\_5\%10\%$, $PDAbuffer\_10\%15\%$ and $PDAbuffer\_15\%100\%$, which are three dummy variables describing the cross-sectional heterogeneity as of February 29th 2020, i.e., the latest monthly observation before the widespread outflows in March. A negative coefficient associated with $PDAbuffer\_5\%10\%$ can be interpreted as follows: crisis-induced outflows were lower for funds with voluntary PDA buffers between 5% and 10%, compared to outflows of funds with PDA buffers in the range between 0% and 5%. The interpretation of coefficients associated with the other dummy variables of interest is similar to the $PDAbuffer\_10\%15\%$ case, including the benchmark which remains the category with PDA buffers between 0% and 5%.

The model controls for many key possible confounding factors, by considering: (i) the proportions of voluntary buffers of deposits ($DepositBuffer$), reverse-repos ($RepoBuffer$) and private debt assets ($PrivateBuffer$) (as of February 29th 2020), (ii) MMF-specific characteristics (because a dependent variable measured through fund-specific differences between pre- and post-March 6th AUM already implicitly controls for MMF-specific characteristics), and (iii) daily varying

[2] There are four MMFs with voluntary PDA buffer above 15%.

macroeconomic dynamics, such as the VIX (by including day fixed effects). For robustness, certain specifications exclude the fixed effects regarding MMF sector-wide characteristics.

6 Results

Table 3 contains the coefficients of Model 1 estimated during the widespread outflows in 2020 (between March 6th and 26th). Column 1 generally confirms the intuitions from the descriptive graphical analysis. It indicates, for instance, that LVNAVs and VNAVs with voluntary PDA buffers between 5% and 10% (as of February 29th 2020) experienced lower redemptions compared to the 0%-5% category, although the coefficient is not statistically different from zero. Column 1 also shows that outflows of funds in the 10%-15% category were significantly lower than funds in the 0%-5% category. The coefficient is equal to 1.13 and can also be considered economically significant since it is greater than twice the average outflow during the peak of the crisis (Table 2 indicates that it is 0.45) and it is a third of its standard deviation (Table 2 indicates that it is 3.31). Unlike descriptive graphical analysis, Column 1 suggests that funds with PDA buffers above 15% experienced lower outflows compared to the 0%-5% category. The reason for the incongruence with the graphical evidence could be related to the fact that Column 1 partially controls for MMF-specific characteristics (such as size and business models) since the dependent variable is the fund-level difference between AUM levels during the crisis and the pre-crisis average AUM. The significantly positive coefficient for the constant indicates that overall the crisis induced widespread outflows.

Column 2 includes dummy variables for WLA and voluntary buffers of deposits and private debt assets. It confirms and reinforces the evidence from Column 1 regarding the resilience effect of PDA buffers. It also indicates that deposit buffers were a significant factor protecting certain funds from crisis outflows.

Column 3 includes a dummy variable for voluntary buffers of repos and day fixed effects. It generally supports the intuitions from the descriptive graphical analysis, indicating a significantly better resilience for funds in the 10%-15% category, compared to the 0%-5% category. The significantly positive coefficient for the repo buffers is apparently counterintuitive because repo markets have remained generally liquid during the COVID-19 crisis. The intuition behind this coefficient is related to the tight interaction with deposit buffers. In fact, the inclusion of the repo buffers makes the negative coefficient for deposit buffers larger in absolute values. The inclusion of the day fixed effects strongly increases the adjusted R-squared and makes the constant insignificant.

The specification behind Column 4 is equal to Column 3 except for the inclusion of a double clustering of standard errors at both fund- and day-level. Column 4 overall confirms the intuitions from the descriptive graphical analysis, indicating a significantly better resilience for funds in the 10%-15% category, compared to the 0%-5% category.

Table 4 explores the same specifications of Table 3 with an alternative categorisation of voluntary PDA buffers. Specifically, it uses five rather than four groups of MMFs based on categories of voluntary PDA buffers (0%-2.5%, 2.5%-7.5%, 7.5%-12.5%, 12.5%-17.5% and 17.5%-100%). The message from Table 4 generally confirms Table 3, as the most comprehensive specification, in Column 3, shows that funds in the 7.5%-12.5% and 12.5%-17.5% categories experienced lower outflows compared to the baseline group which has voluntary PDA buffers between 0% and 2.5%.

7 Conclusion

Our descriptive and econometric evidence attempts to shed some light on the debate about the reform of MMF regulation, which is currently a central theme for several prominent policy institutions. Employing data verified by Irish supervisors, we analyse Irish-domiciled non-public debt MMFs and show that MMFs holding more Public-Debt Assets (PDAs) experienced lower outflows during the COVID-19 crisis.

Our methods compare March 2020 outflows across several categories of MMFs based on their pre-crisis 'voluntary PDA buffers', defined as the part of PDAs that is not necessary at that point-in-time for the fulfilment of the regulatory WLA requirement. Graphical evidence shows resilience improvements going from low to relatively high levels of voluntary PDA buffers. Using as a benchmark the MMFs in the category with the least PDA buffer, outflows from MMFs with greater PDA buffers had lower average outflows during the crisis, except for MMFs with extremely large buffers. Such evidence of resilience effects specifically linked to PDA buffers is also corroborated by several panel regression specifications, which control for a number of potential confounding factors, in particular, related to alternative resilience effects (e.g., by deposit or overall liquid holdings).

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Tables and Figures

Table 1: Descriptive statistics of AUM of LVNAVs and VNAVs.

Voluntary PDA Buffers	Mean	Std. Dev.	Min	Max	N
0%-5%	10.27	14.58	0.08	55.36	1,114
5%-10%	13.03	18.29	0.02	62.56	902
10%-15%	5.11	0.52	4.47	5.92	144
15%-100%	0.89	0.84	0.06	2.14	288

Data: MMIF and Crane, from January to March 2020, covering Irish non-public-debt funds.

The table displays key descriptive statistics of the Asset Under Management (AUM) of Irish MMFs across four categories of voluntary PDA buffer (0%-5%, 5%-10%, 10%-15% and 15%-100%). Voluntary PDA buffer is defined as the part of PDA that is not necessary for the fulfilment of the minimum WLA requirement.

Table 2: Descriptive statistics of key variables.

Variable	Mean	Std. Dev.	Min	Max	N
Crisis outflow (%)	0.45	3.31	-11.07	27.77	612
PDA buffer (%)	9.74	15.59	0.87	90.85	2,448
Private debt buffer (%)	3.35	3.62	0.00	15.04	2,448
Repo buffer (%)	5.77	11.39	0.00	59.94	2,448
Deposit buffer (%)	9.75	8.48	0.00	41.82	2,448
WLA (%)	41.44	14.89	9.59	92.56	2,448
AUM (in Bn Euro)	9.99	16.00	0.05	60.20	2,448

Data: MMIF and Crane, from January to March 2020, covering Irish non-public-debt funds.

The table displays key descriptive statistics of the main variables in the paper. Crisis outflow is the day- and fund-specific difference between a fund's AUM (for each day between March 6th to March 26th) and its average pre-crisis AUM. Voluntary PDA buffer is defined as the part of PDA that is not necessary for the fulfilment of the minimum WLA requirement. Likewise, PrivateBuffer, DepositBuffer and RepoBuffer are defined as the part of private debt securities, deposits or reverse repos that is not necessary for the fulfilment of the minimum WLA requirement. WLA is the percentage of weekly liquid assets relative to Asset Under Management.

Table 3: Regression results.

	(1) CrisisOutflow	(2) CrisisOutflow	(3) CrisisOutflow	(4) CrisisOutflow
PDAbuffer_5%10%	-0.113	-0.311	-0.096	-0.096
	[0.740]	[0.109]	[0.715]	[0.906]
PDAbuffer_10%15%	-1.127***	-1.240***	-0.979***	-0.979***
	[0.000]	[0.000]	[0.000]	[0.008]
PDAbuffer_15%100%	-0.630***	-0.936***	0.061	0.061
	[0.000]	[0.000]	[0.815]	[0.929]
PrivateBuffer		-0.290	-0.020	-0.020
		[0.317]	[0.917]	[0.973]
DepositBuffer		-0.574***	-0.806***	-0.806
		[0.000]	[0.000]	[0.205]
WLA		0.190	-0.083	-0.083
		[0.237]	[0.741]	[0.913]
RepoBuffer			1.066**	1.066
			[0.012]	[0.445]
Constant	0.643***	1.093***	-0.250	-0.250
	[0.000]	[0.002]	[0.362]	[0.549]
Day FE	No	No	Yes	Yes
Double St.Error.Cluster.	No	No	No	Yes
N	612	612	612	612
Adj. R-sq	0.01	0.02	0.09	0.09

Data: MMIF and Crane, from March 6th to March 26th, 2020, covering Irish non-public-debt funds.

The dependent variable is the 'crisis outflow', measured as the differences between each value of a fund's AUM (for each day after March 6th) and its average pre-crisis AUM. MMFs are grouped into four groups of MMFs based on categories of voluntary PDA buffers (0%-5%, 5%-10%, 10%-15% and 15%-100%). Voluntary PDA buffer is defined as the part of PDA that is not necessary for the fulfilment of the minimum WLA requirement. Likewise, PrivateBuffer, DepositBuffer and RepoBuffer are defined as the part of private debt securities, deposits or reverse repos that is not necessary for the fulfilment of the minimum WLA requirement. All p-values are based on standard errors that are robust to heteroscedasticity and clustered at fund level (in a specification they are clustered at fund and date level). N is the total number of observations in each regression. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

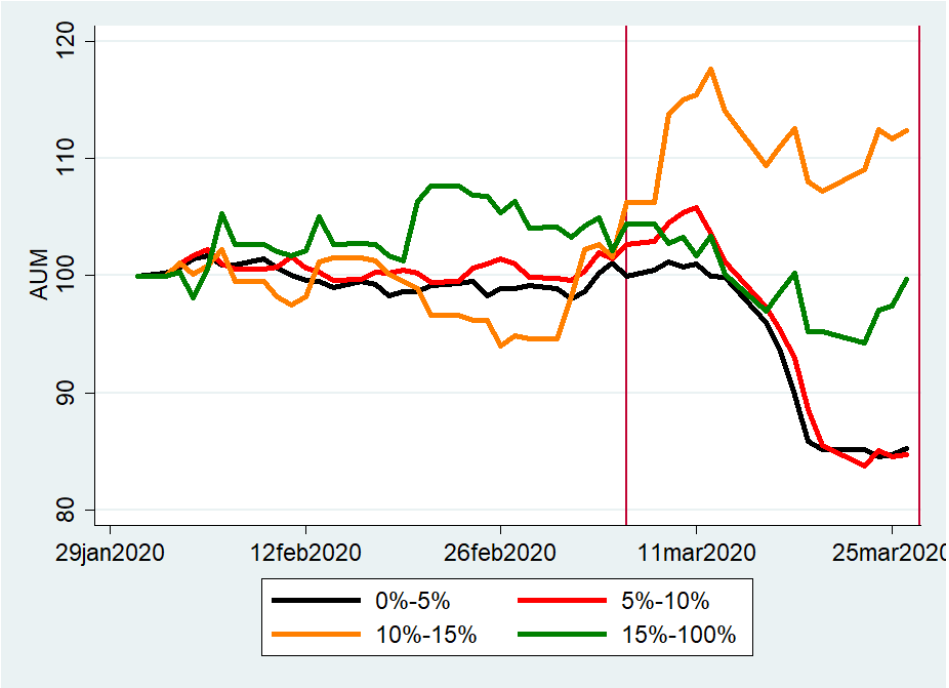
Table 4: Regression results with different categories of voluntary PDA buffers.

	(1) CrisisOutflow	(2) CrisisOutflow	(3) CrisisOutflow
PDAbuffer_2.5%7.5%	0.751** [0.012]	0.683*** [0.007]	0.337 [0.161]
PDAbuffer_7.5%12.5%	-1.328*** [0.000]	-1.555*** [0.000]	-1.766*** [0.000]
PDAbuffer_12.5%17.5%	-0.404* [0.050]	-0.581 [0.123]	-0.679* [0.095]
PDAbuffer_17.5%100%	-0.524*** [0.007]	-0.577* [0.073]	-0.066 [0.820]
PrivateBuffer		-0.177 [0.594]	-0.059 [0.836]
DepositBuffer		-0.697*** [0.000]	-0.910*** [0.000]
WLA		-0.013 [0.952]	-0.299 [0.353]
RepoBuffer			0.863** [0.031]
Constant	0.405** [0.034]	0.937* [0.056]	0.186 [0.667]
Day FE	No	No	Yes
N	612	612	612
Adj. R-sq	0.06	0.08	0.14

Data: MMIF and Crane, from March 6th to March 26th, 2020, covering Irish non-public-debt funds.

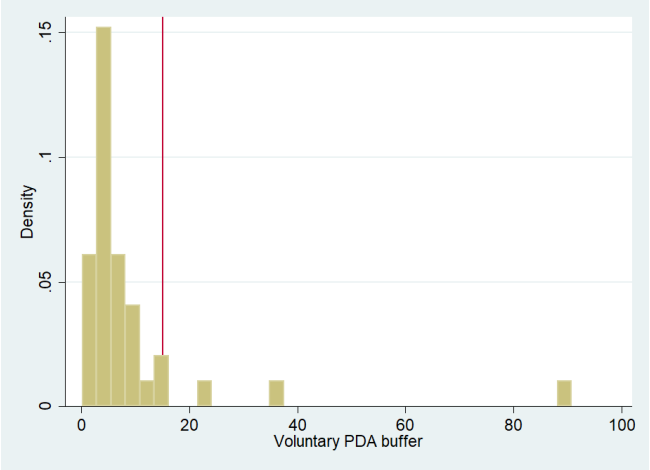
The dependent variable is the 'crisis outflow', measured as the differences between each value of a fund's AUM (for each day after March 6th) and its average pre-crisis AUM. MMFs are grouped into five groups of MMFs based on categories of voluntary PDA buffers (0%-2.5%, 2.5%-7.5%, 7.5%-12.5%, 12.5%-17.5% and 17.5%-100%). Voluntary PDA buffer is defined as the part of PDA that is not necessary for the fulfilment of the minimum WLA requirement. Likewise, PrivateBuffer, DepositBuffer and RepoBuffer are defined as the part of private debt securities, deposits or reverse repos that is not necessary for the fulfilment of the minimum WLA requirement. All p-values are based on standard errors that are robust to heteroscedasticity and clustered at fund level. N is the total number of observations in each regression. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

Figure 1: Performance of MMFs grouped into four categories of Voluntary Public Debt Asset Buffers.



Data: MMIF, Crane. MMFs are grouped into four groups of MMFs based on categories of voluntary PDA buffers (0%-5%, 5%-10%, 10%-15% and 15%-100%). Voluntary PDA buffer is defined as the part of PDA that is not necessary for the fulfilment of the minimum WLA requirement. Y-axis describes Assets Under Management (as an index set equal to 100 on February 1st) weighted by each fund's AUM within a category. The vertical line denotes the period between March 6 and March 26, 2020.

Figure 2: Distribution across levels of voluntary PDA buffers.



Data: MMIF and Crane, from February 1 to March 26th, 2020, covering Irish non-public-debt funds.

Y-axis describes the percentage distribution of MMFs across levels of voluntary PDA buffer, defined as the part of PDA that is not necessary for the fulfilment of the minimum WLA requirement. The vertical line separates the core of the distribution from observations with more than 15% in PDA buffer.

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