Money Market Funds in the Shadow of a U.S. Treasury Default

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Abstract

Debt issued by the U.S. Treasury is commonly seen as default-free, despite the fact that the U.S. has been forced to modify the debt limit 15 times since 2001. Using cross-sectional regressions for the 2013 and 2023 debt ceiling crises, I find that redemptions from money market funds (MMFs) are uncorrelated with a fund's portfolio exposure, institutional ownership and fund size. I instead find that prime funds with a history of volatile fund flows experienced heavier inflows during the 2023 crisis, possibly due to a low-cost liquidity transformation service sought after by yield-chasing investors. My findings imply that a fund manager's efforts to reduce exposure to the risk of technical default sacrifices the opportunity to take advantage of elevated yields in a futile attempt to reduce redemption risk.

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Certificate of Original Authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text. I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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1 Introduction

The term “debt ceiling” is used to describe the upper limit placed on the U.S. Treasury regarding the borrowing of funds. The ceiling itself is set by the U.S. Congress and acts as a statutory limit. If the limit is reached, a debate ensues within Congress regarding whether the upper limit should be raised to accommodate the required borrowing. The alternative to a suspension of the existing ceiling is to allow the U.S. Treasury to enter a state of technical default on its issued debt. It’s worth noting that this state of “technical” default implies only a temporary inability to meet its obligated payments (Gallagher & Collins, 2016). The consequences of a technical default apply primarily to debt securities maturing within the period of default, resulting in reduced demand for these securities relative to securities maturing significantly beyond the period. Despite these mitigating connotations, a state of technical default would result in excessive damage to financial markets as U.S. Treasury securities act as a cornerstone for the global economy (Belton et al., 2011, Gallagher and Collins, 2016).

There have been 15 modifications of the debt limit, including the suspension of the limit during the recent 2023 debt ceiling crisis (Austin, 2015). A debt ceiling “crisis” occurs when the debt limit is approached while Congress appears unwilling to suspend the statutory ceiling. Despite the frequency of modification to the limit, there have only been four debt ceiling “crises” including the 2023 crisis (Gallagher & Collins, 2016).

The 2023 debt ceiling crisis was officially resolved on the 3rd of June, following the suspension of the ceiling itself until 2025. However, the period leading up to the resolution was filled with turmoil for money market funds (MMFs). The U.S. Treasury Secretary forecasted 1 June 2023 to be the deadline after which the Treasury’s ability to meet all government obligations would be called into question (Akabas et al., 2023). Debt securities issued by the U.S. Treasury—typically being viewed as default-riskfree—were now exposed to the technical default risk faced by the U.S. Treasury. This posed a significant threat to MMFs as U.S. Treasury debt accounts for a significant portion of MMF portfolios, particularly government funds since they are mandated to invest 99.5% of their assets in cash, U.S. Government securities, or repurchase agreements collateralized by either of the two. Prime funds, on the other hand, can invest in a broad range of short-term, high-quality assets including U.S. Treasury securities, corporate commercial papers, and certificates of deposit (Baklanova et al., 2021).

The literature has established that MMF managers typically reduce the exposure of their portfolios to the risk of Treasury technical default (Gallagher and Collins, 2016). Prime funds can eliminate their holdings of U.S. Treasury debt, while government funds typically shift their holdings to maturity dates that fall outside of the uncertainty window[1]. The literature is divided as to the efficacy of the decision to reduce portfolio exposure to the debt crisis. Analyses of the 2007 global financial crisis (GFC) and the 2011 eurozone crisis reveal a strong correlation between portfolio risk and investor redemptions (Chernenko and Sunderam, 2014, Kacperczyk and Schnabl, 2013) while research focusing on the 2011 and 2013 U.S. debt crises show conflicting results (Gallagher and Collins, 2016).

These disparities are the motivation behind my research, which explores the recent 2023 debt ceiling crisis to establish whether or not portfolio exposure to U.S. Treasury debt is correlated with subsequent investor redemptions in the lead-up to the negotiation deadline. I begin by analysing overnight rates on repurchase agreements and yields on multiple U.S. Treasury bills maturing around the deadlines of the 2013 and 2023 debt ceiling crises. I then analyse MMF holdings of U.S. Treasury debt by varying maturity windows, as well as the net inflows experienced by these funds

[1] The window of time following the forecasted deadline. Securities maturing within a two- to four-week uncertainty window tend to be the most exposed.

in the weeks leading up to the deadline. These analyses are carried out to establish the market's perception of the true risk of technical default in the period before the negotiation deadline.

Next, I investigate the relation between portfolio risk and fund flows during the 2023 crisis period, using a similar methodology to that of Gallagher and Collins (2016). Gallagher and Collins (2016) had access to unique datasets, including IMoney-Market (IMM) and Investment Company Institute (ICI) data, as well as publicly available N-MFP forms. Since I do not have access to IMM and ICI data, my analysis is restricted to the N-MFP data. I begin my analysis by re-examining the 2013 crisis using only N-MFP data and comparing the results to those obtained by Gallagher and Collins (2016). This establishes a baseline for interpreting my results for the 2023 crisis. I primarily use cross-sectional regressions to analyse the impact of MMF characteristics on the outflows experienced by a MMF in the lead-up to the forecasted deadline. I use a similar method to analyse the impact of fund type—as specified in the N-MFP forms—on fund flows to account for investor reliance on easily obtainable indications of portfolio risk.

I find that the market priced in a significant portion of the risk posed by an impending technical default during both the 2013 and 2023 debt crises. My analysis of the yields on U.S. Treasury bills maturing around each respective deadline indicated a sharp increase in the yields on all securities as the deadline approached. I observed a similar sharp acceleration in the overnight rates on repurchase agreements collateralized by U.S. Treasury debt during the 2023 crisis, which priced in the risk of technical default as the deadline approached. In my analysis of portfolio holdings, I find that the vast majority of MMFs—both prime and government—reduced their holdings of U.S. Treasury debt with maturity dates falling within a two- to four-week window relative to the anticipated deadline, for both the 2013 and 2023 crises. I further find that both prime and government funds held less U.S. Treasury debt during the 2023 crisis, compared to the 2013 crisis, with the median prime fund eliminating all holdings of U.S. Treasury debt during the more recent event. These findings suggest that fund managers perceive a significant risk associated with an approaching debt ceiling negotiation deadline and reduce their holdings of exposed securities. I find that funds catering predominately to sophisticated investors experienced a steady decline in net inflows in the weeks leading up to the 2023 deadline. This, coupled with the observed reduction in MMF exposure to U.S. Treasury debt, may imply that fund managers associate significant portfolio exposure with liquidity risk and the potential for heavier investor redemptions.

Contrary to the actions of fund managers, I find minimal correlation between MMF portfolio risk and subsequent fund flows in the lead-up to both the 2013 and 2023 deadlines. My 2013 analysis produces insignificant coefficients on all portfolio risk variables when analysing both prime and government funds. However, I find that during the 2023 crisis, testing government fund exposure to U.S. Treasury debt generates a weakly significant and negative coefficient, which suggests that these funds experience heavier outflows of around 0.03% of net assets for each additional 1% exposure to U.S. Treasury debt, measured as a percentage of net assets.

I further find that fund flows were not significantly impacted by the proportion of institutional ownership or fund size during the 2023 crisis. These findings contradict previous findings in the literature, which indicate that larger funds and funds catering to institutional investors experience heavier outflows during market crises (Kacperczyk and Schnabl, 2013, Chernenko and Sunderam, 2014, Gallagher and Collins, 2016).

An interesting (and somewhat surprising) aspect of my results is that they hint at a strong correlation between the historical volatility of fund flows and outflows during the 2013 and 2023 debt crises. For the earlier event, I find that government funds experienced heavier outflows of around 0.4% per standard deviation of flows over the prior two years. This can be interpreted to mean that government funds catering to investors with elevated liquidity needs tend to experience heavier outflows during crisis events. During the 2023 crisis, however, I find that prime funds experienced lesser outflows of around 0.6% per standard deviation of fund flows over the preceding two years. This hints at a somewhat counter-intuitive explanation, with funds catering to clientele with elevated liquidity needs experiencing inflows in the lead-up to the negotiation deadline. I theorise that this is due to a shift in the risk appetite of investors, leading them to invest funds in high-volatility prime funds during the crisis, since these funds provide access to the enhanced yields on corporate debt (which were accelerated by the crisis) with relatively low liquidity costs.

These findings have implications for the portfolio management techniques used by MMF managers when dealing with impending crises, such as the recent debt ceiling crisis. First, they suggest that the well-documented precaution taken by fund managers, by reducing their holdings of U.S. Treasury debt as a crisis approaches, does very little to reduce liquidity risk. Moreover, in their efforts to reduce their holdings of these securities, they are unable to capitalise on the enhanced yields observed in the lead-up to the deadline. Thus, my research effectively establishes that managers are paying a needless opportunity cost, since there is very little correlation between the underlying portfolio's exposure to at-risk securities and subsequent fund outflows. Furthermore, the investigation of the relation between fund flow volatility and net inflows during the 2013 and 2023 debt crises presents a curve-ball that should be considered by fund managers when attempting to manage liquidity risk during market crises.

Overall, this paper contributes to the literature on the relation between fund flows and MMF portfolio risk. Previous studies of the GFC and the eurozone crisis reported a strong correlation between portfolio exposure to at-risk securities and subsequent investor redemptions (Chernenko and Sunderam, 2014, Kacperczyk and

Schnabl, 2013). Studies of the 2011 and 2013 debt crises find no correlation between portfolio exposure to at-risk securities and fund flows. Instead, they document that fund outflows are a function of fund size, invested liquidity needs, and investor sophistication (Gallagher & Collins, 2016). My research adds to this debate by including evidence from the recent 2023 debt ceiling crisis. Like the studies of the 2013 crisis, I find no significant impact of fund exposure to at-risk securities on fund flows during the more recent 2023 crisis.

My paper is also related to the literature on investor sophistication as a driver of fund flows during crisis periods. Previous studies indicate that MMFs catering to institutional investors experience heavier investor redemptions during crisis periods (Kacperczyk and Schnabl, 2010, Gallagher and Collins, 2016). My research casts doubt on this pattern by documenting that the proportion of institutional ownership had no significant impact on fund flows in the lead-up to the 2023 debt crisis.

2 Literature Review

2.1 Pricing Risk

Gallagher and Collins (2016) establish that the market's assessment of the risk of a technical default increased during the 2011 and 2013 crises. They find that the yields on Treasury securities maturing near the default windows surged as the forecasted deadlines approached. They also report that this pattern was exaggerated during the second crisis, theorising that investors learned to target these at-risk securities the second time around. In addition, they document that overnight rates on general collateral repurchase agreements rose sharply as the deadline approached, which they attributed to the fact that a large proportion of those repurchase agreements were collateralized by Treasury debt (Belton et al., 2011, Gallagher and Collins, 2016).

Jacewitz et al. (2023) document a similar phenomenon during the recent 2023 debt ceiling crisis, finding that yields on short-term securities rose abruptly in the two weeks before the x-date[2]. Based on these findings, I hypothesise that an analysis of the market's perception of technical default risk during the 2023 crisis will yield similar results. That is to say, an analysis of Treasury yields, repurchase agreement rates, MMF holdings, and MMF flows in the lead-up to the 2023 crisis should provide evidence of an increased risk assessment.

2.2 Money Market Fund Flows

Previous literature establishes that both prime and government funds experience significant outflows in the lead-up to debt ceiling re-negotiations. Jacewitz et al. (2023) report that government funds experienced amplified outflows relative to other types of funds during the weeks leading up to the 2023 deadline, hypothesising that the excess outflows were a function of the excess exposure of those funds to Treasury securities. Although the relation between portfolio exposure and fund flows may seem economically sound, the literature addressing it is somewhat divided. Research addressing the GFC and the eurozone crisis documents a clear relation between portfolio risk and fund flows (Chernenko and Sunderam, 2014, Kacperczyk and Schnabl, 2013). However, Gallagher and Collins (2016) find that the 2011 and 2013 debt crises did not conform to this pattern. Instead, they report that redemptions were uncorrelated with a fund's portfolio risk, in sharp contrast to the existing literature at the time. I pick this unanswered question up, using the 2023 debt crisis to contribute to the debate. In particular, I investigate whether portfolio risk influenced outflows in the lead-up to the 2023 deadline.

[2]The x-date is the forecasted deadline by which the U.S. Treasury's ability to meet its short-term debt obligations is called into question.

2.3 Investor Sophistication

There is a consensus in the literature about the relation between fund flows and the sophistication of a fund's investor base. Kacperczyk and Schnabl (2010) find that institutional investors exhibit stronger reactions to market events than retail investors. Gallagher and Collins (2016) expanded on this, finding a significant correlation between the proportion of institutional investors in a fund and redemptions in the lead-up to the 2011 and 2013 debt crises. They reported that redemptions were more pronounced for larger funds catering to predominately institutional investors with a history of greater liquidity needs. Gallagher et al. (2020) provided further evidence by identifying a correlation between investor sophistication and the decision to reduce the riskiness of a portfolio. They find that funds with primarily sophisticated investors tended to reduce excessive portfolio exposure to the eurozone crisis by reducing the weighted average maturity of its portfolio. These findings set the background for my investigation of the impact of investor sophistication and the liquidity needs of a fund's investors on the flows during the recent 2023 debt crisis.

2.4 Fund Manager Behaviour

Regarding the response of MMF managers to an impending crisis, the literature documents a clear pattern where managers try to shield their funds from liquidity risk by reducing exposure to risky securities. Gallagher and Collins (2016) identified this pattern in their analysis of the portfolio compositions of prime and government funds during the 2011 and 2013 debt crises. In the lead-up to the deadline in each case, both prime and government funds held very little U.S. Treasury debt maturing within a two to four-week window around the deadline. Gallagher and Collins (2016) also find that government funds maintained more exposure to U.S. Treasury debt than prime funds. Related results were obtained by Gallagher et al. (2020) in their analysis of the eurozone crisis. They find that MMF managers catering sophisticated investors selectively adjusted their portfolio exposures to avoid scrutiny from institutional investors.

3 Data

3.1 N-MFP Data

The bulk of my empirical analysis uses monthly and weekly flow data and monthly portfolio holdings sourced from N-MFP forms [3]. These N-MFP forms are officially titled *"Monthly Schedule of Portfolio Holdings of Money Market Fund"* and all MMFs are required to submit monthly iterations of these forms to the SEC, which disclose security-level portfolio holdings and comprehensive fund characteristics ranging from the share class level to the aggregate fund level. By performing textual analysis on these forms, I obtained weekly fund flows for the months preceding the 2013 and 2023 crisis deadlines. Using these flows, I constructed the primary dependent variable of interest (*NetInflows*), which expresses net inflows into a fund immediately before the 2013 and 2023 crisis deadlines as a percentage of the fund's total net assets. For the more recent event, I used net inflows over the last two weeks, May 2023. However, the N-MFP forms for 2013 lack weekly granularity, so I elected to use net inflows for September 2013 for the 2013 event.

I used a MATLAB script to scrape and amalgamate the N-MFP forms from the SEC website into workable data-frames. I gathered data from 2011–2013 and 2020–2023, scraping it by quarters and using another MATLAB script to combine the data into a single cell array for each period. The final output is in the form of security-level portfolio holdings data for each fund, in addition to a data-frame of share class level

[3]https://www.sec.gov/files/formn-mfp.pdf

characteristics. I exported this data to an Excel file and imported that into Stata to perform the analysis, aggregating all share class-level data into fund-level data and filtering out inconsistencies. I used Stata for all subsequent analysis of the data, combining it into a cross-section of fund-level characteristics that contain additional portfolio and flow characteristics pertinent to each fund. The data was separated into Stata files dealing with the 2013 and 2023 debt crises separately. All files are provided in the *.zip* file submitted with this paper, and contain the information and scripts used to calculate the variables used in the empirical analysis.

From the N-MFP forms, I obtained the net assets (*Size*) for each fund from two months before the debt ceiling deadline. The reason for choosing the second preceding month was to obtain a fund size metric that was unbiased by the impending deadline. For example, the 01/06/2023 deadline used MMF net asset values filed on 30/04/2023. If I had instead used the net assets reported on 31/05/2023, the value may have been skewed by potential investor and fund anticipation of the forecasted deadline the very next day.

To control for investor sophistication, I used the method followed by Chernenko and Sunderam (2014), by using the proportion of a fund's assets invested in institutional share classes as a proxy for the sophistication of its investors. The N-MFP data does not specify the intended clientele of different share classes, leading me to perform this classification myself. In detail, the N-MFP forms provide the minimum investment threshold for each share class, which I used to categorise share classes into institutional and retail share classes. I created a dummy variable for institutional share classes by regarding any share class with a minimum investment threshold of \$1m as institutional. However, this classification is not without its flaws, since it is estimated that only half of the assets held in prime institutional share classes are owned by institutions (Gallagher & Collins, 2016).

To account for the liquidity needs of a fund's clientele, I used a similar methodology to that of Gallagher and Collins (2016), creating a measure of fund flow volatility. I used net monthly flow data from the two years preceding the year of each debt crisis (e.g. 2021–2022 for the 2023 debt crisis) and expressed the value as a percentage of the fund's total net assets in the corresponding month. I then calculated the standard deviations (*FlowVol*) of these percentage flows over the 24 months before each crisis and used them as a metric for the volatility in fund flows. I chose to use the two prior years, excluding the year of the crisis, to ensure that the flow volatility measure was not biased by the impending crisis. Note that the variable I constructed is less granular than the corresponding variable used by Gallagher and Collins (2016), since their unique access to the IMM data allowed for an analysis of daily fund flows, which could be used to calculate a higher resolution measure of flow volatility.

I used the portfolio holdings data provided by the N-MFP forms to calculate each fund's portfolio exposure to the risk of U.S. Treasury technical default. I calculated a fund's holdings of U.S. Treasury debt (excluding repurchase agreements backed by such securities) at the end of the month before the forecasted deadline, as a percentage of its net assets in the same month (*Treas*). I replicated this process for U.S. Treasury debt maturing within two- and four-week windows starting from the deadline date. For my 2013 analysis, a large fraction of the asset maturity dates are missing for securities provided in the N-MFP forms. Consequently, the metrics using specific windows are subject to the exclusion of securities that may have matured within these windows.

I recorded a fund's gross yield (*GrossYield*) during the last seven days of the month before each deadline, as well as the weighted average final maturity (*MWAL*) of the fund's portfolio in the month. According to Gallagher and Collins (2016), a fund's gross yield can be used as a rudimentary measure of its total portfolio risk, thereby providing a rough measure of its exposure to U.S. Treasury securities. To justify this idea, I confirmed that U.S. Treasury debt that was exposed to the crisis experienced elevated yields, which would have inflated the gross yields of funds holding those securities. The weighted average maturity of a fund's portfolio is used as a simple measure of its exposure to short-dated U.S. Treasury debt (Gallagher & Collins, 2016). As before, the construction of this variable requires accurate maturity dates for all securities in a fund's portfolio. Due to missing maturity dates in the 2013 N-MFP submissions, the weighted average maturities for the 2013 crisis are less reliable.

3.2 Bloomberg Data

To study the market's reaction to the impending crises, I used Bloomberg yield data for U.S. Treasury bills (T-bills) maturing around the crisis deadlines in 2013 and 2023. This allowed me to gain a better understanding of the market's perception of risk by quantifying the degree to which the risk of technical default is priced into the yields on at-risk T-bills.

Expanding upon this analysis, I downloaded a time series of the UREPGATS index provided by Bloomberg. This index consolidates the overnight rates on repurchase agreements collateralized by U.S. Treasury securities. The risk of a Treasury technical default would manifest in higher rates on repurchase agreements, since U.S. Treasury securities account for a large proportion of the collateral used for these agreements (Belton et al., 2011). The UREPGATS index does not extend back to 2013, so my analysis of repurchase agreement rates is restricted to the 2023 crisis.

4 Empirical Results

4.1 Market Reaction to a Debt Ceiling Crisis

Before analysing the impact of an impending crisis on fund flows, I first establish whether the market considered the recent 2023 debt ceiling crisis to be significantly risky. There is no doubt that a technical default would have had a significant impact on the securities exposed to the event. However, the perceived probability of technical default (when such an event is possible) is what truly impacts security prices. The relatively regular occurrence of debt ceiling crises creates the potential for a "boy who cried wolf" scenario, where investors react less and less to each consecutive crisis (Liu et al., 2009). This issue was addressed in the analysis of the 2011 and 2013 debt crises by Gallagher and Collins (2016). They felt that it was necessary to establish a consistent perception of risk between the two crises, since the "boy who cried wolf" effect may potentially manifest itself in the form of muted outflows in the lead-up to a crisis.

In addition to muted outflows due to the regularity of debt ceiling crises making them seem normal, there is also the possibility that investors could learn from successive crises and modify their behaviour accordingly. Investors adapt over time to the risks posed by financial crises, shifting their funds to reduce the riskiness of their investments. For example, the nature of government funds and their reliance on U.S. Treasury debt means they have heavier portfolio exposures to at-risk Treasury securities than prime funds. Investors may adapt to this pattern, leading to larger outflows from government funds than prime funds during debt ceiling crises (Gallagher & Collins, 2016). Testing this hypothesis for the 2023 debt ceiling crisis is interesting because it occurred ten years after the previous debt crisis in 2013. This gap provided a significant opportunity for investor learning, resulting in a potential shift in market behaviour.

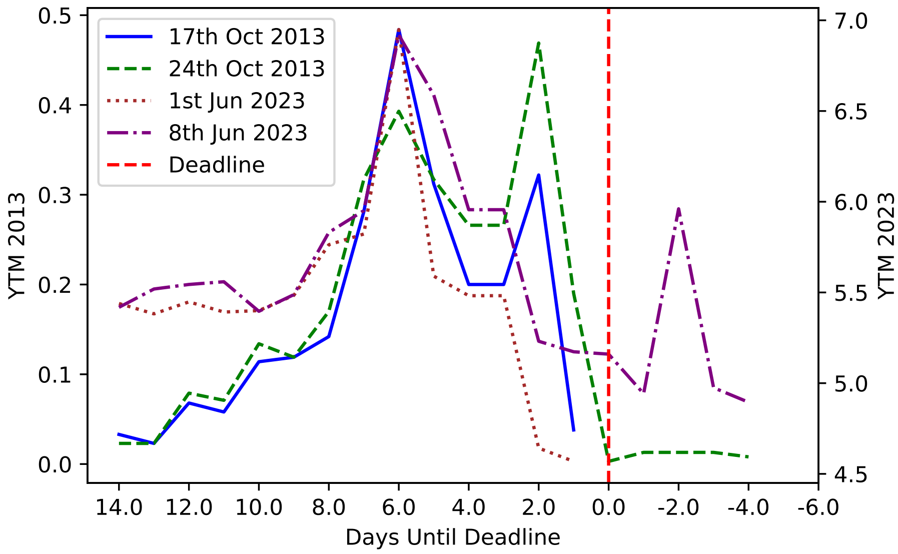

Figure 1: Yields on at-risk Treasury bills, identified by maturity dates, during the 2013 and 2023 debt ceiling crises.

The prospect of a U.S. Treasury default will naturally impact the yields on the Treasury securities maturing within the crisis period. Thus, an analysis of the yields on such instruments in the lead-up to the x-date for each crisis provides an intuitive method of gauging the market's perception of the risks associated with the impending crisis. As illustrated by Figure 1, the yields on T-bills in the lead-up to the deadlines for both crises showed significant increases. The 2013 at-risk T-bills experienced spikes of about 40 basis points, while the 2023 at-risk T-bills experienced spikes amounting to about 150–200 basis points. The market's reaction to the 2023 debt crisis was significantly amplified relative to the case for the 2013 crisis. Gallagher and Collins (2016) observed a similar pattern in the transition from the 2011 crisis to the 2013 crisis, noting that the impact on T-bill yields was significantly higher for the latter event. They theorised that investors learned from the 2011 crisis and began reducing their holdings of at-risk securities maturing close to the 2013 debt renegotiation deadline, resulting in substantially higher yields for those instruments.

This explanation lines up with my own evidence that yields on at-risk securities during the 2023 crisis reacted more extremely than during the 2013 crisis. However, it is important to note the difference in monetary policy environments between the two crises likely contributed to the disparity in market reactions.

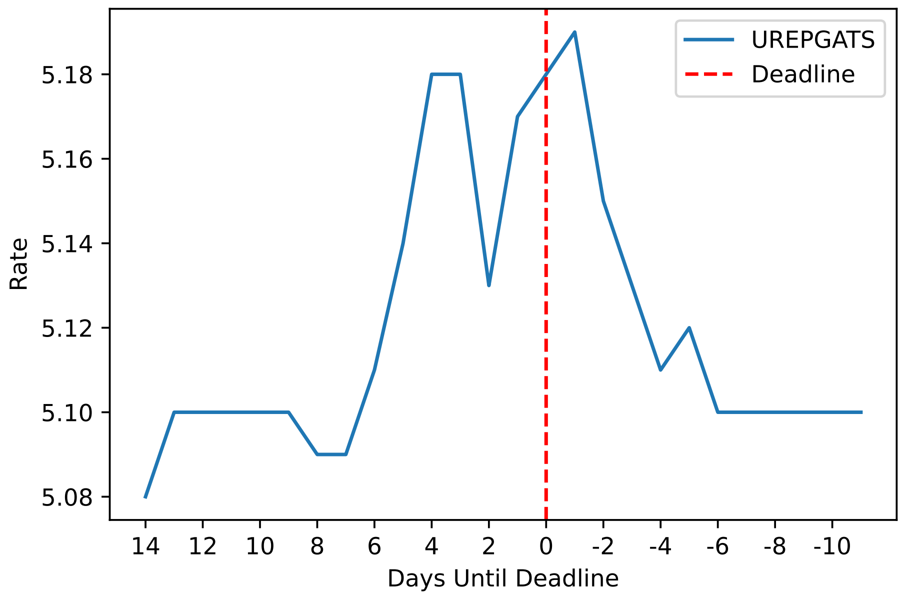

Figure 2: The UREPGATS index of overnight rates on repurchase agreements during the 2023 debt ceiling crisis.

The overnight rates on repurchase agreements collateralized by U.S. Treasury debt provide another measure of the amount of risk priced by the market. Repurchase agreements require securities as collateral to reduce counter-party risk. In 2020, approximately 64% of MMF repurchase agreements were collateralized by U.S. Treasury securities, 31% were collateralized by U.S. Government Agency securities, and only 5% were collateralized by other types of securities (Baklanova et al., 2021). The indirect exposure of repurchase agreements to Treasury debt means that disruptions in the market for Treasury debt will lead to disruptions in the market for repurchase agreements (Belton et al., 2011). Figure 2 illustrates the UREPGATS index during the lead-up to the 2023 crisis. The sharp increase in overnight repurchase agreement rates in the lead-up to the deadline provides clear evidence of the impact of the crisis. Unfortunately, as stated in Section 3.2, the UREPGATS index did not exist in 2013, so a similar analysis cannot be conducted for the 2013 debt crisis.

An analysis of the exposure of MMFs to Treasury securities maturing within the forecasted deadline provides another indication of the risk perceived by the market. Funds reduce their holdings of at-risk securities to limit their exposure to a crisis. Kacperczyk and Schnabl (2010) report that funds reduced their exposures to all types of commercial papers during the GFC since they perceived a significant risk associated with that asset class despite the moratorium on MMF redemptions at the time. To understand the impact of the 2013 and 2023 crises on MMF holdings of Treasury securities, I employed a similar method to that of Gallagher and Collins (2016), sorting the sample of U.S. Treasury debt into buckets based on whether their maturity fell within a two- to four-week window starting from the beginning of the forecasted deadline date (17 October 2013 or 1 June 2023). The results are compiled and represented in Table 1.

Table 1: MMF exposure to Treasury securities

Variable	Crisis	Fund Type	Min	25th	Median	75th	Max Max
All Treasury Holdings	2013	Prime	0.2	3.9	7.2	13.8	85.4
		Gov	0.2	6.8	22.3	48.4	100
	2023	Prime	0	0	0	1.5	86.1
		Gov	0	1.9	6.9	19.7	99.9
4 Week Treasury Holdings	2013	Prime	0	0	0	0	55.4
		Gov	0	0	0	0	54.2
	2023	Prime	0	0	0	0	85.4
		Gov	0	0	0	0	55
2 Week Treasury Holdings	2013	Prime	0	0	0	0	55.4
		Gov	0	0	0	0	37.3
	2023	Prime	0	0	0	0	60.7
		Gov	0	0	0	0	14.8

The exposure is measured as of 31 May 2023 and 30 September 2013. These are the last N-MFP filings before the respective debt crises of each year. The table shows the breakdown of fund direct exposure to U.S. Treasury debt sorted into maturity windows and further sorted by fund type and crisis year. The sample excludes repurchase agreements backed by U.S. Treasury debt and calculates the exposure metrics as the value of U.S. Treasury debt as a percentage of net assets.

Table 1 reveals that during both the 2013 and 2023 crises, MMFs held almost no securities that matured within two- to four-week windows of the debt ceiling renegotiation deadlines. This indicates a clear perception of risk associated with those securities and the underlying threat of technical default. Unsurprisingly, government funds maintained a larger direct exposure to U.S. Treasury debt relative to prime funds. Interestingly, both prime and government funds held significantly smaller proportions of U.S. Treasury debt as a whole during the 2023 crisis, compared to the 2013 crisis. These findings lend credence to the idea of Gallagher and Collins (2016) that investors learn from successive debt crises.

An analysis of fund outflows provides another window on the market's reaction to a debt crisis. Previous literature (Gallagher and Collins (2016), Strahan and Tanyeri (2015), Kacperczyk and Schnabl (2013)) reports a pattern of fund outflows in response to events that appear to elevate MMF portfolio risks. I utilised the weekly breakdown of net inflows provided by the N-MFP forms to analyse fund flows in the weeks leading up to the 2023 crisis deadline. I sought to isolate the funds tailored to institutional investors using the method set out by Chernenko and Sunderam (2014), since they tend to experience amplified investor reactions to the approaching deadline (Kacperczyk & Schnabl, 2010). The resulting aggregate net inflows for government and prime funds, in the weeks leading up to the 2023 crisis deadline, are illustrated in Figure 3

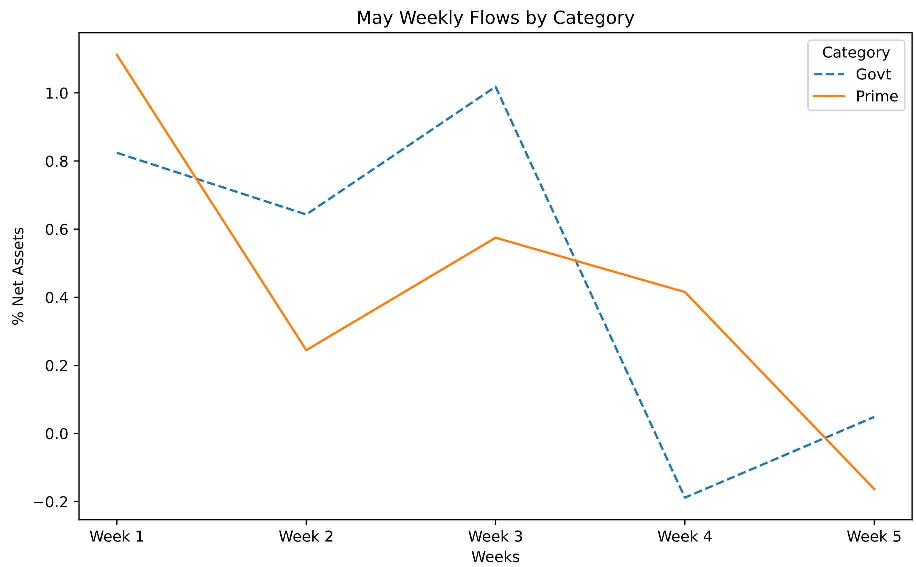

Figure 3: Institutional MMF flows, by fund type

Figure 3 reveals a clear downward trend in net inflows in the weeks leading up to the 2023 forecasted deadline, which can be interpreted as evidence of an increasing perception of risk on the part of institutional investors. Interestingly, the decline in net inflows was not restricted to either prime or government funds. Although Gallagher and Collins (2016) use the same method to analyse the 2011 and 2013 debt crises, I am unable to replicate the weekly flow analysis for the 2013 crisis period, due to the coarseness of my data

Table 2: Distribution of MMF net inflows, by fund type and year

		Statistics				
Fund Type	**Crisis**	**Min**	**25th pctl**	**Median**	**75th pctl**	**Max**
Prime	2013	−14.9	−3.2	2.9	5.6	12.3
	2023	−15.3	−1.9	0.0	1.4	46.7
Gov	2013	−79.8	−1.3	4.4	8.6	21.2
	2023	−10.9	−2.3	0.0	2.2	12.0

This table shows the distribution of net inflows by fund type during the period leading up to both the 2013 and 2023 crises. The values displayed represent net inflows as a percentage of net assets. Due to data granularity issues, the values for 2013 are calculated using net inflows during September 2013, while the 2023 values use weekly net inflows during the final two weeks May 2023.

Table 2 summarises the distributions of net inflows, expressed as a percentage of fund assets, during the 2013 and 2023 crises. (This variable serves as the main dependent variable in the regressions conducted in the next section.) During the 2013 crisis, government funds experienced extreme outflows relative to prime funds. The minimum net inflow values for government funds were almost −80%, while prime funds only experienced an extreme minimum of around −15%. This could potentially be attributed to the excess exposure faced by government funds in terms of their underlying portfolio risk and reliance on U.S. Treasury debt (Jacewitz et al., 2023). Interestingly, the same pattern does not hold for the 2023 crisis, with minimum net inflows into government funds reaching around −10.9%. Prime funds, on the other hand, experienced minimum net inflows of around −14.9%.[4]

[4] Note that the scale difference between the 2013 and 2023 values is due to the fact that the 2013

4.2 The Impact of Exposure to At-Risk Treasury Securities on Fund Flows

I hypothesise that investors interpret the portfolio characteristics of MMFs and respond by shifting their balances accordingly. This hypothesis is supported by Strahan and Tanyeri (2015), who find that fund outflows in the days following the collapse of Lehman Brothers were amplified for funds holding riskier assets. By contrast, Gallagher and Collins (2016) report that fund flows were not correlated with portfolio exposures during the 2011 and 2013 crises. However, Gallagher et al. (2020) find that MMFs with a sophisticated clientele exhibited a correlation between portfolio risk and outflows during the 2011–2012 eurozone crisis.

The 2023 debt crisis provides another opportunity to contribute to this debate. To that end, I performed a cross-sectional regression specified by the model:

$$\begin{aligned} \mathit{NetInflows}_f &= \alpha + \beta_1 \times \mathit{Size}_f + \beta_2 \times \mathit{Inst}_f + \beta_3 \times \mathit{FlowVol}_f \\ &\quad + \beta_4 \times \mathit{Treas}_f + \beta_5 \times \mathit{Controls}_f + \varepsilon_f \end{aligned} \tag{1}$$

Using data from prime and government funds in the months before the 2013 and 2023 deadlines.

The regression includes controls for the weighted average final maturity (MWAL) and short-term gross yield ($\mathit{GrossYield}$) of MMF portfolios. (However, the MWAL variable is not included in the 2013 regression due to a lack of accurate maturity dates for the provided securities.) As noted before, the *NetInflows* variable for 2023 is calculated as the net inflow during the last two weeks of May 2023, expressed as a

values represent net inflows for the month of September 2013 while the 2023 values represent net inflows during the last two weeks of May 2023. As discussed, this discrepancy is due to the flow data obtained in 2013 N-MFP forms is less granular than the corresponding data obtained from the 2023 N-MFP forms.

percentage of total net assets, while it captures only the net inflows over the month of September 2013, in the case of the 2013 crisis. This is due to the discussed restrictions of the N-MFP forms during the 2013 period.

Table 3: 2013 effect of fund exposure to Treasury securities on net inflows

Variable	**Prime Funds**			**Gov Funds**		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	4 Week	2 Week	All	4 Week	2 Week
Constant	−2.880	−1.739	−1.747	−19.64	−24.31	−22.94
	(0.616)	(0.759)	(0.758)	(0.197)	(0.104)	(0.123)
Size	0.104	0.0932	0.0930	1.258	1.357*	1.309
	(0.692)	(0.723)	(0.724)	(0.063)	(0.047)	(0.055)
Inst	0.0292	0.0278	0.0280	0.0154	0.0132	0.0135
	(0.064)	(0.081)	(0.078)	(0.591)	(0.641)	(0.635)
FlowVol	−0.114	−0.111	−0.113	−0.423*	−0.408*	−0.416*
	(0.217)	(0.239)	(0.231)	(0.025)	(0.030)	(0.028)
Treas	0.0558	−0.00655	0.00396	−0.0258	0.156	0.134
	(0.285)	(0.946)	(0.968)	(0.605)	(0.406)	(0.647)
N	147	147	147	122	122	122

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table contains the result of the cross-sectional regression outlined in Equation (1). The dependent variable captures the net monthly inflows of a fund reported as of 30 September 2013 expressed as a percentage of the fund's net assets reported as of 31 August 2013 (*NetInflows*). The independent variables include fund net assets (*Size*), investor sophistication (*Inst*), historical flow volatility (*FlowVol*), and its exposure to U.S. Treasury securities (*Treas*). Regressions are run on separated samples of prime and government funds, with three specifications based on whether the *Treas* variable captures exposure to all U.S. Treasury debt or only debt maturing within a two- or four-week window relative to the deadline (17 October 2013).

Table 4: 2023 effect of fund exposure to Treasury securities on net inflows

Variable	Prime Funds			Gov Funds		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	4 Week	2 Week	All	4 Week	2 Week
Constant	4.520	4.466	4.849	0.941	−0.0656	0.0383
	(0.704)	(0.712)	(0.685)	(0.815)	(0.987)	(0.993)
Size	−0.229	−0.227	−0.243	0.00293	0.0140	0.00125
	(0.656)	(0.664)	(0.639)	(0.986)	(0.934)	(0.994)
Inst	−0.0221	−0.0220	−0.0222	−0.00640	−0.00785	−0.00712
	(0.208)	(0.207)	(0.203)	(0.442)	(0.352)	(0.398)
FlowVol	0.586***	0.586***	0.585***	0.0200	0.0225	0.0195
	(0.000)	(0.000)	(0.000)	(0.482)	(0.434)	(0.501)
Treas	−0.00402	−0.00275	−0.0144	−0.0338*	−0.0492	−0.0759
	(0.949)	(0.967)	(0.878)	(0.027)	(0.276)	(0.581)
N	147	147	147	122	122	122

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table contains the result of the cross-sectional regression outlined in Equation (1). The dependent variable captures the net inflows of a fund taken during the last two weeks May 2023 expressed as a percentage of the fund's net assets as of 30 April 2023 (*NetInflows*). The independent variables include fund net assets (*Size*), investor sophistication (*Inst*), historical flow volatility (*FlowVol*), and its exposure to U.S. Treasury securities (*Treas*). Regressions are run on separated samples of prime and government funds, with three specifications based on whether the *Treas* variable captures exposure to all U.S. Treasury debt or only debt maturing within a two- or four-week window relative to the deadline (1 June 2023).

I find that the impact of a fund's size on its flows (*Size*) was generally insignificant during the lead-ups to the forecasted deadlines for both the 2013 and 2023 debt crises. Some weak significance is exhibited in my analysis of the 2013 crisis, with a weakly significant coefficient on fund size for government fund exposure to U.S. Treasury debt holdings maturing within a four-week window from the deadline. All other variations of the exposure metric exhibit statistically insignificant coefficients. Beyond this, the coefficients themselves are positive, implying that larger funds experienced larger net inflows. According to the coefficient found in column (5) of Table 3, an increase of one standard deviation in the logarithm of total assets (*Size*) results in a 1.36% increase in net inflows. These findings clash with those of Gallagher and Collins (2016) who report that the size of government funds is strongly significant in its impact on fund flows, with larger funds experiencing heavier outflows for all specifications of the exposure metric. My analysis of the 2023 debt crisis yielded unanimously insignificant coefficients on fund size for prime and government funds, and for all measurements of exposure.

When considering the impact of investor sophistication on fund flows, I find that the proportion of a fund's net assets invested in institutional share classes (*Inst*) did not exert a statistically significant impact on fund flows in the lead-ups to the deadlines of for either crisis. My findings for the 2013 period (Table 3) reveal a positive yet statistically insignificant coefficient on investor sophistication, indicating a lack of correlation between the sophistication of a fund's clientele and fund flows in the lead-up to the 2013 deadline. These findings contrast with those of Gallagher and Collins (2016), who find a negative and statistically significant relation between investor sophistication and flows for prime funds in their analysis of the 2013 debt crisis. My findings for the 2023 crisis result in the same outcome, with investor sophistication generating a negative but statistically insignificant coefficient. Contrary to the established literature regarding investor sophistication and market events (Kacperczyk and Schnabl, 2013, Gallagher and Collins, 2016), my results imply that, on average, funds catering to institutional investors exhibit no extraordinary outflows relative to other funds.

My research yields somewhat conflicting results regarding the correlation between historical fund flow volatility and subsequent flows in the lead-ups to the deadline for each crisis. My 2013 results show negative and statistically significant coefficients on historical flow volatility in columns (4)–(5) at the 5% level across all variations of the model. These findings indicate that government funds with higher monthly flow volatilities, measured over the 2011–2012 period, experienced heavier outflows on average, by around 0.42% per additional standard deviation of flow volatility. These findings complement those of Gallagher and Collins (2016), who find a negative and strongly significant dependence between historical flow volatility and fund flows for their sample of government funds during the 2011 and 2013 crises. Note that the coefficients estimated by Gallagher and Collins (2016), using data with a much higher resolution than my data, are statistically more significant than my coefficient estimates. This suggests that my results understate the true statistical significance of coefficient estimates.

In my analysis of the 2023 crisis, the estimated coefficients on historical flow volatility are surprising and somewhat counter-intuitive, since they have the opposite sign to the corresponding coefficients for the 2013 data, this seems to clash with economic intuition. According to previous literature, funds with greater historical flow volatility experience heavier outflows in the lead-up to a debt crisis (Gallagher & Collins, 2016). However, the results in columns (1)–(3) of Table 4 show a positive and strongly significant coefficient on historical flow volatility. This implies that prime funds with an additional standard deviation of historical flow volatility experienced heavier inflows by around 0.59%, relative to other prime funds, on average. This may seem economically counter-intuitive at first, since one would expect that funds with volatile flows are subject to extraordinary outflows during market events.

Gallagher and Collins (2016) use the volatility of historical flows as a proxy for the liquidity needs of the fund's clientele to explain the dependence of fund flows on historical flow volatilities. I theorise that high levels of flow volatility identify funds that provide an enhanced liquidity transformation service. Investors seeking to harvest the enhanced corporate yields associated with a crisis require the liquidity transformation services of prime funds to access corporate debt instruments. These instruments exhibit very high yields during crises, which makes them very cheap, but are quite illiquid. Investors wishing to make use of the opportunity to purchase cheap corporate debt therefore need to utilise the liquidity transformation services of prime funds. On the other hand, since U.S. Treasury debt is liquid by nature, investors do not require the same service from government funds. This potentially explains the positive and strongly significant coefficients on historical flow volatility seen in the columns (1)–(3) of Table 4, while the corresponding coefficients in columns (4)–(6) are insignificant. Investors seek out prime funds with the lowest liquidity transformation costs, which corresponds with more volatile historical flows. However, the liquidity transformation service of government funds is much less valuable.

With regard to portfolio exposure, my results point to a unanimously insignificant relation between fund flows and portfolio exposure to U.S. Treasury debt in the lead-up to the 2013 crisis. A very similar relation is captured in my analysis of the 2023 debt crisis, with a negative and weakly significant coefficient when considering government funds holdings of all U.S. Treasury debt. The result implies that a government fund holding an additional 1% of its net assets in U.S. Treasury debt experiences heavier outflows, by around 0.03%. The weak statistical and economic significance of this coefficient leads me to much the same conclusion as Gallagher and Collins (2016), who conclude that the exposure of a fund's portfolio to a debt ceiling crisis does little to explain fund flow activity in the lead-up to the forecasted crisis deadline.

The control variables used to estimate the regression model (1) included a fund's gross yield during the last 7 days of the month before the deadline ($GrossYield$) and the weighted average final maturity of the fund's portfolio ($MWAL$). These variables were excluded from the displayed results in Tables 3 and 4, but the coefficients are neither economically nor statistically significant.

Due to the disparity in statistical significance between my findings during the 2013 crisis and the findings of Gallagher and Collins (2016), I theorise that my subsequent findings during the 2023 crisis are likely to be understating the magnitude of significance for various coefficients. This differential is likely attributable to the data and granularity differences. Thus, the comparatively weak significance of my 2013 estimated coefficients relative to the strong significance of the results obtained by Gallagher and Collins (2016) suggests that my 2023 coefficient estimates would be much more significant if I had access to more refined data.

4.3 Robustness Checks

I conducted a robustness check based on variations in measurement of a fund's exposure to at-risk securities. The *Treas* exposure variable is measured at the end of the month preceding the crisis deadline, since this is the last available submission of the N-MFP forms. One could argue that by using a fund's exposure at that point in time, I am effectively "putting the horse before the cart". For example, the 2023 forecasted deadline fell on the 1st of June, while the last available N-MFP form reported fund holdings as of 31 May (exactly 1 day before the deadline). This causes an issue because one cannot expect a fund's holdings—reported only 1 day before the deadline—to have an impact on fund flows two weeks before the deadline. Thus, as a robustness test, the appendix includes estimates for equation (1) (Tables 7, 8, 9) with the *Treas* exposure variable calculated using data reported two months before the month of the deadline (*LagTreas*). My findings are robust to these variations, with the estimated coefficients maintaining similar values, statistical significance, and economic interpretations.

I conducted an additional robustness check with a similar design to a test in

Gallagher and Collins (2016). To account for the potential of elevated monitoring costs and inaccurate data in the lead-up to the debt crisis deadlines, I estimated the following model:

$$\begin{aligned} \mathit{NetInflows}_f = \alpha + \beta_1 \times \mathit{Treas}_f + \beta_2 \times \mathit{Gov}_f + \beta_3 \times \mathit{FlowVol}_f \\ + \beta_4 \times \mathit{Controls}_f + \varepsilon_f \end{aligned} \tag{2}$$

This model captures the possibility that investors are either unable or unwilling to access complex measurements of the risk of particular funds. It assumes instead that investors choose to use simple and easily accessible metrics to measure the exposure of a fund's portfolio in the lead-up to the crisis. Table 5 presents the results from estimating this model for both crisis periods.

The coefficients on the government dummy variable in columns (1) and (4) of Table 5 are not statistically significant, implying no correlation between fund type and outflows in isolation. However, the results differ when accounting for an interaction between fund type and flow volatility. I find that during the 2013 crisis period, government funds with low flow volatility experienced heavier inflows relative to similar funds with higher flow volatility, by around 4.6%. However, when accounting for fund exposure to at-risk securities, the statistical significance is much weaker. These findings differ from those of Gallagher and Collins (2016), who find that investors in government funds with amplified flow volatility are significantly more likely to redeem than similar investors in prime funds. My findings suggest that the risk of redemption by these investors is no greater than for their prime fund counterparts, when accounting for differences in flow volatility and portfolio exposure, during the 2013 crisis.

My analysis of the 2023 crisis in columns (4)–(6) of Table 5 offers contrasting

Table 5: The impact fund type on net inflows

Variable	**2013**			**2023**		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−11.46	−12.06	−12.62	1.116	−0.643	−1.422
	(0.102)	(0.084)	(0.073)	(0.762)	(0.855)	(0.694)
Size	0.592	0.560	0.563	−0.0679	0.0436	0.0745
	(0.069)	(0.085)	(0.078)	(0.683)	(0.785)	(0.647)
Inst	0.0189	0.0203	0.0214	−0.00491	−0.0129	−0.0144
	(0.243)	(0.208)	(0.181)	(0.537)	(0.095)	(0.067)
Treas	−0.00508	−0.00261	0.0465	−0.0253	−0.0249	−0.0156
	(0.856)	(0.926)	(0.733)	(0.490)	(0.476)	(0.800)
Gov	1.640	4.554^{*}	0.497	0.147	-3.808^{***}	-3.857^{***}
	(0.234)	(0.026)	(0.863)	(0.835)	(0.000)	(0.000)
FlowVol	-0.274^{**}	−0.0854	−0.108	0.0707^{*}	0.0252	0.0484
	(0.007)	(0.539)	(0.531)	(0.028)	(0.424)	(0.207)
FlowVol × *Gov*		−0.362	0.210		0.472^{***}	0.464^{***}
		(0.053)	(0.444)		(0.000)	(0.000)
FlowVol × *Gov* × *Treas*			−0.0169			−0.0108
			(0.167)			(0.547)
N	269	269	269	262	262	262

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table contains the result of the cross-sectional regression outlined in Eq. (2). The dependent variable (*NetInflows*) captures the net monthly inflows during September for the 2013 sample and the net inflows during the last two weeks May for the 2023 sample. The dependent variables include a fund's net assets (*Size*), investor sophistication (*Inst*), exposure to U.S. Treasury debt (*Treas*), and historical flow volatility (*FlowVol*). A dummy variable is included capturing fund type. *Gov* is equal to one if the fund is classified as a government fund and equal to zero if classified as a prime fund. For the 2013 period, the *Treas* variable captures all holdings of all U.S. Treasury debt while the 2023 model uses U.S. Treasury debt maturing within a four-week window relative to the deadline.

results. I find that government funds with higher flow volatilities experienced heavier inflows, by around 0.46%, relative to other funds, while government funds with lower flow volatilities experienced heavier outflows, by around 3.86%, relative to other funds. This is somewhat consistent with the liquidity cost theory I proposed previously, but now it is applied to government funds rather than prime funds.

I've also created a variation of the previous model, using prime funds rather than government funds as the fund type dummy, to compare with the results from my previous analysis (Table 4). In detail, I estimated the following regression model:

$$\begin{aligned} \mathit{NetInflows}_f = \alpha + \beta_1 \times \mathit{Treas}_f + \beta_2 \times \mathit{Prime}_f + \beta_3 \times \mathit{FlowVol}_f \\ + \beta_4 \times \mathit{Controls}_f + \varepsilon_f \end{aligned} \tag{3}$$

According to column (3) in Table 6, investors were no more likely to redeem prime fund investments in 2013, after controlling for differences in flow volatility and exposure. Interestingly, the weakly significant but positive coefficient on fund exposure to at-risk securities suggests that investors were less likely to redeem from funds with more exposure. The coefficient can be interpreted to mean that funds with a 1% higher exposure to U.S. Treasury debt, as a fraction of their net assets, experienced heavier inflows by around 0.13%.

With respect to the 2023 crisis, column (6) of Table 6 suggests that prime funds with lower flow volatilities experienced heavier inflows by around 3.86%, while prime funds with higher flow volatilities experienced heavier outflows by around −0.47% for an additional standard deviation of historical fund flows over the period of 2021–2022. This implies that investors are more likely to redeem from prime funds with heavier flow volatilities, after accounting for fund type, flow volatility and portfolio exposure. These findings are in line with those of Gallagher and Collins (2016), implying that

Table 6: The impact fund type on net inflows

Variable	**2013**			**2023**		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−9.823	−7.504	−12.12	1.263	−4.451	−5.279
	(0.170)	(0.298)	(0.096)	(0.735)	(0.230)	(0.162)
Size	0.592	0.560	0.563	−0.0679	0.0436	0.0745
	(0.069)	(0.085)	(0.078)	(0.683)	(0.785)	(0.647)
Inst	0.0189	0.0203	0.0214	−0.00491	−0.0129	−0.0144
	(0.243)	(0.208)	(0.181)	(0.537)	(0.095)	(0.067)
Treas	−0.00508	−0.00261	0.128^{*}	−0.0253	−0.0249	0.125
	(0.856)	(0.926)	(0.017)	(0.490)	(0.476)	(0.430)
Prime	−1.640	-4.554^{*}	−0.497	−0.147	3.808^{***}	3.857^{***}
	(0.234)	(0.026)	(0.863)	(0.835)	(0.000)	(0.000)
FlowVol	-0.274^{**}	-0.448^{***}	0.102	0.0707^{*}	0.497^{***}	0.513^{***}
	(0.007)	(0.001)	(0.641)	(0.028)	(0.000)	(0.000)
FlowVol × *Prime*		0.362	−0.210		-0.472^{***}	-0.464^{***}
		(0.053)	(0.444)		(0.000)	(0.000)
FlowVol × *Prime* × *Treas*			0.0169			0.0108
			(0.167)			(0.547)
N	269	269	269	262	262	262

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table contains the result of the cross-sectional regression outlined in Equation (3). The dependent variable (*NetInflows*) captures the net monthly inflows during September for the 2013 sample and the net inflows during the last two weeks May for the 2023 sample. The dependent variables include a fund's net assets (*Size*), investor sophistication (*Inst*), exposure to U.S. Treasury debt (*Treas*), and historical flow volatility (*FlowVol*). A dummy variable is included capturing fund type. *Prime* is equal to one if the fund is classified as a prime fund and equal to zero if classified as a government fund. For the 2013 period, the *Treas* variable captures all holdings of all U.S. Treasury debt while the 2023 model uses U.S. Treasury debt maturing within a four-week window relative to the deadline.

funds with greater liquidity experienced heavier outflows. The only difference is that this relation is seen in prime funds rather than government funds. These findings also contradict my idea, based on the results in Table 4, that redemptions are concentrated in prime funds with higher flow volatilities.

5 Conclusions

The 2023 debt ceiling crisis provided a unique opportunity to investigate the factors that influence MMF outflows in the lead-up to a debt ceiling crisis. My investigation of this crisis provides additional input into the debate around whether factors such as a fund's portfolio risk influence fund flows in the weeks leading up to a debt ceiling crisis deadline. The results of my analysis suggest that portfolio exposure to U.S. Treasury debt has little influence on fund flows before the deadline. My results also indicate that factors such as a fund's net assets or the sophistication of its investors have little explanatory power as determinants of fund outflows in the weeks before the crisis. However, the volatility of a fund's historical flows seems to play an important role as a determinant of fund flows during crisis periods.

These findings are consistent with the theory that investors are primarily concerned with the liquidity provision service of MMFs and the impact a technical default might have on the ability of investors to access invested funds or profit from investment opportunities. However, the shift in coefficient signs between 2013 and 2023 leads to a counter-intuitive result, which I explain in terms of the yield-chasing behaviour of investors.

As a word of caution, my robustness tests lead to a state of inconclusiveness. My primary regression estimates in Tables 3 and 4 are consistent with the theory that investors search for prime funds with low liquidity costs, measured by amplified flow volatility, to capitalise on enhanced yields on the corporate debt securities during a crisis. However, the results of the robustness test in Table 6 suggests that investors are more likely to redeem from prime funds with higher flow volatilities, leading to a conclusion much more in line with that of Gallagher and Collins (2016). These results are consistent with the theory that redemptions are heaviest for funds with high flow volatilities, due to the liquidity needs of their investors. Ultimately, my findings are restricted by the coarseness of my data relative to the data used in other studies. Nevertheless, my results indicate that the market's response to the 2023 debt crisis is not as straightforward as the literature might imply.

The implications of my results are relevant to industry and academic literature. My findings contribute to the academic argument for (Chernenko and Sunderam, 2014, Kacperczyk and Schnabl, 2013) and against (Gallagher and Collins, 2016) the significance of portfolio exposure as a determinant of investor redemptions during crisis periods. In particular, my results suggest that the portfolio exposure of a fund to at-risk securities has little impact on outflows during a crisis. My results clash with the established literature regarding the relation between investor sophistication and fund outflows during market events (Gallagher and Collins, 2016, Kacperczyk and Schnabl, 2010), with my results indicating that investor sophistication is uncorrelated with outflows in the weeks before debt ceiling deadlines.

The implications of these results are relevant to industry, since according to my preliminary analysis (Table 1), fund managers actively reduce their holdings of at-risk securities to reduce the liquidity risk posed by a crisis. The lack of correlation between exposure and outflows implies that this action has little impact on redemptions, making the sacrifice of the enhanced yields brought about by the crisis (Figure 1) unnecessarily. Furthermore, the significant yet conflicting results reported in my analy sis of the correlation between flow volatility and fund flows prior to a debt ceiling renegotiation presents a potential curve-ball that fund managers should consider when attempting to manage the liquidity risk during market crises.

6 Appendix

Table 7: 2013 effect of lagged Treasury exposure on net inflows

	Prime Funds			Gov Funds		
	(1)	(2)	(3)	(4)	(5)	(6)
	NetInflows	NetInflows	NetInflows	NetInflows	NetInflows	NetInflows
Constant	−3.040	−1.347	−1.654	−24.78	−26.70	−25.62
	(0.598)	(0.811)	(0.768)	(0.107)	(0.082)	(0.092)
Size	0.103	0.0929	0.103	1.303	1.436*	1.395*
	(0.695)	(0.722)	(0.693)	(0.059)	(0.040)	(0.045)
Inst	0.0286	0.0273	0.0276	0.0163	0.0173	0.0178
	(0.069)	(0.082)	(0.078)	(0.581)	(0.553)	(0.542)
FlowVol	−0.106	−0.119	−0.120	−0.419*	−0.400*	−0.408*
	(0.250)	(0.195)	(0.192)	(0.031)	(0.039)	(0.035)
LagTreas	0.0636	−0.514	−0.923	0.0276	0.286	0.420
	(0.276)	(0.223)	(0.146)	(0.592)	(0.280)	(0.338)
N	147	147	147	117	117	117

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The model is identical to that of Table 3 with the exception of the *Treas* variable which is now taken as of 31 August 2013 as opposed to 30 September 2013

Table 8: 2013 effect of lagged Treasury exposure on net inflows

	Prime Funds			Gov Funds		
	(1)	(2)	(3)	(4)	(5)	(6)
	NetInflows	NetInflows	NetInflows	NetInflows	NetInflows	NetInflows
Constant	4.770	5.467	5.447	0.0683	0.563	0.437
	(0.686)	(0.649)	(0.649)	(0.986)	(0.890)	(0.915)
Size	−0.238	−0.268	−0.267	0.0314	−0.00429	−0.00559
	(0.639)	(0.605)	(0.605)	(0.851)	(0.980)	(0.974)
Inst	−0.0224	−0.0224	−0.0224	−0.00605	−0.00719	−0.00653
	(0.203)	(0.198)	(0.198)	(0.467)	(0.391)	(0.438)
FlowVol	0.585^{***}	0.585^{***}	0.585^{***}	0.0221	0.0175	0.0180
	(0.000)	(0.000)	(0.000)	(0.437)	(0.542)	(0.532)
LagTreas	−0.0122	−0.0321	−0.0566	-0.0238^{*}	−0.0736	−0.0992
	(0.876)	(0.761)	(0.757)	(0.023)	(0.155)	(0.243)
N	70	70	70	192	192	192

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The model is identical to that of Table 4 with the exception of the *Treas* variable which is now taken as of 30 April 2023 as opposed to 31 May 2023

Table 9: Effect of fund type on net inflows using lagged Treasury exposure

Variable	**2013**			**2023**		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−12.42	−12.98	−13.38	1.419	−0.223	−0.446
	(0.078)	(0.064)	(0.066)	(0.702)	(0.950)	(0.900)
Size	0.623	0.587	0.591	−0.0794	0.0283	0.0356
	(0.057)	(0.072)	(0.072)	(0.634)	(0.860)	(0.825)
Inst	0.0210	0.0226	0.0230	−0.00463	−0.0127	−0.0134
	(0.201)	(0.167)	(0.165)	(0.559)	(0.098)	(0.084)
LagTREAS	0.0255	0.0297	0.0566	−0.0459	−0.0551	−0.00210
	(0.384)	(0.309)	(0.714)	(0.346)	(0.234)	(0.981)
Gov	0.823	3.821	4.074	0.108	-3.887^{***}	-3.868^{***}
	(0.555)	(0.062)	(0.175)	(0.878)	(0.000)	(0.000)
FlowVol	-0.283^{**}	−0.0890	−0.104	0.0681^{*}	0.0218	0.0378
	(0.005)	(0.524)	(0.582)	(0.034)	(0.490)	(0.287)
$FlowVol \times Gov$		-0.376^{*}	−0.339		0.476^{***}	0.464^{***}
		(0.046)	(0.239)		(0.000)	(0.000)
$FlowVol \times Gov \times LagTREAS$			−0.00242			0.000007
			(0.883)			(1.000)
N	264	264	264	262	262	262

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The model is identical to that of Tables 5 and 6 with the exception of the *Treas* variable which is now taken as of August 2013 and April 2023 as opposd to September 2013 and May 2023.

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