8-2020

Crisis Regulations: The Unexpected Consequences of Floating NAV for Money Market Funds

Kyle D. Allen
Boise State University

Drew B. Winters
Texas Tech University

Publication Information

Allen, Kyle D. and Winters, Drew B. (2020). "Crisis Regulations: The Unexpected Consequences of Floating NAV for Money Market Funds". *Journal of Banking & Finance, 117*, 105851-1 - 105851-22. https://doi.org/10.1016/j.jbankfin.2020.105851

Crisis Regulations: The Unexpected Consequences of Floating NAV for Money Market Funds

Kyle D. Allen
Department of Finance
Boise State University
Boise, Idaho
kallen@boisestate.edu

Drew B. Winters
Lucille and Raymond Pickering Chair in Finance
Texas Tech University
Lubbock, TX
drew.winters@ttu.edu

This version: 5/4/2020

Abstract

From the inception of money market funds (MMFs), all MMFs reported a fixed $1 NAV (Net Asset Value). In July 2014, the Securities and Exchange Commission (SEC) issued new regulations for MMFs that require Prime institutional MMFs to report floating NAVs. The SEC did not expect a significant impact on the MMF industry from requiring floating NAVs for Prime institutional funds. We find that over 70% of the assets under management in Prime MMFs left Prime funds with over half the Prime funds closing. We find that more than half of the Prime retail MMFs (which are not required to switch to floating NAV) closed with more than 50% of the assets under management exiting these funds. Finally, we find that for every dollar that exited Prime MMFs a dollar was added to Government MMFs. Based on the SEC's economic discussions, these results all represent unexpected consequences.

JEL classification: G00; G01; G20; G21; G23; E44

Keywords: money market funds; floating NAV; prime funds; Securities and Exchange Commission; unintended consequences; financial crisis

1. Introduction

The "Great Recession" of 2007 through 2009 is often referred to as a financial crisis. After the financial crisis, the U.S. Congress and regulators responded with new laws and regulations for the financial markets in an attempt to prevent the next crisis. One sector of the financial markets to receive new regulations is money market funds (MMFs).

On July 23, 2014, the Securities and Exchange Commission (SEC) finalized new regulations for MMFs that require Prime institutional MMFs to report floating Net Asset Values (NAVs).[1] From the inception of MMFs in 1970, all MMFs reported a fixed $1 NAV. The SEC's new rule changed a primary feature of MMFs, but only for Prime institutional MMFs. The point of the change in 2014 is to improve transparency of market values in riskier MMFs to eliminate runs (Strahan and Tanyeri (2015), Acharya and Mora (2015)). The SEC's discussion of the changes concluded that the changes would have only minor impacts on MMFs. However, there were several criticisms of the new rule, so we examine the rule change for unexpected consequences.

[1] See Securities and Exchange Commission Release No. 33-9616, IA-3879: IC-31166: FR-84: File No. S7-03-13. Money Market Fund Reform. Final Rule.

Investors and funds responded to the changes with assets shifting away from Prime MMFs. Specifically, from October 13, 2015 to October 11, 2016 assets under management in Prime MMFs decreased from $1,155 billion to $329 billion, a decrease of over 71%. Based on the SEC's discussion, the over $825 billion in assets under management exiting the Prime MMFs is an unexpected consequence. Prime institutional MMFs are required to change to a floating NAV, while Prime retail MMFs are allowed to retain a fixed $1 NAV. Over half of the assets under management in Prime retail MMFs exited with the new rule, which is another unexpected consequence.

Prime MMFs focus their holdings in private-issue money market securities. In other words, Prime MMFs provide short-term debt to businesses. Accordingly, we examine where investors move their money when leaving Prime MMFs. The answer is they moved into Government MMFs, and the move was virtually dollar for dollar. This move is another unexpected consequence of the SEC rule change as $825 billion left the market for short-term business debt. Investors have higher yield mutual fund alternatives that provide debt to businesses, but institutional investors chose the one remaining mutual fund that can still provide the fixed $1 NAV and retail investors moved with them.

In this paper we find results consistent with Potter (2018) and other previous research. Additionally, we find that assets left Prime funds in response to new money market fund regulations. Our main contribution is comparing empirical evidence against SEC expectations and policy implications. We document and analyze why money left Prime money market funds, when it left, and where it went. Our findings address SEC expectations, investor preferences, accounting implications, and tax treatments.

2. Background and Research Questions

Money markets and money market funds (MMFs) were at the center of the financial crisis. Taylor and Williams (2009) identify August 9, 2007 as the beginning of the financial crisis because that is the day that money market rates jumped signaling the end of years of relative calm. The Federal Reserve Bank (FRB) of St. Louis' financial crisis timeline shows that on August 9, 2007 BNP Paribas announced that it closed three MMFs because it could not determine the NAV of the funds as there were no reliable prices for the asset-backed commercial paper (ABCP) held by the funds. Taylor and Williams (2009) note that the FRB-NY responded by pumping liquidity into the market. In December of 2007, the Fed created the Term Auction Facility (TAF) to provide banks liquidity without having to access the discount window.[2]

The epicenter of the financial crisis was the bankruptcy of Lehman Brothers on September 15, 2008. Holdings in Lehman short-term debt caused Reserve Primary (the first ever MMF) to break-the-buck on September 16, 2008; and, by the end of the day received redemption requests totaling about $39.9 billion, which was more than half of the total assets of the fund.[3] The U.S. Treasury and the Federal Reserve responded with several programs to support the financial system, including the Troubled Asset Relief Program (TARP). Two of these programs specifically supported money markets: the Asset-backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) and the Commercial Paper Funding Facility (CPFF).[4]

As the financial crisis waned, Congress and regulators stepped in to change the rules of the financial system in an attempt to shore up the system against any future financial crisis. Rule 2a-7 of the Investment Act of 1940 governs MMFs. In 2010 the Securities and Exchange Commission (SEC) modified rule 2a-7 in an attempt to improve the liquidity and credit quality of MMFs.[5] However, some did not believe the 2010 changes to rule 2a-7 were sufficient. For example, in October of 2010 the President's Working Group on Financial Markets proposed a two-tiered system for MMFs where tier 1 MMFs would be very low risk and continue the traditional standard of a fixed $1 NAV and tier 2 MMFs would allow more risk, but be required to use a floating NAV.

In 2014, the SEC announced additional changes to rule 2a-7 to implement a two-tiered system. The new rules require Prime institutional MMFs to switch to a floating NAV. However, not everyone believed the new rules would work (Price (2015)). Hanson, Scharfstein, and Sunderam (2015) suggested the floating NAV rules may be insufficient in addressing the instabilities associated with MMFs.

[2] For details on TAF see: Blau, Hein and Whitby (2016), Allen, Hein and Whitledge (2017), and Cyree, Griffiths and Winters (2017).
[3] See, Akay, Griffiths and Winters (2014) for a detailed discussion to the collapse of Reserve Primary.
[4] See, Akay, Griffiths, Kotomin and Winters (2013) for a discussion of AMLF and Fairbanks, Griffiths and Winters (2018) for a discussion of CPFF.
[5] See, Akay, Griffiths and Winters (2015) for a detailed discussion of the 2010 changes to rule 2a-7.

The point of the change in 2014 is to improve the transparency of market values in riskier MMFs to eliminate runs (Strahan and Tanyeri (2015), Acharya and Mora (2015)). Akay, Griffiths and Winters (2015) question the effectiveness of a floating NAV since most money market securities trade infrequently. Allen, Cashman and Winters (2016) examine floating NAVs on closed-end mutual funds that hold securities that trade infrequently and find that floating NAVs do not provide information beyond what is already available to investors. With no value added from the rule change, they raise the question of value destruction from the change. An ICD report suggests that a floating NAV for MMFs may drive investors to alternative investments.[6]

On July 23, 2014 the SEC posted the final rule implementing in part, the floating NAV rule for Prime institutional MMFs.[7] The rules were effective starting October 14, 2014 with a compliance date starting two years later on October 14, 2016. In the final ruling the SEC states: "A long compliance period will give more time for funds to implement any needed changes to their investment policies and train staff, and also will provide more time for investors to analyze their cash management strategies."[8] We examine the implementation of the floating NAV to determine what unexpected consequences, if any, have occurred in MMFs.

2.1. Research Question 1

> Our first research question: Did the new floating NAV regulations for Prime MMFs reduce investor appetite for Prime MMF investments?

Cipriani and La Spada (2018) suggest that an important feature of MMFs is that a fixed $1 NAV allows claims on MMFs to function like money. They argue that a switch to a floating NAV causes MMFs to be less money-like and therefore be less attractive to money market investors.[9] Baghai, Giannetti and Jäger (2018) argue that the floating NAV makes MMFs less money-like, which increases the risk of the MMFs causing investors to exit. The ICD report suggests that a floating NAV makes MMFs less liquid. All of these arguments provide reasons why investors will exit MMFs with floating NAVs.

The SEC, in the background section (part B, pages 16 through 25) of the final rule, mentions that money funds are cash management tools that provide tax and administrative convenience to investors. The SEC also mentions that a stable (fixed $1 NAV) price allows MMFs to sell and redeem shares on demand. The SEC does not discuss how a floating NAV eliminates redemption on demand, which would reduce the money-like nature of MMFs.

The SEC acknowledges the concern of switching to a floating NAV, but concludes: "We do not anticipate our reforms will have a substantial effect on the total amount of capital invested, although investors may reallocate assets among investment alternatives" (SEC final report, p.599). The SEC elaborates with "we believe as much as $1.269 trillion in assets could be at risk for being reallocated to government funds and other investment alternatives. But as discussed below, neither the Commission nor most commenters believe that all institutional investors in non-government funds will reallocate their assets." (SEC final report, p. 600) Instead, the SEC reaches the following conclusion: "… that the relative costs to investors from losing certain features of some of today's money market funds should be acceptable in light of the significant benefits stemming from advancing our goals of reducing money market funds' susceptibility to heavy redemptions, improving their ability to manage and mitigate potential contagion from redemptions, and increasing the transparency of their risks." (SEC final report, p. 615 & 616)

Floating NAV regulations create additional risk for investors. Investors can no longer use Prime MMFs as a substitute for bank deposits because of the risk of values changing. While Prime funds remain relatively safe, the move away from Prime MMFs being money-like creates incentives for alternative investment options.

---

[6] ICD commentary: Operational and accounting issues with the floating NAV and the impact of money market funds (July 2013). https://www.sec.gov/comments/s7-03-13/s70313-40.pdf

[7] The changes to rule 2a-7 also include: liquidity fees and redemption gates. Fees and gates apply to all Prime MMFs, while the floating NAV applies only to Prime institutional MMFs. In section 2.5., we discuss the implications of fees and gates on Prime retail MMFs. (See, SEC: Money Market Fund Reform. Final Rule)

[8] See Securities and Exchange Commission Release No. 33-9616, IA-3879: IC-31166: FR-84: File No. S7-03-13. Money Market Fund Reform. Final Rule.

[9] Potter (2018) states that: "Money-likeness refers to an asset's lack of information sensitivity, such that, when it is used in transactions, economic agents need not worry about its future, at least in the short term and in most states of the world. Because of this, money like assets are usually short-term, liquidity assets with no credit or counterparty risk…" https://econpapers.repec.org/paper/fipfednsp/269.htm.

2.2. Research Question 2

The 2014 ruling from the SEC is very specific about what type of MMFs is required to switch to a floating NAV. The SEC requires a floating NAV for Prime Institutional MMFs. Prime MMFs have two basic categories: (1) institutional and (2) retail. The difference between institutional and retail is the size of the minimum investment, which is typically $1 million or more for institutional funds.[10] With the requirement for a floating NAV applying only to Prime institutional MMF, we re-define our first research question as follows for our second research question.

> Our second research question: Did the new floating NAV regulations for Prime MMFs affect assets for only Prime institutional MMFs or were assets in Prime retail funds also affected?

The SEC comments that: "We anticipate few investors in retail funds will reallocate assets to other investment choices, given that retail funds will continue to offer price stability, yield, and liquidity in all but exceptional circumstances." (SEC final report, p. 600) The changes to rule 2a-7 allow for liquidity fees and redemption gates for all Prime MMFs under clearly defined circumstances, which may create reasons for Prime retail MMF investors to seek other investment alternatives. We provide details on fees and gates below in section 2.5.

2.3. Research Question 3

The SEC raises the question of reallocation of funds. Accordingly, we ask our third research question.

> Our third research question: Assuming assets exit Prime institutional MMFs with the implementation of floating NAV, where does the money go?

The SEC comments on where the funds might go with the following statements. "We believe, and a number of commenters agreed, that some capital will be reallocated from non-government funds, especially institutional Prime funds, to government money market funds." (SEC final rule, p. 624) and "It is important to note that although investors may reallocate assets to government funds, it is also possible and even likely that some will reallocate assets to bank demand deposits and other investment vehicles, which would mitigate the negative impact of the reforms on the short-term funding market in general and bank issuers of short-term papers in particular." (SEC final rule, p. 625)

2.4. Shadow Floating NAV

The SEC posted the final rule implementing, in part, the floating NAV rule for Prime institutional MMFs on July 23, 2014.[11] These rules were effective starting October 14, 2014 with a compliance date starting two years later on October 14, 2016. However, starting on October 14, 2015, MMFs had to begin calculating daily shadow floating NAVs to prepare for the implementation of the new rule.[12] Beginning the calculation and reporting of daily shadow floating NAVs has implications for accounting and tax treatments that may cause investors to begin altering their portfolios with the start of the shadow floating NAV.

The shadow price of a MMF is the true value of a share. Under a fixed $1 NAV, MMFs can round any value of $0.995 and higher up to a $1 NAV. Reporting the shadow (true) price has not been required. Under the floating NAV rules, MMFs have to begin reporting the true value a year in advance of implementing the floating NAV rule, so the true value is referred to as a shadow price. The floating NAV rules require a move to four-decimal prices ($1.0000), which is often referred to as basis point pricing. Accordingly, the shadow prices will be decimal prices.[13]

---

[10] Our data is from iMoneyNet and they label MMFs as institutional or retail. We use their designations. Li, Lui and Musto (2018) note that the 4/16 filing of form N-MFP1 is that first time funds were asked to declare if they are a retail fund. The definition of a retail MMF that goes with the new declaration is a fund that has procedures designed to limit all investors to natural persons.

[11] We remind readers that the changes to rule 2a-7 also include: liquidity fees and redemption gates. (see, footnote 7). We examine the implementation of the floating NAV and leave any analysis of fees and gates for other studies. (See, SEC: Money Market Fund Reform. Final Rule)

12 An Investment Company Institute (ICI) report titled: Money Market Fund Reform—Final Rule Implementation (2015) provides the date for the beginning of the shadow NAV period with the following statement. "Final reforms require all money market funds to disclose six months of daily "shadow" NAVs, calculated to four decimal places, on fund websites by April 14, 2016. To disclose six months of daily shadow NAVs beginning April 14, 2016, funds should calculate and save daily shadow NAVs to four decimal places beginning October 14, 2015."

13 We recognize that our minimum currency increment is one penny. However, institutional MMFs usually purchased and redeemed in large dollar amounts (minimum initial investment in an institutional MMFs is typically $1 million), so four decimal pricing functions well.

Historically, with a fixed $1 NAV, MMFs have been reported on the balance sheet as a cash equivalent. The U.S. GAAP definition of a cash equivalent is: "short-term, highly liquid investments that are readily convertible to known amounts of cash and that are so near their maturity that they present insignificant risk of changes in value because of changes in interest rates".[14] When a MMF is required to use a floating NAV, it does not convert to a known amount of cash. If a MMF is not a cash equivalent for accounting purposes then it becomes an investment held for sale, which requires mark-to-market accounting.

An ICD commentary (July 2013) concludes a floating NAV for MMFs will require mark-to-market accounting.[15] KPMG (2013) suggests that floating NAV MMFs remain cash equivalents under normal market conditions. Accordingly, leading into the rule change there is uncertainty as to how floating NAV MMFs are to be reported on balance sheets.

Regardless of the accounting treatment of floating NAV MMFs, there are tax implications. Under a fixed $1 NAV, an investor buys a share of the MMF for $1 and later redeems that share for $1.[16] However, under a floating NAV, an investor buys a share for $X and redeems the share for $Y and the difference is a taxable gain or loss. This means that every movement of money into and out of a floating NAV MMF must be tracked and priced for tax purposes.[17] Thus, floating NAV MMFs no longer function like a bank account.

During the shadow period, Prime institutional MMFs could switch to a floating NAV, but the SEC expects that funds will delay switching to a floating NAV until the compliance date (October 14, 2016). As an example, Fidelity changed their Prime institutional MMFs from fixed $1 NAV to floating on October 3, 2016. However, the tax implications begin with the beginning of daily shadow prices. If a Prime institutional MMF continues a fixed $1 NAV until the compliance date, then the investors will transact at $1. But, the true value (as reported by the shadow price) may be different from $1 resulting in taxable gains or losses on each transaction.

With the beginning of the shadow period, Prime institutional MMF investors had to make accounting and tax changes to accommodate the floating NAV. These changes are costly and apply separately to each investor. MMFs also had to make changes to accommodate the floating NAV. However, the changes move MMFs to floating prices, which is something the fund families have always done for their other funds. Accordingly, while costly, these changes and costs should be minor relative to changes and costs for the investors. The costs associated with the change to a floating NAV occur with start of shadow pricing, instead of at the date of compliance with the new rule. Consequently, the accounting and tax implications align with the beginning of shadow pricing.

2.5. Additional Changes to Rule 2a-7

The focus of our paper is the change to rule 2a-7 implementing a floating NAV on Prime institutional MMFs. However, along with the change to a floating NAV for Prime institutional MMFs there was a change to allow fees and gates for all non-government MMFs. Also, there was another change to rule 2a-7 in October 2015 with implementation in October 2016 to bring rule 2a-7 in compliance with the Dodd-Frank Act. These changes to rule 2a-7 during our shadow NAV period could be confounding events. These four changes are the only changes to rule 2a-7 during our sample period. In this section we discuss each of these additional changes and explain why they are not confounding events.

As part of the reforms by the SEC to rule 2a-7 all non-government funds were required to be capable of imposing and lifting fees and gates by October 14, 2016. The rule change permitted MMFs to impose a liquidity fee of up to 2% if weekly liquid assets fall below 30% and the board believes it is in the best interest of the fund. These funds will be required to impose a 1% liquidity fee if weekly liquid assets fall below 10% of total assets unless the board believes the fee would be detrimental to the fund. Fees must be removed when a fund's weekly liquid assets reach 30%. Redemption gates are temporary suspensions of redemptions for shareholders. Funds are permitted to place gates if

[14] See, KPMG letter to the SEC. https://www.sec.gov/comments/s7-03-13/s70313-184.pdf
[15] ICD Commentary (July 2013) Operational and Accounting Issues with the Floating NAV and the Impact on Money Market Funds. (icdportal.com)
[16] Earnings are in the form of interest, which is taxed annually.
[17] On July 8, 2016, the IRS issued a ruling on taxes for floating NAV MMFs. The ruling is to simplify the process. The simplified process taxes gains and losses based on the investor's change in aggregate value over the tax period.

weekly liquidity falls below 30% of assets. Orders placed when a gate is imposed are rejected.[18] Gates have a maximum period of 10 days over any 90 day period. The decisions to implement either fees and/or gates are made independently. A fund can impose one or the other or both.

The final rule on fees and gates provides each fund's board the flexibility to impose fees and gates when the board determines it is in the best interest of the fund.[19] This is very different from the requirement of Prime institutional MMFs to implement a floating NAV with shadow NAVs beginning in October 2015. Additionally, implementing fees and gates before the mandate is possible, but this would require a vote by investors which is a costly process that can be avoided by simply waiting until the fees and gates are required in October 2016. The ability to impose fees and gates reduces the money-like feature of Prime MMFs, including Prime retail MMFs, so the imposition of fees and gates should be part of the decision of retail investors as they evaluated the changes in the MMF industry.

There is nothing in the imposition of fees and gates that suggest this imposition is a confounding event for the beginning of floating NAV shadow pricing. Instead, if the beginning of shadow pricing causes movement away from Prime MMFs in October 2015 then the reduction in the money-like feature of MMFs from potential fees and gates starting in October 2016 should be part of the decision process, but not a trigger for the movement.

Rule 2a-7 was modified for credit ratings and diversification in October 2015 with compliance required in October 2016. The October 2015 effective date for these changes aligns with the beginning of shadow floating NAVs and thus creates the potential for a confounding event.

The Dodd-Frank Act requires agencies to review any regulations with respect to credit-worthiness of a money market instrument. To comply with the Dodd-Frank Act, rule 2a-7 was modified to remove the requirement of NRSRO ratings, which was replaced with "an eligible security to be a security with a remaining maturity of 397 calendar days or less that the fund's board of directors (or its delegate) determined presents minimal credit risks."

The rule 2a-7 change includes a statement: "The requirement that a security present minimal credit risks to a money market fund has been part of rule 2a-7 since it was adopted in 1983." (MMF Final Rule, Page 16). Accordingly, we believe that this change has little impact on how funds do business or where investors chose to place their funds.

Additionally, the October 2015 rule change included the elimination of an exclusion to the issuer diversification requirement. The exclusion is for securities subject to a guarantee issued by a non-controlled person. With the change all MMFs that invest in securities subject to a guarantee must "comply with the 10 percent diversification requirement for the guarantor as well as the 5 percent diversification requirement for the issuer." (MMF Final Rule, Page 45) The change simply eliminates the exclusion to the diversification requirement and is not expected to cause funds to close or investors to exit.

We conclude that changes to comply with the Dodd-Frank Act and to eliminate the narrow exclusion from the diversification rules will not change investor preferences nor fund operations. Accordingly, these two changes are not confounding events.

3. Data and Analysis

We analyze holdings of money market funds (MMFs) from 2010 through 2016. We acquire our data from iMoneyNet. iMoneyNet provides two data sets: (1) aggregated data classified by fund type (Government vs. Prime and Institutional vs. Retail) and tax status (Taxable or Tax-exempt) and, (2) individual funds with total assets under management as well as portfolio composition and other fund information, such as, expense ratio and weighted average maturity (WAM).

Our sample is all taxable Master fund MMFs with individual fund level data. We make this choice because part of our analysis is done at the fund level. Therefore, when we analyze data aggregated by fund type, we aggregate fund level data rather than use the aggregate data provided by iMoneyNet. When we do this, we find that our aggregated data is a subset of the iMoneyNet aggregate.

[18] If the investor wants to complete the rejected trade, the trade must be resubmitted once the redemption gate is removed.
[19] The discussion of fees and gates includes if a fund could issue a blanket statement from the board to not allow the imposition of fees and gates. The SEC rejected this suggestion and stated that they prefer that the board must act when choosing to not impose fees and gates.

Figure 1 provides two plots of total assets under management for Prime MMFs. The aggregate data provides the iMoneyNet aggregate while the fund level data provides our aggregate from the individual Prime funds. Figure 1 provides at least two important insights. First, the two plots follow the same basic pattern. Second, the plots start in January of 2010 with our sample aggregate at about 70% of the aggregate total assets from iMoneyNet. The percentage increases through time and is about 75% at the end of 2014, about 78% in October of 2015, and about 79% in October of 2016. Figure 1 suggests that our sample is representative of the population. Accordingly, the remainder of our analysis is conducted using only the fund level data, which we aggregate for some of our analysis.

The primary focus of our study is Prime MMFs. However, we also make use of Government MMFs. Government MMFs hold mainly less risky securities (U.S. Treasuries and Repurchase Agreements (Repos) backed by U.S. Treasuries) and are allowed to continue using the traditional fixed $1 NAV.

iMoneyNet provides aggregate and fund level data for Government MMFs. We use the fund level data and aggregate that data when an aggregate is needed. We repeat the process we used on the Prime MMFs to determine if our sample is representative of the population. We do not present the plots in the interest of brevity. We observe that the plot of our sample total asset under management follows the same pattern as the iMoneyNet aggregate total assets. In January of 2010 our sample total assets is about 63% of the iMoneyNet aggregate, and this percentage holds through October of 2015 (when shadow NAV reporting starts). After October 2015 the sample total assets percentage of the population increases steadily and reaches 88% in October 2016. Our analysis suggests that our sample is representative of the population.

This paper uses weekly data. Our sample period covers 365 weeks from January 2010 through December 2016. There are 267 different Prime MMFs across the sample separated into 134 Prime retail MMFs and 133 Prime institutional MMFs. There are 258 distinct Government MMFs across the sample period.

3.1 Research Question 1

> Our first research question: Did the new floating NAV regulations for Prime MMFs reduce investor appetite for Prime MMF investments?

We begin our analysis with a plot of total assets under management for our sample of Prime MMFs, which appears in Figure 1. Fund level data shows two downturns in total assets. The first is a downturn around June of 2011. It starts a small decline and coincides with the European debt crisis discussed in Chernenko and Sunderam (2014). The second downturn is around October 2015 and is the beginning of a substantial decline in Prime MMF assets under management. This downturn coincides with the beginning of shadow pricing for floating NAVs on Prime MMFs. The decline in Prime institutional MMFs assets under management shown in Figure 1 is consistent with plots provided in Potter (2018) and Li, Lui and Musto (2018).

Table 1 provides summary statistics around the October 2015 decline in total assets of Prime MMFs.[20] Table 1 provides summary statistics at four points in time: (1) July 22, 2014 (the week before the final rule posting date on floating NAV), (2) October 13, 2015 (the week before shadow pricing for NAV begins), (3) October 11, 2016 (the week before the floating NAV compliance date) and, (4) December 13, 2016 (a sample end date that avoids the year-end).

Panel A of Table 1 reports the number of Prime MMFs on our analysis dates. The data show a large decline in the number of Prime MMFs during the shadow NAV period. In fact, over half of the Prime MMFs closed during the year of shadow NAVs. Once the floating NAV is required, only another six Prime MMFs close.

Table 1 reports total assets under management by Prime MMFs. Consistent with Figure 1, a major decline in total assets under management coincides with the shadow NAV period. The statistics show that assets under management decline by 71.5% during this period. This decline has about $825 billion leaving our sample of Prime MMFs. For comparison, Chernenko and Sunderam (2014) document a decline of $180 billion in Prime MMF assets under management around the European sovereign debt crisis. Panel C in Table 1 provides additional summary statistics

[20] We test the change in Prime MMFs' assets under management for structural breaks using both a Supremum Wald test and a structural break test based on Bai and Perron (2003). Both tests find a structural break in the first week of December 2015 with a confidence interval from November 17th to December 15th 2015. This structural break aligns with the beginning of shadow floating NAV for Prime institutional MMFs.

on the change in total assets per fund. Shadow pricing of floating NAVs coincides with a median decline in total assets by fund of 100%, which is consistent with more than half of the Prime MMFs closing. At the 75th percentile, Prime MMFs lost 80% of assets under management.

Our first research question is, did investors leave Prime MMFs with the rule change to a floating NAV? The answer to this question is yes. Investors exited Prime MMFs once (shadow) NAVs started floating. This is an unexpected consequence, as the SEC noted that while a substantial exit is possible, they believed it unlikely.

We conclude that we have empirical support to state that substantial assets left Prime MMFs during the shadow NAV period. We believe that it is an economically significant decline when over 70% of assets under management totaling $825 billion leaves a market. Accordingly, we believe that we have identified an economically significant exit from Prime MMFs. The remainder of the paper is a more detailed analysis of the unexpected consequences of a floating NAV on Prime MMFs.

3.2. Research Question 2

There are a variety of reasons why money market investors might exit Prime MMFs with the regulatory change to a floating NAV. However, the change only applies to Prime institutional MMFs while Prime retail MMFs can continue using the traditional fixed $1 NAV.

> Our second research question: Did the new floating NAV regulations for Prime MMFs affect assets for only Prime institutional MMFs or were assets in Prime retail funds also affected?

Figure 2 plots total assets under management for Prime MMFs separately for institutional MMFs and retails MMFs. Figure 2 provides a number of insights about Prime MMF assets under management. First, prior to a floating NAV, about two-thirds of Prime MMF assets under management were in institutional funds. Second, the plot pattern of institutional total assets is a noisy version of the plot pattern in Figure 1. Finally, Prime retail MMF assets were relatively stable with a small downward drift leading into the floating NAV, but show a break and a substantial decline with the beginning of the shadow NAV. Interestingly, the break in retail total assets is about one month later than the break in institutional total assets. Clearly, the break in retail total assets is not a direct result of the floating NAV because retail MMFs do not have to float. The decline in Prime retail MMF assets under management is an unexpected consequence of the floating NAV as the SEC stated that Prime retail investors were not expected to leave their funds.

Table 2 replicates Table 1 with Prime MMFs divided into institutional and retail. Panel A of Table 2 provides the number of institutional Prime MMFs and retail Prime MMFs and shows that before the SEC ruling that the mix is about 55% institutional and 45% retail. During the shadow NAV period, more than half of each group closed with more retail closings than institutional. The mix changed to about 60% institutional and 40% retail. Again, the decline in the number of retail MMFs cannot be a direct result of a floating NAV and is clearly an unexpected consequence.

Panel B of Table 2 provides total assets under management for each group. Before shadow floating NAVs, institutional Prime MMFs have substantially more assets under management. In fact, the institutional funds hold about 64% of the assets under management, while being about 55% of the number of funds. During the shadow NAV period, institutional Prime MMFs lost almost 81% of their assets under management, while retail Prime MMFs only lost about 55%. By the end of the shadow period, Prime retail MMFs held more assets under management with about 56% of total assets in Prime MMFs. Institutional Prime MMFs continued their decline in total assets following the requirement of floating NAV and lost another 20% of assets under management. Retail Prime MMFs leveled off in the required period and only lost another 4% in assets. Panel C of Table 2 provides additional details on the change in total assets. It shows that the median MMF in both groups closed during the shadow period.

Our second research question: Did the new floating NAV regulations for Prime MMFs reduce investor appetite for only institutional Prime MMFs or did retail investors also exit Prime MMFs? The answer to the second question is that investors left both institutional and retail Prime MMFs. Substantially more assets exited Prime institutional MMFs than exited Prime retail MMFs. However, more than half of the assets under management in Prime retail MMFs left during the shadow period of floating NAV.

Next, we do a detailed analysis of the 44 Prime retail MMFs that closed during the shadow NAV period. We hypothesize that during the shadow period fund families saw a substantial decline in their Prime institutional MMFs and made a joint decision to close all of their Prime MMFs.

Table 3 provides a list of fund families that closed a Prime retail MMF during the shadow NAV period and what happened with the other Prime MMFs in each family. The first column provides the fund family. The families that completely exit Prime MMFs are in bold type. Column 1 has 30 different family names with 17 bolded for the families that exit Prime MMFs. Our hypothesis is that a family closes a Prime retail MMF when it exits Prime funds. Our results show that just over half of the families that close a retail Prime MMF exit Prime MMFs entirely, which does not support our hypothesis. Accordingly, we take a closer look at what the fund families did during the shadow period.

The second column in Table 3 reports the number of Prime institutional MMFs that each family has during the shadow period while column 3 reports the average change in assets under management for these funds. Fourteen of the 30 families do not have an institutional MMF during the period. Eleven of these 14 families exit Prime funds by closing their retail MMFs during the shadow period. The three exceptions are: Deutsche, Putnam and T. Rowe Price. Each keeps a Prime retail MMF open, and Deutsche opens a new Prime institutional MMF once floating NAVs are required. When the average change in assets under management in column 3 is -100% a family has closed it institutional MMFs. Six fund families close their Prime institutional MMFs along with their Prime retail MMFs and exit Prime funds. Ten fund families show a decline of less than -100% in assets under management in their institutional MMFs. Thus, ten families remain in Prime MMFs with six keeping both institutional and retail Prime MMFs.

Our analysis of the fund families suggests that when a family closes a Prime retail MMF it may not be exiting Prime MMFs altogether. Instead, it appears that the fund families are analyzing the changing landscape of Prime MMFs and are making strategic re-alignments, which may lead to completely exiting Prime MMFs.

Above in section 2.5., we discuss that the imposition of liquidity fees and redemption gates were part of the change to rule 2a-7 in July of 2014 along with the requirement of floating NAVs for Prime institutional MMFs. We note that fees and gate reduce the money-like nature of Prime MMFs, but that fees and gates are not imposed until October 2016. Therefore, fees and gates are not a confounding event for the beginning of shadow NAVs in October 2015. Instead, we suggest that fees and gates will reduce the money-like nature of Prime retail MMFs and therefore will be part of the decision process for Prime retail MMF investors as Prime MMFs evolve under the new rules. Our analysis here on the exit of Prime retail MMFs during the shadow NAV period suggests strategic decision making by retail investors instead of a specific trigger for their exit.

3.3. Research Question 3

Our first two research questions examine whether investors exit Prime MMFs when NAVs start floating. The answer to both is yes, so we now move on to our third research question.

> Our third research question: Assuming assets exit Prime institutional MMFs with the implementation of floating NAV, where does the money go?

The SEC believed some capital would be reallocated to government money market funds. However, they also believed that it is possible and even likely that some of the reallocation would be to bank demand deposits and other investment vehicles.

We begin our analysis with a chart of total assets under management. We replicate fund level data from Figure 1 and add Government MMF assets under management to create Figure 3. We create Figure 3 by aggregating our fund level sample data.

Figure 1 contains two breaks in Prime fund assets under management. Figure 3 shows that Government MMFs exhibit the same two breaks, and that at both breaks the Prime MMFs lose assets and the Government MMFs gain assets in a similar amount. Beginning with the shadow floating NAV period Prime MMFs lose about $825 billion in assets under management, while Government MMFs gain roughly the same amount in assets under management. The change in assets under management shown in Figure 3 is consistent with plots provided in Potter (2018) and Li, Lui and Musto (2018).

Table 4 replicates Table 1 to provide details on the changes in Government MMFs. As with Prime MMFs the major changes in Government MMFs occur during the shadow NAV period. Panel A of Table 4 reports the number of Government MMFs. During the shadow period there is a net increase of 37 Government MMFs with 55 new funds opened and 18 funds closed.[21] Panel B of Table 4 reports total assets for Government MMFs. Government MMFs add assets as we move across our four reporting dates. The big jump in assets under management occurs during the shadow period with a 105% increase. Interestingly, after more than doubling assets under management during the shadow NAV period, Government MMFs continue to add assets in the last two months of 2016 during the time when Prime institutional MMFs are required to have a floating NAV and continue to lose assets. Specifically, Government MMFs added another 7.7% in assets under management.

Our third research question: Assuming assets exit Prime institutional MMFs with the implementation of floating NAV, where does the money go? The answer is that it moved to Government MMFs. The move was not a partial move as suggested by the SEC, but instead was a completed move as for every dollar that left Prime MMFs a dollar entered Government MMFs. This is clearly an unexpected consequence of the floating NAV.

This suggests that there is something about the MMF product that MMF investors prefer as other close substitutes exist and typically provide higher yields. The main difference between Government MMFs and the other close substitutes for Prime MMFs is that Government MMFs maintain a $1 fixed NAV.

3.4. Changes in Short-Term Business Debt

Chernenko and Sunderam (2014) note that a reduction in commercial paper (CP) held by Prime MMFs reduces funds available to businesses. Whitledge and Winters (2015) show that large banks buy liquidity from large Prime MMFs. Accordingly, we need to determine if the shift of $825 billion from Prime MMFs to Government MMFs during the shadow period reduces the funds available from MMFs for businesses.

On July 22, 2014, the last weekly observation before the announcement of the rule changes, Government MMFs hold about 85% of their portfolios in Treasury securities with about 55% of those portfolios in Treasury securities and about 30% in repos on Treasury securities. The 85% in Treasuries is consistent with rule 2a-7 prior to the October 2014 rule change (to be implemented in October 2016), which allows Government MMFs to hold up to 20% of their portfolios in non-government assets.

The changes in the 2014 rule reduce the amount of non-government assets held by Government MMFs. Specifically, the new rule limits Government MMFs to holding a maximum 0.5% of assets under management in non-government (i.e., private-issue or business) debt. Table 4 shows $661 billion in total assets in Government MMFs in 2014 prior to the rule change, and at that time our sample held about 15% of their portfolio in private-issue securities, which is about $99 billion. With the rule changes, Government MMFs will need to replace about $100 billion of private-issued securities with government-issued securities.

Next, when funds move from Prime MMFs to Government MMFs the funds will be invested in government securities, so the remaining question is: how much of Prime MMFs is being held in private-issue securities before the switch? On July 22, 2014, Prime MMFs hold a wide spectrum of instruments with the focus on private-issue debt with little invested in government securities. Specifically, Prime MMFs hold about 9% of their assets in Treasury securities and hold 12.6% of their assets in repos. Prime MMF repos need not be on Treasuries; however, if we assume that these are repos on Treasuries then Prime MMFs hold about 21.6% of their assets in Treasuries. This means that 78.4% of their assets under management are in private-issue securities, which will need to switch to government securities as funds move into Government MMFs. We find that $825 billion move from Prime MMFs to Government MMFs, which means that $646.8 billion (78.4% of $825) exit private-issue securities and enter government securities.

Our point is that the access to short-term debt for businesses changes as the result of the floating NAV for MMFs. This does not mean that businesses cannot access debt. It means that they will need to make changes. One change could be lines of credit with banks, but with the floating NAV, banks have less access to funds from MMFs. Chernenko and Sunderam (2014) are concerned with the disruption to business activity from a decline of $180 billion

[21] Li, Lui and Musto (2018) state that many Prime MMFs convert to Government MMFs. Potter (2018) notes that most of the money that left Prime MMFs stayed in the same fund family in a Government MMF. We note, for example, that in March and April 2015 Fidelity created five new Government MMFs that then acquired Fidelity Prime MMFs.

in assets under management around the European sovereign debt crisis. We suggest the same concern around the implementation of the floating NAV, but on a much larger scale. We find that the rule changes to Prime MMFs lead to a decline of $825 billion in assets under management and to a decline of private-issue debt of $746.8 billion (646.8 from Prime MMFs plus $100 billion from Government MMFs) held by MMFs.

3.5 Robustness

3.5.1. Basic Regression: Aggregated Data

We run a series of parsimonious OLS regressions as a robustness check. Each regression represents one of the measures of total assets under management. The dependent variable changes across regressions. The independent variables are dummy variables representing the time periods used in Tables 1, 2, 4, and 5. Our dummy variables are defined as:

Period 1 dummy = 1 from 1/2/2010 through 7/22/2014 and 0 otherwise,

Period 2 dummy = 1 from 7/29/2014 through 10/13/2015 and 0 otherwise,

Period 3 dummy = 1 from 10/20/2015 through 10/11/2016 and 0 otherwise, and

Period 4 dummy = 1 from 10/18/2016 through 12/27/2016 and 0 otherwise.

Our OLS regressions omit the Period 1 dummy and include a constant.

The regressions in Table 5 represent Figure 1, Figure 2, and Figure 3. The dependent variable for each regression is the percent change in total assets from week to week. Column 1 of Table 5 is all Prime funds using the individual fund aggregated data from Figure 1. There are two significant parameter estimates: period 3 and period 4. Both significant parameters are negative, which confirms our earlier analysis we show in Figure 1.

After October 2015, asset levels, on average, decreased for Prime funds. However, after October 2015 only Prime institutional funds are required to report floating NAVs. We separate Prime funds into retail and institutional funds. Column 2 of Table 5 reports results for Prime retail funds. Counter to the results on all Prime MMFs, the parameter estimates for period 3 (shadow floating NAV) and period 4 (required floating NAV) are statistically insignificant. Conversely, in column 3 of Table 5, Prime institutional funds show a significant decrease in asset levels during periods 3 and 4. This is consistent with previous results for research questions 1 and 2. Assets moved out of Prime institutional funds that required the newly calculated floating NAV. The regression results on Prime retail MMFs do not support a statistically significant decline in assets during period 3 (shadow floating NAV).

The last column of Table 5 addresses research question 3: "where do the funds move to?" The dependent variable is the weekly change in assets under management in Government MMFs. There is a significant increase in Government MMF assets during period 3 (shadow NAV) when billions of dollars are leaving Prime institutional funds. There are no other significant parameter estimates for Government MMFs. These results are consistent with Figure 3.

3.5.2. Yield Spreads and Expenses

We show a substantial decline in assets under management by Prime institutional MMFs with the decline beginning, as MMFs are required to report shadow NAVs. We also show the money that exits Prime MMFs enters Government MMFs. Our results suggest that the regulatory change caused the exit. However, the primary difference between Prime and Government MMFs is that Prime MMFs take more risk and provide a higher yield. If the yield spread declines as the shadow NAV period begins, then an alternative explanation for the reallocation of funds would exist. Accordingly, we examine the average (gross) spreads between Prime and Government MMFs.

Cipriani and La Spada (2018) and Baghai, Giannetti and Jäger (2018) state that floating NAVs make MMFs riskier. So, we need to determine if Prime institutional MMFs can switch to floating NAVs during the shadow NAV period. The SEC provides some guidance here with the following statements. First, "We are providing a two-year compliance date (as proposed) for money market funds to implement the floating NAV reform. A long compliance period will give more time for funds to implement any needed changes to their investment policies and train staff, and also will

provide more time for investors to analyze their cash management strategies." (SEC final rule, p.199) Second, "We recognize that, although money market funds may comply with the rule amendments at any time between the effective date and the compliance date, in practice, money market funds may implement amendments relating to floating NAV near the end of the transition period." (SEC final rule, p. 201)

The SEC believes that early changes to the floating NAV are unlikely. As an example, consistent with the SEC's position, we find that Fidelity changed their Prime institutional MMFs from fixed $1 NAV to floating on October 3, 2016. With most MMFs likely to wait to change to a floating NAV until near the compliance date, we believe that it is reasonable to assume no change in risk associated with floating NAVs until the compliance date, which allows us to proceed with our analysis of the average spreads between Prime and Government MMFs.

Figure 4 provides a time series plot of the spread between the average weekly yield on Prime MMFs and the average weekly yield on Government MMFs. The plot provides several important points. First, from the beginning of the sample to October of 2014, the average spread is about 12 basis points (bps) with a minimum of 9 bps and a maximum of 17 bps. Second, during most of the shadow NAV period (October 2015 through September 2016) the average spread is about 15 basis points (bps) with a minimum of 11 bps and a maximum of 18 bps. Third, following the implementation of the floating NAV on October 14, 2016 spreads jumped up 3 bps and continued a rapid increase through the end of our sample period.

The spread during most of the shadow NAV period stayed in the same basic range as the spread prior to the shadow period. This suggests that a spread decline is not the cause of the reallocation of assets under management. Once the floating NAV is required, the spread increases substantially with the increased spreads driven by an increase in the yield on the Prime MMFs.[22] This result is consistent with an increase in risk from the floating NAV.

Table 6 shows the results of two regressions we run using the dependent variable of Prime AUM/Government AUM. The independent variable *SPREAD* is the difference between average Prime yield and average Government yield. The independent variable *SHADOW* is a dummy variable taking the value of one after the shadow NAV pricing came into effect (October 14, 2015). *SHADOW*SPREAD* is an interaction of the two variables. Historically, Prime investors seek higher yields. However, Table 6 shows that the ratio of Prime/Government assets declines as the *SPREAD* between average Prime yields and average Government yields increases. The ratio also declines during the *SHADOW* period. In the second column, we see that most of the decline in the ratio comes as the spread increases after shadow pricing is introduced. This finding suggests that relative yields are not driving the exodus from Prime to Government funds. It is negatively correlated with the spread, which suggests Prime funds were paying higher yields relative to Government funds and capital was still flowing out of Prime funds and into Government funds.

MMFs investors earn fund yield less fund expenses. Our analysis of yields provides little to explain why investors exited Prime MMFs during the shadow period in favor of Government MMFs. However, complying with the shadow NAV process and other adjustments for a daily floating NAV is costly, so Prime MMF investors could see their expenses rise relative to Government MMFs. Figure 5 plots average expense ratios for Prime and Government MMFs. The difference (Prime minus Government) in average expense ratios is relatively constant at about 15 basis points leading into the beginning of the shadow floating NAV period. During the shadow floating NAV period expense ratios increase for both Prime and Government MMFs. However, Government MMF expense ratios increase more than Prime MMFs expense ratios with the difference decreasing to about 7.5 basis points.

The plots in Figures 4 and 5 show that Prime MMF yield spreads increase while their expense ratio spread decreases relative Government MMFs during the shadow floating NAV period. This suggests that investors were not increasing their returns with a move from Prime to Government MMFs.

Additionally, it is possible that macro-economic variables could explain fund flows. Any time the economy turns, investors re-evaluate their money market investments. However, looking at GDP, consumer confidence, and the S&P index there is no reason to believe a major shift in assets from Prime to Government should occur due to macro-economic conditions during our sample period.

[22] The SEC final report discussed that a relocation of funds to Government MMFs could reduce their yields. The yields on these funds did not decrease during either the shadow floating NAV period or the floating NAV period.

3.5.3. Regressions with Control Variables: Fund Level Data

The results in Table 5 show that, in aggregate, funds moved from Prime MMFs to Government MMFs during the shadow floating NAV period. Figures 4 and 5 show that, in aggregate, the move to Government MMFs did not increase earnings for investors. Aggregated data conceals information from individual MMFs. Accordingly, we now estimate our dummy variable regressions with fund level data with the addition of some control variables. We report the regression results in Table 7.

The dependent variable is the weekly percent change in assets under management at the fund level. We report four sets of regression results in Table 7. The sets vary by the type of MMF analyzed and are described in the column headings. The independent variables include the time period dummy variables from the previous regressions and four control variables. The first control variable is for fund expenses *(EXPENSE)*. There is little change in the fund expense ratio from week to week, so we use a dummy variable that equals 1 when a MMFs is waiving its expense fee and 0 when it is charging for expenses. The second control variable is the weekly change (first difference) in the annualized fund yield *(YIELD)*. The third control variable is the weekly percent change in fund weighted average maturity *(WAM)*. The final control variable is the weekly change (first difference) in the percentage of the fund held in risky assets *(RISKY)*. We define risky assets as: commercial paper (CP), asset-back commercial paper (ABCP) and floating rate notes (FRNs).

Period 3 is the shadow floating NAV period. The results we report in Table 7 show a statistically significant and negative parameter estimate during period 3 for Prime MMFs. The period 3 parameter estimate for Prime retail MMFs is not statistically significant, while the period 3 parameter estimate for Prime institutional MMFs is significant and negative. Money left Prime institutional MMFs during the shadow period. The period 3 parameter estimate for Government MMFs is significant and positive. Thus, the results, from individual fund level data, continue to suggest that as money left Prime MMFs during the shadow floating NAV period, it arrived in Government MMFs.

The control variables provide some interesting insights. First, waiving fees is not significant. However, Figure 5 shows that average expense ratios are less than 4.5 basis points across our sample. Accordingly, MMF fees are minimal so waiving fees does not appear to change the flow of funds. Second, increases in yields are significant and positively relate to changes in assets under management for Prime institutional MMFs, but are significant and negatively related to changes in assets under management for Prime retail MMFs. Historically, institutional MMF investors have been sensitive to changes in yield. Third, a change in WAM is significant and negatively relates to a change in assets under management for both institutional and retail Prime MMFs. An increase in WAM increases risk and our results suggest that Prime investors exit when this happens. A change in WAM is insignificant for Government MMFs. Finally, an increase in risky assets is significantly and negatively related to a change in assets under management for all types MMFs. Historically, MMF investors have demanded low credit risk and continue the aversion to credit risk during our sample period.

Overall, our results from the robustness tests confirm findings from the previous figures and tables. Addressing the research questions on fund groups: investors left Prime funds, investors left Prime institutional funds more significantly, and funds shifted from Prime to Government funds. The movement of funds occurred primarily during the shadow floating NAV period, and our analysis suggests that the movement of funds is related to the shadow NAV and not to alternative explanations.

4. Conclusion

From the inception of MMFs in 1970 all MMFs reported a fixed $1 NAV. However, on July 23, 2014, the Securities and Exchange Commission (SEC) finalized new regulations for MMFs that requires Prime institutional MMFs to report floating Net Asset Values (NAVs). With its final regulations the SEC provides an economic discussion of possible impacts and concludes: (1) some investors may leave the floating NAV MMFs, but the exit should not be substantial, (2) Prime retail MMFs should be unaffected because they can retain the fixed $1 NAV, and (3) some of the reallocation may go to Government MMFs, but bank deposits and other alternatives should receive a substantial portion of the reallocation. In other words, the SEC does not expect a significant impact on the MMF industry from requiring floating NAVs for Prime institutional funds.

We find that over 70% of the asset under management in Prime MMFs left Prime funds with over half the Prime funds closing. We find that the exits were not confined to Prime institutional MMFs. Instead, more than half of the Prime retail MMFs closed with more than 50% of the assets under management exiting these funds. Finally, we find that for every dollar that exited Prime MMFs a dollar was added to Government MMFs. Based on the SEC economic discussions, these results all represent unexpected consequences.

Following the financial crisis there was a push for improved financial regulations. Change for change's sake is never a good idea. The change to a floating NAV virtually eliminated a market (Prime MMFs) and reallocated over a $1 trillion ($825 billion in our sample). About 80% of the reallocation removed funds from the market for short-term business debt. Ultimately, institutional MMF investors have choices and they chose the one investment alternative that can still provide a fixed $1 NAV and retail investors followed them.

References

Acharya, V. V., & Mora, N., 2015. A crisis of banks as liquidity providers. The Journal of Finance, 70(1), 1-43.

Akay, O., Griffiths, M. D., Kotomin, V., & Winters, D. B., 2013. A look inside AMLF: What traded and who benefited. Journal of Banking and Finance, 37, 1643-1657.

Akay, O., Griffiths, M. D., & Winters D. B., 2014. Reserve Primary: Fools rush in where wise men fear to tread. Journal of Investment Management, 12, 1-17.

Akay, O., Griffiths, M. D., & Winters D. B., 2015. Changing rule 2a-7 and the risk profiles of money market mutual funds. Journal of Applied Finance, 25, 6-20.

Allen, K. D., Cashman, G. D., & Winters, D. B., 2016. How informative is floating NAV when securities trade infrequently? Financial Review, 51(1), 69-82.

Allen, K. D., Hein, S.E., & Whitledge, M. D., 2017. The evolution of the Federal Reserve's Term Auction Facility and FDIC-insured bank utilization. Journal of Financial Stability, 31, 154-166.

Baghai, R., Giannetti, M., & Jäger, I., 2018. Liability Structure and Risk-Taking: Evidence from the Money Market Fund Industry. Working Paper.

Bai, J., & Perron, P., 2003. Computation and analysis of multiple structural change models. Journal of applied econometrics, 18(1), 1-22.

Blau, B. M., Hein, S. E., & Whitby, R. J., 2016. The Financial Impact of Lender-of-Last-Resort Borrowing from the Federal Reserve during the Financial Crisis. Journal of Financial Research, 39(2), 179-206.

Chernenko, S., & Sunderam, A., 2014. Frictions in shadow banking: Evidence from the lending behavior of money market mutual funds. The Review of Financial Studies, 27(6), 1717-1750.

Cipriani, M., & La Spada, G., 2018. Investors' appetite for money-like assets: the money market fund industry after the 2014 regulatory reform. Working Paper.

Cyree, K. B., Griffiths, M. D., & Winters, D. B., 2017. Implications of a TAF Program Stigma for Lenders: The Case of Publicly Traded Banks versus Privately Held Banks. Review of Quantitative Finance and Accounting, 49, 545-567.

Fairbanks, J.C., Griffiths, M. D., & Winters, D. B., 2018. Financial Crisis Solutions in the Commercial Paper Market: An Analysis of the CPFF and the TLGP. Managerial Finance, forthcoming.

Hanson, S. G., Scharfstein, D. S., & Sunderam, A., 2015. An evaluation of money market fund reform proposals. IMF Economic Review, 63(4), 984-1023.

Li, S., Liu, W., and Musto, D., 2018. The effect of NAV flotation on the management of Prime money market portfolios. DERA working paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3303388

Potter, S., 2018 The supply of money-like assets. Remarks for American Economic Association Panel Session. https://econpapers.repec.org/paper/fipfednsp/269.htm

Price, C. B., 2015. What Money Market Mutual Fund Reform Means for Banks and Money Market Deposit Accounts. NC Banking Inst., 19, 243.

Strahan, P. E., & Tanyeri, B. 2015. Once burned, twice shy: Money market fund responses to a systemic liquidity shock. Journal of Financial and Quantitative Analysis, 50(1-2), 119-144.

Taylor, J. B., & Williams, J. C. 2009. A black swan in the money market. American Economic Journal: Macroeconomics, 1(1), 58-83.

Whitledge, M. D., & Winters, D. B. 2015. The price of liquidity: CD rates charged by money market funds. Journal of Banking & Finance, 54, 104-114.

Figure 1

This figure shows a time series of the aggregate and fund level Prime Money Market Fund total assets under management.

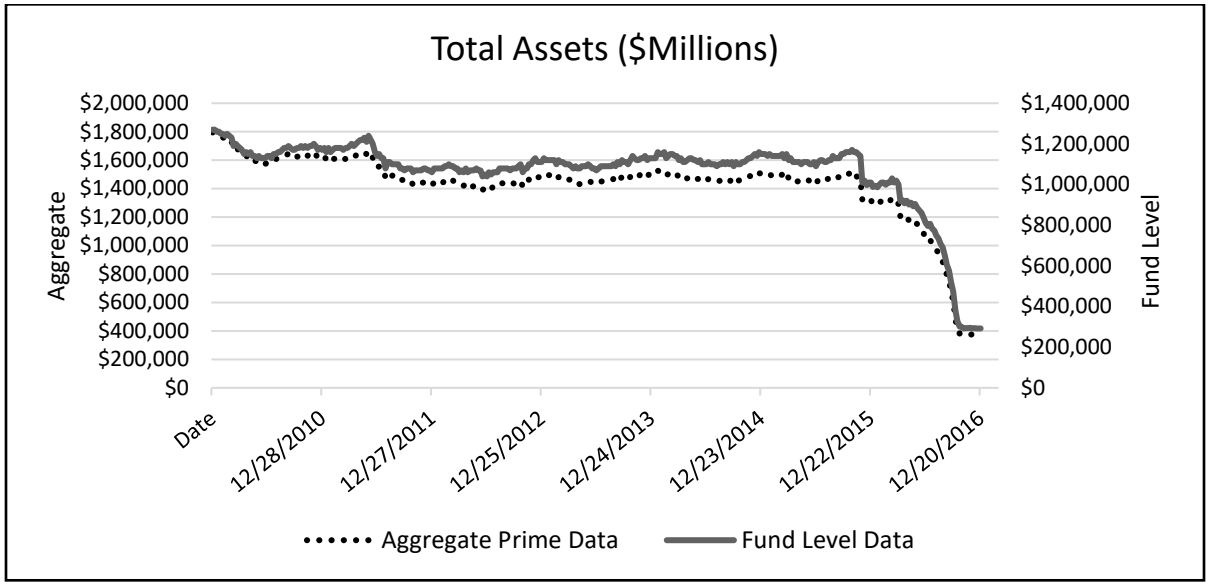

Figure 2

This figure shows time series assets in our data set. We separate Prime Retail and Prime Institutional MMFs.

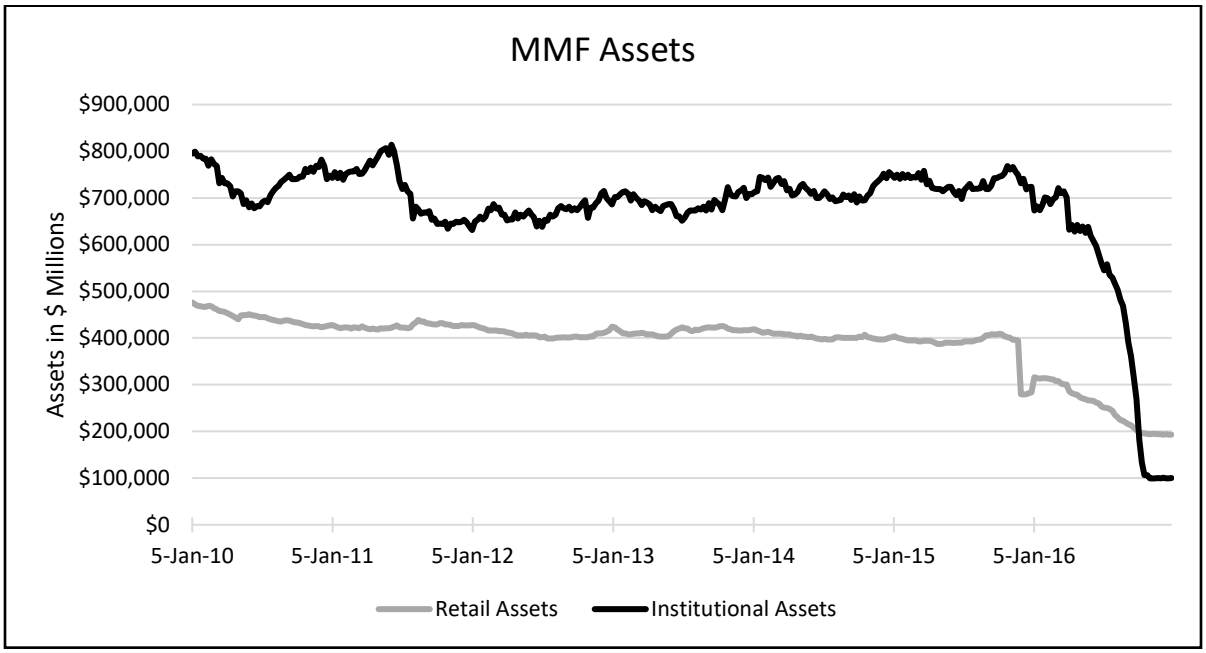

Figure 3

This figure shows a time series of aggregate assets of Prime MMFs and Government MMFs.

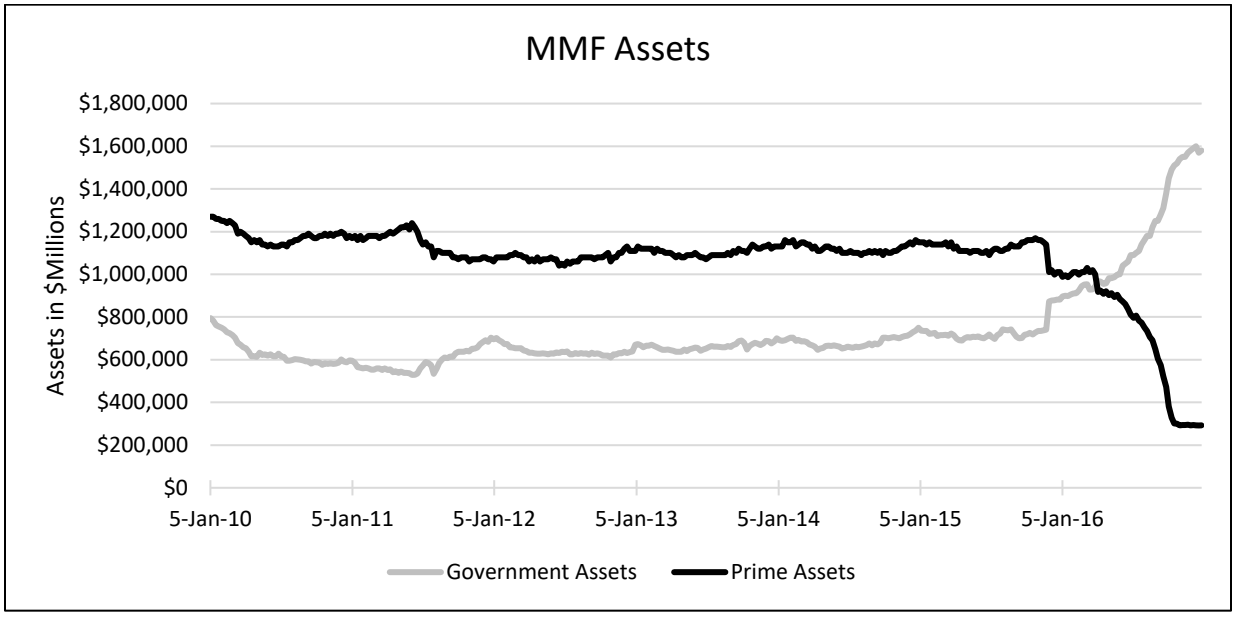

Figure 4

This figure shows a time series of the spread between the average weekly yield on Prime MMFs and Government MMFs. The Figure is in basis points.

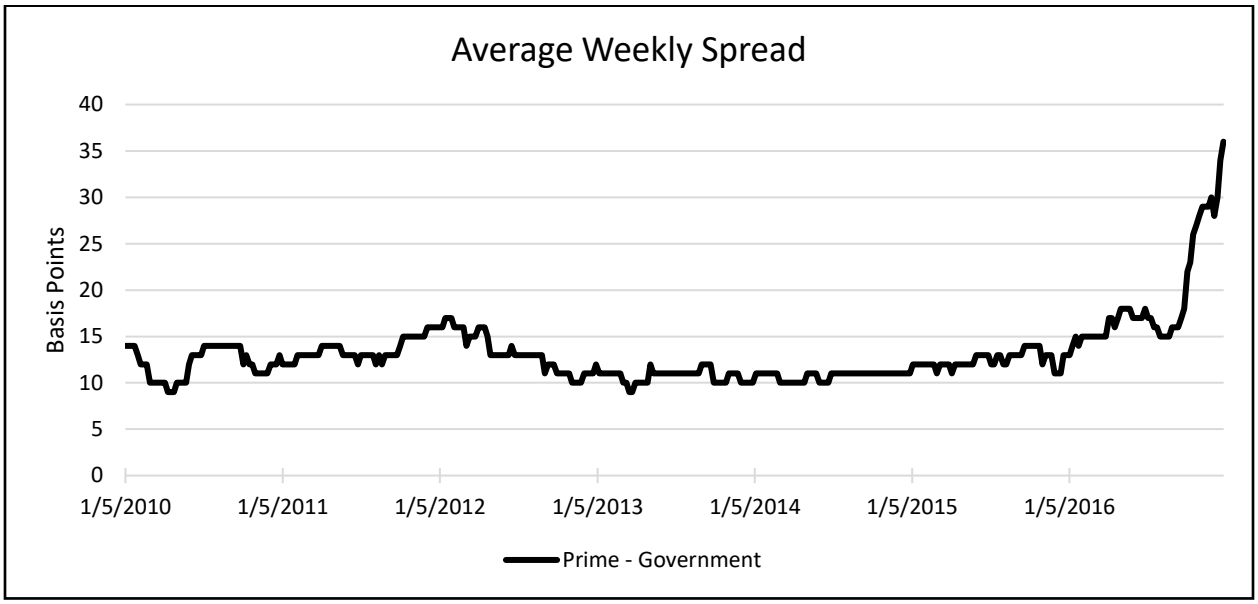

Figure 5

This figure shows a time series of the average weekly expense ratios for prime MMFs and government MMFs, respectively. Prime expense ratios are in black. Government expense ratios are in grey. Expense ratios are shown as percentages.

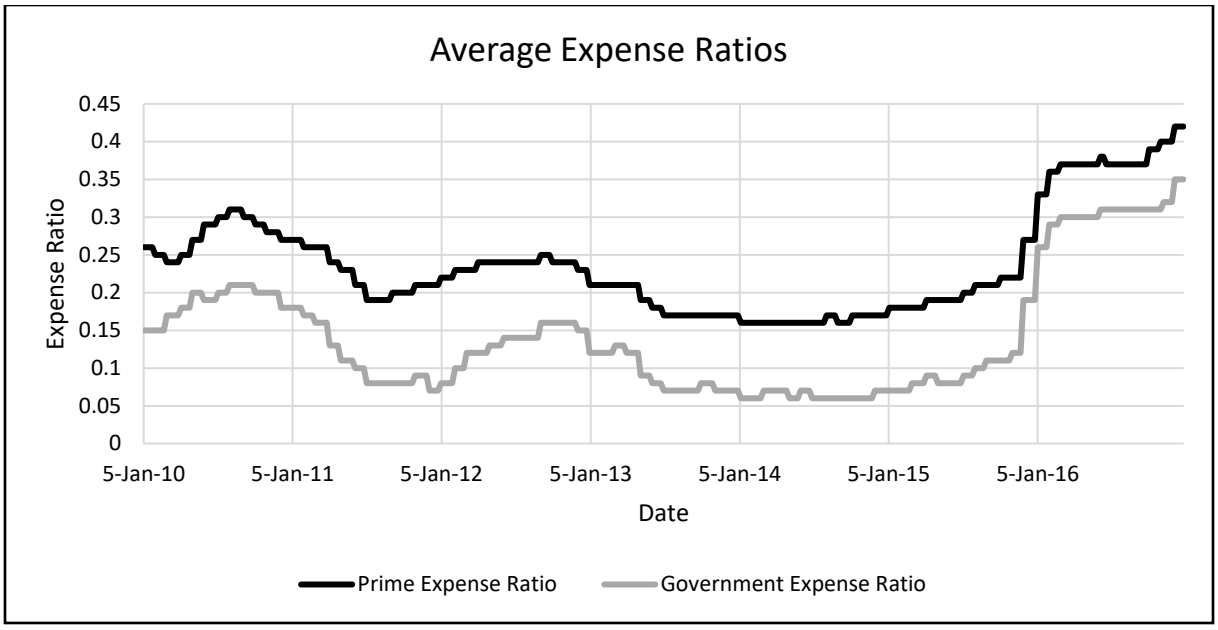

Table 1

This table shows sample descriptive statistics for Prime MMFs. Each column is a significant week and event for the floating NAV regulations. Panel A shows the number of funds at each date, the number of new funds since the previous date, and the number of closed funds from the previous date. Panel B shows the totals assets at each date and the change in total assets from the previous date. Panel C shows the change in total assets for the average fund (mean), median funds, 75th percentile fund, and 25th percentile fund.

Panel A: Number of MMFs

	7/22/2014	**10/13/2015**	**10/11/2016**	**12/13/2016**
Prime MMFs				
Total # of funds	166	154	***77***	71
# of new funds from previous date		0	***8***	0
# of closed funds from previous date		12	***85***	6

Panel B: Total Assets

	7/22/2014	**10/13/2015**	**10/11/2016**	**12/13/2016**
Prime MMFs				
Total Assets held ($ millions)	1,095,099	1,155,147	***329,155***	293,196
Change at Total Assets		5.5%	***-71.5%***	-10.9%

Panel C: Change in MMFs total assets

Prime MMF change in assets	**7/22/2014**	**10/13/2015**	**10/11/2016**	**12/13/2016**
Mean		13%	***-81%***	-19%
Median		-1%	***-100%***	-6%
75th percentile		10%	***-80%***	0%
25th percentile		-17%	***-100%***	-37%

Table 2

This table shows the sample descriptive statistics for Prime MMFs separated by Institutional and Retail funds. Each column is a significant week and event for the floating NAV regulations. Panel A, separated by retail and institutional funds, shows the number of funds at each date, the number of new funds since the previous date, and the number of closed funds from the previous date. Panel B, separated by retail and institutional funds, shows the totals assets at each date and the change in total assets from the previous date. Panel C, separated by retail and institutional funds, shows the change in total assets for the average fund (mean), median funds, 75th percentile fund, and 25th percentile fund.

Panel A: Number of MMFs

	7/22/2014	**10/13/2015**	**10/11/2016**	**12/13/2016**
Institutional				
Total # of funds	92	83	***45***	41
# of new funds from previous date		0	***4***	2
# of closed funds from previous date		9	***42***	6
Retail				
Total # of funds	74	71	***31***	29
# of new funds from previous date		0	***4***	0
# of closed funds from previous date		3	***44***	2

Panel B: Total Assets

	7/22/2014	**10/13/2015**	**10/11/2016**	**12/13/2016**
Institutional				
Total Assets held ($ millions)	696,223	747,451	***145,204***	115,595
Change at Total Assets		7.4%	***-80.6%***	-20.4%
Retail				
Total Assets held ($ millions)	398,865	407,696	***183,950***	177,601
Change at Total Assets		2.2%	***-54.9%***	-3.5%

Panel C: Change in MMFs total assets

Institutional	**7/22/2014**	**10/13/2015**	**10/11/2016**	**12/13/2016**
Mean		14%	***-85%***	-29%
Median		-1%	***-100%***	-21%
75th percentile		14%	***-84%***	-5%
25th percentile		-22%	***-100%***	-52%
Retail				
Mean		13%	***-76%***	-3%
Median		-1%	***-100%***	-1%
75th percentile		8%	***-37%***	6%
25th percentile		-14%	***-100%***	-6%

Table 3

This table shows Prime Retail MMFs closed during the shadow period and other family activity. The first column identifies the fund family name and the number of retail MMFs that were closed during the shadow period. The second column gives the number of institutional funds. Column 3 shows the overall change in assets under management for institutional funds. Column 4 gives the number of surviving retail funds. The last column gives the overall change in assets under management for the surviving retail funds.

Family Name (number of retail MMFs closed) [a]	Number of Institutional MMFs	Change in Assets under Management for Institutional MMFs	Number of surviving Retail MMFs	Change in Assets under Management for Surviving Retail MMFs
USAAllianz	0		0	
American	0		0	
Blackrock (4)	9	-69%	0	
Columbia (2)	0		0	
Delaware	0		0	
Deutsche	0 [b]		1	-27%
Dreyfus	9	-85%	1	-79%
Federated (2)	6	-82%	1	-40%
Fidelity (2)	5	-91%	1	-21%
Forest	0		0	
Franklin	0		0	
Huntington	0		0	
Invesco	3	-84%	0	
John Hancock	0		0	
MFS	0		0	
Morgan Stanley (3)	3	-91%	1	-97%
Nationwide	1	-100%	0	
Oppenheimer (3)	1	-100%	0	
UBS (4)	1	-86%	0	
Prudential	1	-100%	0	
Putman	0		1	-37%
SEI	2	-100%	0	
SSgA	5	-84%	0	
Schwab	2 [b]	-30%	4	-11%
T Rowe Price	0		1	-57%
Thrivent	1	-100%	0	
Transamerica	0		0	
Voya (2)	1	-100%	0	
Wells Fargo	2	-85%	1	-92%
William Blair	0		0	

[a] Family names that are **Bold** closed all of their Prime MMFs during the shadow NAV period.

[b] Opened a new Prime Institutional MMFs after floating NAV is required.

Table 4

This table gives sample descriptive statistics for Government Money Market Funds. Each column is a significant week and event for the floating NAV regulations. Panel A shows the number of funds at each date, the number of new funds since the previous date, and the number of closed funds from the previous date. Panel B shows the totals assets at each date and the change in total assets from the previous date. Panel C shows the change in total assets for the average fund (mean), median funds, 75th percentile fund, and 25th percentile fund.

Panel A: Number of MMFs

	7/22/2014	10/13/2015	10/11/2016	12/13/2016
Government MMFs				
Total # of funds	144	134	***171***	178
# of new funds from previous date		4	***55***	8
# of close funds from previous date		14	***18***	1

Panel B: Total Assets

	7/22/2014	10/13/2015	10/11/2016	12/13/2016
Government MMFs				
Total Assets held ($ million)	661,538	725,334	***1,490,176***	1,604,268
Change at Total Assets		9.6%	***105.4%***	7.7%

Panel C : Change in Total Assets

Government MMF change in holdings	**7/22/2014**	**10/13/2015**	**10/11/2016**	**12/13/2016**
Mean		20%	***871%***	8%
Median		-1%	***23%***	3%
75th percentile		23%	***122%***	11%
25th percentile		-17%	***-17%***	-3%

Table 5

This table shows results of the OLS regressions for Prime, Prime Retail, Prime Institutional, and Government money market funds. The dependent variable for each regression is the weekly percent change in total assets. The independent variables are dummy variables with the value of 1 if the week is during each period. Period 2 = 1 if the week occurs after July 22, 2014 and by October 13, 2015. Period 3 = 1 if the week occurs after October 13, 2015 and by October 11, 2016. Period 4 = 1 if the week occurs after October 11, 2016. Each column is representative of an earlier figure. Column 1 represents lines from Figures 1 and 3 (Prime). Column 2 represents a line from Figure 2 (Prime Retail). Column 3 represents a line from Figure 2 (Prime Institutional). Column 4 represents a line from Figure 3 (Government Funds). P-values are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

	Prime	Prime Retail	Prime Institutional	Government
VARIABLES	Figure 1	Figure 2	Figure 2	Figure 3
Period 2	0.00225	0.00330***	0.00113	0.0315
	(0.150)	(0.007)	(0.677)	(0.293)
Period 3	-0.00689***	0.00123	-0.0136***	0.0910***
	(0.000)	(0.427)	(0.000)	(0.004)
Period 4	-0.0131**	-0.00161	-0.0260***	-0.00564
	(0.012)	(0.664)	(0.009)	(0.924)
Constant	0.000303	-0.00251***	0.00286**	0.0149
	(0.652)	(0.000)	(0.016)	(0.258)
Observations	63,149	29,604	33,545	55,372
R-squared	0.000	0.000	0.001	0.000

Table 6

This table represents a weekly OLS regression using the dependent variable as the ratio of prime assets under management divided by the government assets under management. The independent variable SPREAD is the difference between average prime fund yields and average government fund yields. The SHADOW variable is a dummy variable with the value of one for weeks after October 14, 2015. The SHADOW*SPREAD variable is an interaction of the two. P-values are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)
SPREAD	-3.787***	0.925
	(0.000)	(0.136)
SHADOW	-0.710***	0.198*
	(0.000)	(0.062)
*SHADOW*SPREAD*		-6.587***
		(0.000)
Constant	2.180***	1.609***
	(0.000)	(0.000)
Observations	365	365
R-squared	0.772	0.814

Table 7

This table is a duplication of Table 5 with added control variables. Table 7 shows results for OLS regressions for Prime, Prime Retail, Prime Institutional, and Government money market funds. The dependent variable for each regression is the weekly percent change in total assets. The independent variables are dummy variables with the value of 1 if the week is during each period. Period 2 = 1 if the week occurs after July 22, 2014 and by October 13, 2015. Period 3 = 1 if the week occurs after October 13, 2015 and by October 11, 2016. Period 4 = 1 if the week occurs after October 11, 2016. Additional control variables *EXPENSE*, *YIELD*, *WAM*, and *RISKY*. EXPENSE is a dummy variable equal to 1 if the fund reduces or eliminates fund expenses. YIELD is the 7 day annualized gross yield. WAM is the weighted average maturity of the fund. RISKY represents to percentage of the fund held in risky assets defined as: Asset backed commercial paper, commercial paper, and floating rate notes. Each column is representative of an earlier figure. Column 1 represents lines from Figures 1 and 3 (Prime). Column 2 represents a line from Figure 2 (Prime Retail). Column 3 represents a line from Figure 2 (Prime Institutional). Column 4 represents a line from Figure 3 (Government Funds). P-values are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)
	Prime	Prime Retail	Prime Institutional	Government
EXPENSE	-0.000870	0.000188	-0.00147	0.0327
	(0.535)	(0.860)	(0.550)	(0.252)
YIELD	-0.0351	-0.623***	0.151**	-0.0928
	(0.505)	(0.000)	(0.049)	(0.935)
WAM	-0.0297***	-0.0290***	-0.0292***	-0.0183
	(0.000)	(0.000)	(0.000)	(0.522)
RISKY	-0.00187***	-0.000894***	-0.00268***	-0.0118*
	(0.000)	(0.000)	(0.000)	(0.076)
Period 2	0.00207	0.00325***	0.000689	0.0329
	(0.186)	(0.007)	(0.800)	(0.273)
Period 3	-0.00792***	0.00207	-0.0159***	0.0932***
	(0.000)	(0.181)	(0.000)	(0.003)
Period 4	-0.00807	0.00893**	-0.0206**	-0.00157
	(0.129)	(0.019)	(0.041)	(0.979)
Constant	0.00103	-0.00269***	0.00414*	-0.0127
	(0.434)	(0.007)	(0.072)	(0.644)
Observations	63,029	29,528	33,501	55,272
R-squared	0.004	0.010	0.005	0.000