The Stability of Money Market Mutual Funds: The Effect of the 2010 Amendments to Rule 2A-7*

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Abstract

This paper identifies a large amount of heterogeneity in the shareholders of self-identified "institutional" shareclasses of prime money market mutual funds (MMMFs), ranging from individuals within retirement plans to sophisticated financial institutions. Using a new dataset of shareholder-types, we provide insight into the stability of the MMMF industry after the 2010 Amendments, and also following implementation of the 2014 Amendments, which will completely segregate into separate funds institutional and retail investors. We find a concentration of *true* institutions in a minority of funds, and show that higher ownership by true institutions is related to greater flow volatility, redemption-risk during stress events, ownership of bank-issued securities, and incentive to differentiate on yield. It is perhaps for these reasons that these funds also maintain substantially higher demand for liquid assets. Our results indicate that the 2014 Amendments will help protect retail investors from the trading behavior of institutional investors. However, we also highlight possible unintended consequences once this buffer of retail "slow money" is eliminated.

Key words: Money market mutual funds; financial crisis, money fund crisis, breaking the buck, quantile regression.

JEL codes: G01, G21, G23

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1. Introduction

During the week of September 15, 2008, the Reserve Primary Fund "broke the buck," that is, marked the net asset value of the fund below $1 per share, following the failure of Lehman Brothers on September 14. This event was the first time a large money market mutual fund (MMMF) failed to return a fixed equity value of $1.00 per share to investors on demand.[1] During the ensuing days, investors redeemed shares from prime MMMFs, propagating fears of widespread bank-like runs from that entire category of funds.[2] Market participants feared that buyers for commercial paper may disappear–thus, spreading the crisis to the industrial and commercial banking sectors. In response, the U.S. Treasury stepped in by week's end to guarantee (up to a limit) the investments of shareholders in money market funds. Over the following month, further support was provided by the Federal Reserve, both for MMMFs and for commercial paper markets.

During these events, institutional shareclasses of MMMFs were substantially more likely to experience large-scale redemptions than retail shareclasses. From this observation, it has been widely assumed that "institutional" investors are more likely to run from MMMFs during a stress event (e.g., Kacperczyk and Schnabl, 2014; Scharfstein, 2012). This has been attributed to several factors. First, some regulators and academics (e.g., FSOC, 2012; IOSCO, 2012; McCabe, 2010) contend that these investors may have a greater understanding of the negative externalities that their actions pose on other investors. According to this view, sophisticated investors may better grasp that they can exit a fund at a price that could potentially exploit other investors who do not redeem as quickly should liquidity dry up. Also, institutional shareholders may have greater capital at risk and may better monitor their funds' portfolio holdings (Schapiro, 2012). Nevertheless, prior

[1] Money market mutual funds (MMFs) are mutual funds that may only invest in short-term high quality money market instruments. With assets totaling $2.6 trillion, MMFs are an important investment and cash management vehicle for U.S. corporations and individuals. Moreover, they are an important component of the U.S. money market, holding 36 percent of commercial paper, 19 percent of repurchase agreements, and 53 percent of U.S. Treasury and agency securities as of March 2013.

[2] This paper focuses on prime MMFs, which is the category most affected by the money fund crisis of 2008. Prime funds invest in a range of money market securities, including commercial paper, bank CDs, medium-term and floating-rate notes, repurchase agreements (repos) and Treasury and agency securities. Government MMFs typically invest only in Treasury or agency securities or repos backed by Treasuries and agencies.

to our study, it has been impossible to precisely test this assumption due to a lack of information about the types of shareholders in individual MMMFs.

This paper employs a unique dataset on the characteristics of MMMF investors to provide the most accurate assessment to date of how these investor characteristics impact (1) fund flows during market stress events, (2) flow volatility, (3) portfolio holdings, and (4) competition for assets across prime MMMFs. This assessment is valuable since, as we will show, prime funds and shareclasses have a great deal of variation in their shareholder bases. If we define "true institutional" accounts as those in which natural persons do not represent the beneficial ownership interest of the account, then we estimate that 27% of prime institutional shareclasses have less than 5% true institutional investors, while 17% of prime institutional shareclasses have at least 95% true institutional investors, by dollar value. Such heterogeneity is not captured in prior research.

An assessment of how investor characteristics impact fund characteristics might help regulators. In response to events during the 2008 financial crisis. the Securities and Exchange Commission (SEC) adopted amendments to Rule 2a-7 of the Investment Company Act of 1940 to boost the resilience of MMMFs to shocks. The amendments, which went into effect on May 5, 2010, impose several new requirements on MMMFs. These amendments include requirements, such as limits on less-liquid portfolio holdings.

Importantly for our study, one of the requirements of the 2010 Amendments is that the advisor to an MMMF must consider the redemption behavior of its investors (i.e., "know your customer"). Specifically, this requires a fund to adjust its liquidity levels appropriately and to incorporate the redemption behavior of its shareholder base into its stress testing procedures. A rational for this requirement is that, as the industry acknowledged after the crisis, "some money market funds were surprised by particularly severe redemption pressures because they may have lacked detailed knowledge of their client base" (MMWG, 2009). Thus, this "know your investor" requirement is designed to bring attention to the portfolio choice of funds owned by investors who are more likely to redeem on short notice. Whether this requirement has succeeded in altering the safety of portfolios and in preventing further run-like behavior during stress events, prior to our study, is unknown.

Of great interest is whether these amendments to 2a-7 have been effective at reducing the potential for money fund runs, partly because the SEC has recently implemented further requirements for certain types of funds in an attempt to further reduce the potential for runs.[3] The new 2014 Amendments to Rule 2a-7 will segregate the types of clientele that invest in each fund.[4] In particular, the new rules will require management companies to segregate investors that are natural persons (i.e., retail) from other types of investors (i.e., institutional) into different funds. Funds serving institutional investors will no longer be permitted to use amortized cost pricing – an accounting principle that helps MMMFs to offer a stable $1 net asset value (NAV) – for securities maturing in over 60 days. Instead, institutional prime funds will "float" their NAV (a.k.a., "variable" NAV). According to one SEC Commissioner, this requirement "eliminates the first-mover 'put' advantage that favors sophisticated institutional investors at the expense of retail investors" (Gallagher, 2014). Thus, in order to protect retail investors, some funds will be more highly concentrated with agents that invest for corporate, funds, and other large-scale investors – giving our study further importance to policy-makers and academics that study the stability of the cash economy.

Our novel dataset, obtained from individual management companies through the Investment Company Institute (ICI), contains information on fund ownership, of each MMMF, by investors belonging to different categories. For example, we have fund ownership by financial corporations, non-financial corporations, retirement plans, state and municipal investors, retail broker-directed accounts, and retail self-directed accounts. These data provide us with the first opportunity to examine the flow behavior of different types of MMMF clientele in much more detail than past research, which only contained self-designated shareclass types. As we reveal, so-called "institutional" shareclasses are populated by a broad range of investor types, ranging from investment banks to individual investors within their 401(k) plans. Our study separates truly institutional investors (those who act as an investment agent for a principal that is not a natural person) from truly retail investors (including those that invest through a large 401(k) plan or through an omnibus

[3] We define these groups more carefully in Section 4.1.

[4] Specifically, effective October 14, 2016, the new rules require a floating net asset value (NAV) for institutional prime and institutional municipal money market funds. Additionally, under the July 2014 rules, non-government money market fund boards can impose liquidity fees and gates (a temporary suspension of redemptions) when a fund's "weekly liquid assets" falls below 30 percent of its total assets (the regulatory minimum). The final rules also include additional diversification, disclosure, and stress testing requirements, as well as updated reporting by MMFs. These rules come with a two-year transition period, requiring full implementation in 2016.

brokerage account).

The primary aim of our study is to establish, more clearly, the investor types that may redeem heavily during crises and whether the 2010 Amendments diminished this risk. Our secondary objective is to anticipate whether greater client concentration, as will soon be mandated under the 2014 Amendments, may boost flow variability in a minority of funds, alter aggregate demand for certain security types, and intensify yield-based competition between funds.

Prior studies that treat all institutional shareclasses alike have missed a good deal of the heterogeneity in the true character of the underlying investors. We first show that only about half of the money in self-designated prime institutional shareclasses come from true institutions. A significant fraction originates from natural persons, as 26.8% is held by individuals through retail accounts or through their brokers as of year-end 2013. Further significant proportions are held by fiduciaries and retirement plans for individual investors.

Next, we show there is a large cross-sectional variation in the share of true institutional investors in the capital structure of MMMFs. This variation allows us to analyze how investor characteristics relate to fund characteristics. About 46% of prime funds have very little or no institutional ownership. On the other hand, 3% of prime funds are almost entirely owned by true institutions. Further, in 2013, 11% of prime funds are comprised of at least three-quarters institutional assets, up from 9% in 2007. We would expect that flows are more variable in such money funds. Thus, we establish that, if anything, the concentration of true institutions within certain funds has increased from 2007 (prior to the crisis) to 2013 (year-end); that is, we find an increased segregation of institutions into certain funds (portfolios). And, as mentioned above, this segregation will become almost complete when the 2014 Amendments become binding in October 2016.

Using our proprietary database merged with datasets that contain MMMF flow information at the shareclass and fund level, we model the covariates of investor outflows during market stress events, including the MMMF crisis of September 2008, the eurozone crisis of 2011, and the U.S. debt ceiling crisis of 2011.[5] It is notable that these latter two crises provide a "test bed" for the

[5] Although there have not been any wholesale runs on the money fund industry since the week of September 15, 2008, there have been several more minor disruptions in financial markets that may provide some empirical evidence of what may happen during future major disruptions. In this paper, we focus on two such "mini-crises": first, a particularly troublesome period of the ongoing debt crisis in the European Union occurred during late June of 2011; this spike in the crisis also precipitated large outflows from prime money funds–especially those perceived to have

effectiveness of the 2010 Amendments, as well as for any lessons learned by investors and fund management companies from the 2008 crisis. These results inform our discussion of whether a greater concentration of institutions in certain funds could affect how these funds operate and, possibly, the money markets themselves.

Our results indicate that "true" institutions exhibit a much higher tendency than individual investors (i.e., "natural persons") to redeem from MMMFs during the 2011 market stress events. This tendency may in fact be stronger than previously thought. Indeed, the influence of institutional ownership on outflows during market stress events has only slightly decreased since the 2008 crisis. In particular, nonfinancial corporations remain the quickest to redeem, while retirement plan investors and investors in individual retail accounts remain significantly less likely to withdraw during a market stress event. Further, we find that weekly flow volatility, across the entire post-2010 Amendment period, is significantly higher for prime funds having the largest level of true institutional investors. And, this effect is non-linear: in some periods, the top 20th percentile of prime MMMFs, by true institutional ownership, exhibits about twice the level of additional volatility as funds in the 60th-80th percentiles.

In further tests, we find that part of this flow volatility appears related to institutions quickly moving their money between prime MMMFs and repurchase agreements (repo), depending on the relative yields between the two markets. Together, these findings show that institutions are more sensitive to yields and are the fastest to withdraw from funds during a market stress event. Whether the variable NAV requirement helps to mitigate this outcome in the future remains to be seen.

Further, we show that funds that are predominately institutional manage their portfolios differently from funds that are predominately retail. Most notably, highly institutional funds hold significantly more liquidity. Further, this positive correlation between a fund's liquidity ratio and its institutional ownership has grown since the crisis and since the implementation of the SEC's 2010 reforms. However, funds with greater institutional ownership also tend to have a smaller portion of assets (6% less, on average) maturing in the 7 to 60 day window. In fact, on average, highly institutional funds have about the same percentage of assets maturing in under 60 days as

exposure to riskier investments in Europe. And, second, the debt ceiling crisis of late July/early August 2011, where a stalemate over funding of the U.S. Government by Congress precipitated severe outflows from both government and prime MMMFs.

funds with no institutional investors. This might be characterized as a sort of "barbell" strategy that captures yield in longer-term securities while holding greater levels of short-term (less than 7-day maturity) securities to meet redemptions.

The 2014 Amendments could affect short-term markets. Our analysis reveals that prime funds currently dominated by institutional investors tend to hold lower levels of U.S. Treasurys and commercial paper (both traditional and ABCP), and greater levels bank-issued securities, such as repos, CDs, and time deposits. Also, our results signal that greater investor concentration will drive prime funds to hold more liquidity for every institutional dollar.[6] If we extrapolate from these results, we could image scenarios in which the 2014 Amendments put downward pressure on repo markets. First, as noted by Ho, Iborg, and Roever (2014), this could happen if the new reforms cause institutional assets to shift into government-only MMMFs, which invest heavily in Treasury/Agency repo. Alternatively, this could also happen if institutional assets remain in prime MMMFs, but a greater concentration of institutions in certain portfolios generates extra demand for highly liquid securities. Either of these outcomes could result in additional demand for liquid securities, which are already in short supply. According to analysts at JP Morgan, such additional demand may complicate the Federal Reserve's reverse repo facility, which has controlled short-term interest rates by setting a floor for overnight money market rates.[7] They write that extra demand for highly liquid securities by MMMFs could cause short rates to "persistently trade through the Fed's reverse repo facility," presenting a "leaky floor" challenge for the Fed as it tries to raise interest rates (Ho, Iborg, and Roever, 2014).

Our final tests demonstrate that, in the current flat (and essentially zero) short-rate yield curve environment, in combination with the greater restrictions on portfolio risk required by the 2010 Amendments, prime funds do not appear to be able to attract significant flows through the small net yield differentiation that they may create through greater risk-taking or costs reductions.[8] This

[6] This cannot be fully offset by retail prime funds holding less liquidity, since the SEC's 2010 Amendments placed a floor on MMF liquidity ratios (10% daily and 30% weekly liquidity).

[7] Prime funds purchase repo from this facility, particularly at quarter-ends when outside repo dries up. The size of this facility is limited, however.

[8] Results suggest that, after controlling for net yields, institutional investors tend to react negatively to increases in gross yields – suggesting that institutions value both the return and the relative safety of their money fund holdings. It follows that competitive pressures are more likely to push down charged expenses rather than push up gross yields (i.e., portfolio risk).

is true even among funds with a highly institutional clientele. Indeed, institutions appear to be switching between prime funds and other cash sectors (e.g., the repo market) in search of additional yield. This contrasts with a strong flow-performance sensitivity among institutional investors before the 2008 crisis. Given the substantial reforms to MMMFs enacted in recent years, it is unclear whether this flow-performance sensitivity will return to prior levels once interest rates rise and meaningful yield differentiation becomes possible.

To summarize, our paper provides evidence on the effect of the 2010 Amendments, as well as the potential effect of the 2014 Amendments, on the stability of the money fund industry and its underlying portfolio investments. Our study shows that the 2014 Amendments, which will segregate retail and institutional investors, will have two effects, one risk-reducing, the other unknown. During a market stress event, concentration of investor types will create a concentration of redemption-risk in funds having institutional investors, with little or no risk in funds held by retail investors. That is, the buffer of "slow money" will be substantially reduced once the new regulations are fully implemented. Further, it is likely that institutional prime assets will become more concentrated in certain fund companies – those that already have a substantial institutional clientele and the economies of scale necessary to overcome the costs of opening variable NAV prime funds. Finally, changes in institutional prime assets could influence the liquidity of security-types, such as repos, that are disproportionately held by MMMFs with greater institutional ownership. This could put downward pressure money market rates. The net impact of these reforms on systemic risk is unknown. Thus, regulators and industry practitioners will wish to closely monitor developments as the 2014 Amendments become phased in over the next two years.

Our paper proceeds as follows. Section 2 provides a background on the structure of MMMFs, as well as a short overview of the events of 2008 and 2011, and the 2010 Amendments that were imposed by the SEC following the 2008 money fund crisis. Section 3 describes our databases, while Section 4 provides empirical results. In Section 5, we conclude.

2. Background

2.1. The Structure of Money Market Funds

Money market funds are mutual funds. Like other mutual funds, they are regulated under the Investment Company Act of 1940 and its various amendments (henceforth, ICA). However, they operate under a special provision of the ICA, Rule 2a-7, which allows for valuing of portfolio securities at "amortized cost" (book) value, rather than at mark-to-market value. Under amortized cost, securities are valued at the purchase price of securities minus computed premium or discount, amortized over the securities' remaining life.[9] This provision of the ICA allows money funds to seek to maintain a constant $1.00 per share net asset value. For investors, this has many advantages. It allows retail investors to easily use their money market funds for transactions purposes, such as paying bills and settling securities trades. They are also able to tie their money market funds to bank products, such as checking accounts, ATMs, and credit cards. A constant $1.00 NAV allows many kinds of institutions (e.g., state and local governments) that are restricted from investing in variable NAV products to hold their liquid balances in money market funds. And, for both retail and institutional investors, a constant $1.00 NAV vastly simplifies tax accounting by eliminating the need to track the capital gains and losses that arise with a long-term mutual fund.

However, according to some experts (e.g., SEC, 2012; Schapiro, 2012), valuing money fund holdings at amortized cost creates the potential for runs, because the fund's price per share (which is based on book value) can diverge from the market value of the fund's underlying portfolio securities. Others disagree, citing no cross-section variation in the rate of redemptions among stable NAV and variable NAV money funds in Europe during the 2008 crisis (Gordon and Gandia, 2014). Nevertheless, regulators have remained concerned that, in the event of rapid, large-scale outflows, an MMMF might become liquidity-constrained, unable to meet redemption requests, despite holding highly liquid assets.

These risks have been controlled differently in banks and money funds. Banks are required to maintain excess capital, and small depositors are insured, but banks may generally hold highly

[9] This is also how bonds are valued on accounting balance sheets of corporations.

illiquid assets (e.g. 30-year mortgages), hold assets that may be lower-rated or difficult to rate or price, and may employ leverage. Money market funds, in contrast, under Rule 2a-7, must hold only highly liquid, high quality assets, and generally may not use leverage.[10]

Prior to September 2008, Rule 2a-7 had worked well to control risks. From the point at which Rule 2a-7 was first adopted by the SEC in 1983 to September 2008 only a single money market fund had "broken the buck" (i.e., failed to return $1.00 per share). Even that event went largely unnoticed, because the fund was small and held by a limited number of institutional investors (primarily banks).[11] However, this changed on September 16, 2008, when the Reserve Primary Fund "broke the buck."[12]

2.2. The Crisis of September 2008

On Friday, September 19, 2008, the U.S. Treasury offered a limited guarantee to money funds in exchange for an "insurance premium" payment.[13] On that same day, the Federal Reserve announced the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, which extended loans to banking organizations to purchase asset backed commercial paper (ABCP) from money market mutual funds. This program was set up to assist money funds holding such paper to meet redemption demands and to promote liquidity in the ABCP market and in the money markets more generally (Plaze, 2008). This program began operations on September 22, 2008, and was closed on February 1, 2010.

In addition, in response to the growing difficulty of corporations in rolling over their short-term commercial paper, the Fed announced The Commercial Paper Funding Facility on October 7, 2008, followed by additional details on October 14, 2008. This program took effect on October 27, 2008, and was designed to provide credit to a special purpose vehicle that would purchase three-month commercial paper from U.S. issuers.

[10] Over the years, the provisions of Rule 2a-7 have been tightened to further reduce systemic risks (see Collins and Mack, 1994).

[11] The Community Bankers US Government Fund broke the buck in 1994. It was an institutional fund, and paid investors 96 cents per share.

[12] It should be noted that there are several instances where the $1 NAV would have been broken, had the fund advisor not intervened by injecting capital or buying poorly performing assets (Brady, Anadu, and Cooper, 2012).

[13] It has occasionally been implied that the Treasury Department guaranteed trillions of dollars in MMF assets (e.g., Bair, 2013; Kacperczyk and Schnabl, 2013). To clarify, the Treasury's exposure was limited to the roughly $50 billion (corresponding to 3% of prime MMF assets) available to it through the Exchange Stabilization Fund.

On October 21, 2008, the Federal Reserve announced another program, The Money Market Investor Funding Facility (MMIFF). The MMIFF was a credit facility provided by the Federal Reserve to a series of special purpose vehicles established by the private sector. Each SPV was able to purchase eligible money market instruments from eligible investors using financing from the MMIFF and from the issuance of asset-backed commercial paper (ABCP). Eligible assets included certificates of deposit, bank notes and commercial paper with a remaining maturity of at least seven days and no more than 90 days.

Following these developments, investors continued to redeem shares from prime funds, but at a diminishing rate. By the end of October 2008, redemptions essentially ceased.

2.3. The 2010 Amendments to Rule 2a-7

In response to the events of September 2008, the Securities and Exchange Commission (SEC) implemented the 2010 Amendments to Rule 2a-7. See the Appendix for details on the various restrictions added by these amendments.

While the 2010 Amendments contain many new restrictions that are designed to reduce the risk of money funds, one of the stipulations of the amendments is designed, for the first time, to require management companies of money funds to focus on the characteristics of their investors. Specifically, one of the requirements of the 2010 Amendments requires "fund management to 'know your clients' to assess the potential volatility of fund flows, and to adjust upward the liquidity of the fund accordingly, if necessary."

Our study examines the make-up of investors in each money market mutual fund using our dataset of investor types. As such, we are uniquely able to provide an in-depth assessment of how investor-type impacts the tendency to exhibit runs during stress events.

2.4. The Events of 2011

Two major events occurred during 2011 that affected MMMFs: the Eurozone debt crisis and the U.S. debt-ceiling crisis.

2.4.1. Debt Ceiling Crisis of 2011

The U.S. Congress was locked in a stalemate over extending the borrowing capacity of the federal government during late July 2011. On July 25, Republicans and Democrats proposed separate deficit-reduction approaches. Also, bond markets were put in turmoil when an $850 million futures trade (requiring the commitment of over $1 billion of real capital) was placed that bet on the U.S. losing its AAA rating or defaulting (Barnes, 2011). On July 29, the Senate tabled a Republican-sponsored bill to raise the debt ceiling, while, on July 30, the House defeated a Democratic-sponsored bill. By August 2–the day the U.S. Treasury estimated that the borrowing authority of the federal government hit the debt ceiling–the two sides had compromised, and a bill was passed and signed by President Obama to raise the debt ceiling. In the end, this impasse is estimated to have driven $57 billion out of prime MMMFs during the 5 business days ending August 1, 2011 (Collins and Gallagher, 2015).

2.4.2. Eurozone Debt Crisis (Episode of 2011)

A second crisis occurred during 2011. On June 13, Standard and Poor's downgraded Greek sovereign debt to CCC and, on June 15th, Moody's announced that it was placing several French banks under review. In response, the European Central Bank (ECB) approved a financing bailout of €12 billion for Greece on July 2. However, on July 5, Moody's downgraded Portuguese sovereign debt to "junk" status, followed by a similar downgrade of Ireland on July 12. On July 21, the ECB approved a second rescue package for Greece in the amount of €109 billion.

Over the course of the summer, fears of contagion from spread from Greece, Ireland, and Portugal to Italy and Spain. Weak growth prospects in Italy and Spain, political instability, and concerns that the size of the European Financial Stability Facility was too limited to support these countries led to a widening of sovereign bond yields in mid-July (Bank for International Settlements, 2011). Eventually, concerns of contagion spread to much of the European continent and CDS premiums on banks in core European countries rose markedly. By early 2012, the immediate crisis was averted by a series of huge injections of low-cost, long-term funds by the European Central Bank along with international bailouts, deals with private creditors, and political agreements to

implement tough spending cuts.

The threat of a default by several countries using the euro as their currency led to outflows from MMMFs in the U.S.–especially among those that invested in European domiciled banks (Chernenko and Sunderam, 2014). Collins and Gallagher (2015) estimate that investors redeemed as much as $69 billion from prime funds during the second half of June 2011 due to individual prime funds' exposures to the eurozone.

3. Data

Our data are derived from three sources: iMoneyNet (www.imoneynet.com), SEC Form N-MFP, and the Investment Company Institute. This section describes the datasets assembled from these sources and how they facilitate the study of shareholder behavior and money funds. This section also presents summary statistics generated from these datasets.

3.1. Shareholder Types

A problem with past datasets, including those that contain information on shareclass types (such as iMoneyNet), is that so-called "institutional" shareclasses often are comprised of collective trusts or omnibus accounts sold through brokers, which have large numbers of retail investors (also referred to as "natural persons"). We overcome this problem using a unique database, unavailable to prior studies of money funds (or any other studies of mutual funds). These data are from the Investment Company Institute (ICI), and consist of the proportion of assets, for each MMMF shareclass, held by each category of investors at each year-end during 2005 to 2013. We aggregated the data across shareclasses to the fund level (i.e., portfolio level). The information is gathered from fund transfer agents. A more detailed discussion of the construction of this dataset, and its potential biases, is available in Appendix B. The data classify investors by the following types:

- Corporations, nonfinancial*
- Corporations, financial*
- Nonprofit accounts*
- State and local governments*

- Other intermediated funds* (e.g., hedge funds and fund-of-fund mutual funds)
- Other institutional investors* (e.g., international organizations, unions, and cemeteries)
- Retirement accounts (e.g., 401(k) and defined benefit pension plans)
- Fiduciary accounts (e.g., estates and inheritance trusts)
- College 529 Savings Plans
- Retail brokerage-directed accounts (e.g., pooled brokerage omnibus accounts)
- Retail individual-directed accounts

This dataset allows us to study the behavior of true institutional investors (i.e., accounts for which natural persons do not represent the beneficial ownership interest). To achieve this, we segregate high-level investor types by whether they are predominantly "institutional" or "retail" in origin. Operationally, if we determine that most investors within a given category likely have social security numbers, then we label these shareholdings as being truly "retail". Otherwise, they are labeled as truly "institutional." In our study, true institutional investors consist of categories designated with a "*" above.[14][15]

3.2. Money Fund Flows, Holdings, and Other Characteristics

This shareholder dataset is joined with daily, weekly, and monthly data from iMoneyNet; this dataset captures both fund and shareclass level assets at various frequencies. In particular, iMoneyNet collects daily information for over 2,000 U.S. registered MMMF shareclasses that invest primarily in U.S. short-term, dollar-denominated debt obligations. These money funds are offered to retail as well as institutional investors. The iMoneyNet data consists of weekly total net assets by shareclass, as well as data on the fund investment objective, fund family/adviser (i.e., "complex"), fund type (i.e., retail vs. institutional), portfolio average maturity, and asset breakdown. Our weekly money fund dataset from iMoneyNet covers the period December 31, 2004 to June 30, 2014. We approximate weekly fund shareclass flows as the weekly percentage change in shareclass assets (this

[14] The "other intermediated funds" category typically accounts for less than 1% of prime MMF assets. We classify "other intermediated fund" accounts as "institutional" primarily because a portion may come from hedge funds. However, the remaining assets in these shareclasses could be a mix of retail and institutional investors. We have no way of seperating assets in these two types of accounts.

[15] The "other institutional investors" category, which is extremely small in dollar value across all years, consists of accounts that are difficult to classify elsewhere.

ignores the negligible effect of the small daily dividends that MMMFs declare).[16]

The iMoneyNet database also contains information on shareclass net yields and expenses, which we aggregate to the fund level by taking asset-weighted averages. At the fund level (i.e., portfolio level), iMoneyNet provides gross yields, assets maturing in under 7 days, and weighted-average maturities (WAMs), as well as security type information, such as the percentage of fund assets invested in foreign bank CDs.

Next, this data is joined with another shareclass-level dataset from the ICI that contains the minimum investment requirement for each MMMF shareclass as of March 31 of each year, as well as whether the shareclass is referred to as "institutional" in the fund's prospectus. This latter data allows us to compare our survey data, which precisely identifies investor types, with publically available shareclass information. We also collect monthly net new cash flow data for each prime fund from the ICI, which is slightly more complete than that from iMoneyNet.[17]

Finally, these data are joined with a dataset of detailed portfolio holdings information for each fund. The 2010 Amendments to Rule 2a-7 require each MMMF starting in November 2010 to file Form N-MFP each month with the SEC. The SEC releases this data to the public within 60 days of the end of the month. We obtain this detailed monthly portfolio-level holdings information from SEC's Edgar data site. On Form N-MFP, a fund must disclose every security that it holds, including the name of the security's issuer, the security's credit rating, legal maturity date and interest rate "reset date" for floating rate securities. From this dataset, we calculate the portion of fund assets invested in securities that meet the SEC's definition of "weekly liquidity" (U.S. Treasury securities, U.S. agency securities maturing within 60 days, and all other securities maturing within 5 business days). We also use this dataset to calculate the portion of each fund's assets invested in eurozone banks as of May 2011.

The union of datasets from these three sources (the ICI, iMoneyNet, and SEC Form N-MFP) represents, to our knowledge, the most comprehensive and complete empirical database studied to date on MMMFs in the academic literature. We believe that these unique data allow an analysis

[16] Almost all money fund dividends are reinvested in the same money fund share class, so distributions (and their passive reinvestments) have a negligible effect on our estimates of *active* flows.

[17] When computing daily and weekly flows, we use iMoneynet, as it is more complete at that frequency than ICI data.

of differences in behavior between retail and institutional investors not possible using past datasets available to academics.

3.3. Construction of Ownership Variables

Throughout much of our analysis, we divide funds (not shareclasses) into groups based on the percentage of fund assets coming from true institutional investors at the end of each year, as detailed above. (Henceforth, when we use the term "fund," we are referring to a MMMF at the portfolio level, not the shareclass level). We assume that these ownership levels are constant until the next ICI shareholder year-end update.

We divide funds into quintiles, such that funds with institutional ownership in the bottom 20th percentile are in the first quintile, called "INST[Q1]", and funds in the top 20th percentile of institutional ownership are in the fifth quintile, called "INST(Q5]." We also refer to these quintiles, in our analysis to follow, more simply as "Q1" and "Q5," respectively. We also create a sixth group of funds called "INST>90%." These funds are a subset of the fifth quintile, and include funds with over 90% of their assets held by true institutional investors. Funds in this latter group are most similar in shareholder composition to the future 100% institutional variable NAV (henceforth, VNAV) funds. In 2013, 16 prime funds belonged to this extreme group.

In our various regressions, we often include dummy variables for a fund belonging to a given institutional ownership group. We usually omit the bottom two quintiles, which typically have less than 3% institutional ownership, so that dummy variable coefficients can be interpreted as the effect relative to a fund that is almost entirely retail owned. At the same time, INST>90% can be interpreted as the additional effect, on top of already belonging to the highest quintile (Q5), of also being almost wholly institutional.

3.4. Summary Statistics

Figures 1 and 2 show a breakdown of prime funds and prime institutional shareclasses, respectively, into the proportion of shares held by their end investors. Specifically, Figure 1 shows year-end proportions of aggregate assets in prime funds (both retail and institutional shareclasses, combined)

from 2005 to 2013. Note that about 57% of assets derive from retail shareholders through individual accounts and brokers, while about 31% of assets derive from financial and non-financial corporations at year-end 2013. Further, these proportions have remained relatively constant over time. Therefore, the underlying composition of investor types, at least in aggregate, have not changed substantially through time.

For many institutional shareclasses, retail shareholders currently represent a significant buffer against potential run-like investor behavior of true institutions.[18] Figure 2 shows that, when we focus only on prime *institutional* shareclasses, the aggregate compositions are also relatively stable from 2005 to 2013. It is also notable that a significant fraction of money in self-designated "institutional" shareclasses originates from natural persons, as 26.8% is held by individuals through retail accounts or through their brokers as of year-end 2013. Further significant proportions are held by fiduciaries and retirement plans for individual investors.

We see a large amount of heterogeneity in the level of true institutional shareholders across different prime MMMFs. In Tables 1 and 2, we show distributional information as well as several summary statistics of prime funds (portfolio level), ranked by their institutional ownership level, as well as statistics for the 16 funds in which institutional shareholders own over 90% of fund assets (see "INST>90%"). Table 1 shows that the 80th percentile of funds, sorted by institutional ownership, has 42.6-47.5% true institutional investors, on average. Therefore, in 2013, the lowest level of institutional ownership in Q5 is 47% and the highest level is 100%. The lowest quintile (Q1) has negligible true institutions, while the second quintile (Q2) has, at most, 2-5% true institutions as shareholders. This large heterogeneity will make it possible, in our tests to follow, to identify the effect of ownership type on various fund characteristics, such as the standard deviation of weekly flows, the liquidity of portfolio holdings, the tendency to offer higher net yields, and the risk of run-like behavior during market stress events.

Figure 3, Panel A, shows the high level of heterogeneity in institutional ownership levels of prime funds at the end of 2013. The reader should note that 46% of prime funds have very little

[18] We note that Schmidt, Timmermann, and Wermers (2014) find that run-like behavior during September 15-19, 2008, was exhibited mostly by institutional investors in shareclasses with very large minimum investment levels. Thus, most retail investors, who are invested in small minimum investment shareclasses, did not run during the crisis week.

institutional ownership ("< 5%"). On the other hand, 3% of prime funds are almost entirely owned by true institutions (>=95%). **One** might suspect that run-risk may be concentrated in such money funds. Further, in 2013, 11% of prime funds are comprised of at least three-quarters institutional assets, up from 9% in 2007. Note that this concentration has increased from 2007 (prior to the crisis) to 2013 (year-end), indicating an increased segregation of institutions into certain funds (portfolios). Figure 4 demonstrates the significant growth in the portion of prime institutional shareclasses that are over 75% owned by institutions, from 22% in 2007 to 31% in 2013.

Institutions especially benefit from the lower fee levels charged by higher minimum investment shareclasses. Table 2 shows that institutional investors tend to hold shares in funds that are only slightly riskier–having only slightly higher gross yields (although this relation is not monotonic in ownership)–and offer significantly higher net-of-fee yields. This is related to the fact that funds in the highest institutional ownership quintile, Q5, are much larger in total net assets (TNA), as well as the level of minimum required investment (as expected). The average fund in the highest quintile has assets of $11 billion, compared to just $1 billion in assets for funds in the lowest quintile, Q1. Half of funds in the highest quintile of institutional ownership require a minimum investment of over $2.6 million. Meanwhile, funds with no institutional investors typically have no minimum. Therefore, funds that are dominated by institutional investors are larger, have shareclasses that require a higher investment minimum, and hold portfolios with greater 7-day liquidity.

Figure 3, Panel B, provides a sense of the business imperative for companies to open new VNAV institutional prime funds. This figure shows histograms of institutional ownership in prime funds *at the management company level*. Surprisingly, in 2013, 37% of fund companies had almost no institutional ownership in their prime funds, up from 27% in 2007. Also in 2013, 10% of fund companies had over three-quarters of their prime fund assets coming from institutional investors. Thus, for a large number of fund companies, the operational costs of offering a VNAV prime fund may outweigh the benefits. A logical scenario is that institutional prime assets become even more concentrated in a small number of large fund management companies – those with the economies-of-scale necessary to overcome the fixed costs of opening VNAV prime funds.[19]

[19] There are a number of costs involved in opening and operating VNAV prime funds. Unlike other mutual funds, MMFs often provide intraday liquidity to their investors. Thus, to retain institutional shareholders in a VNAV setting, prime funds are considering how to strike a NAV at two or more points during the day. According to industry experts,

4. Empirical Results

4.1. Institutional Ownership and Fund Flows during Crises

Schmidt, Timmermann, and Wermers (2014; STW), using quantile regression techniques, argue that institutional investors were more likely to run from money funds during the crisis of 2008. However, our dataset on investor characteristics (i.e., financial corporations vs. retail investors) provides a deeper look at this issue, as about half of so-called institutional shareclasses are actually comprised of natural persons (through, for example, an omnibus account).

In Table 3, we segregate money funds into quintiles, according to the level of true institutional ownership within the fund, as of the prior year-end. Each fund is assigned a value of one for the true institutional ownership quintile to which it belongs. These quintile dummies are the key explanatory variables in these cross-sectional regressions. The dependent variable is 3-week fund flows (as a percentage of beginning of period assets). In the first set of regressions in the table, fund flows are measured during September 9-30, 2008. Also included (but not shown) are several control variables: gross yield, portfolio liquidity, weighted average maturity of portfolio, total net assets, and minimum investment amount, all computed by value-weight averaging the corresponding values across all shareclasses within a given fund. In designated specifications, we show standardized results in order to facilitate comparisons between different market stress events.

Consistent with STW's results for shareclasses self-labeled as "institutional," we find that *true* institutions were much more likely to redeem heavily from funds during September 9-30, 2008. A fund with 10% larger institutional ownership experienced 2.03% (as a percentage of total net assets) greater outflows (or 2.03% lower inflows) during the Lehman crisis weeks (regression (1)). In standardized terms (regression (2)), a one standard deviation (which amounts to a 29%) increase in a fund's institutional ownership results, on average, in outflows of 0.3 standard deviations, or 6 percent (-0.309*18.9; 18.9% is the standard deviation of the y-variable). Regression (3) shows that this effect is primarily driven by funds in the highest quintile of institutional ownership, Q5. Note, also, that this effect is highly non-linear: funds within Q5 have more than double

this involves costs.

the percentage outflows, relative to funds within Q4. However, funds with greater than 90% institutional shareholders exhibited a level of outflows that are statistically indistinguishable from that of Q5.[20]

Funds tend to persist in their segregation by levels of true institutional ownership. Figure 5 reinforces these regression results by showing that money funds that experienced large outflows during the crisis of 2008 had a greater proportion of institutional shareholders. In this figure, we group together prime funds with outflows of over 28% of fund assets (i.e., the bottom 10th percentile) during the week of the money fund crisis following the Lehman Brothers default (September 15-19, 2008). Within this group of funds, we take the median percentage of fund assets owned by institutions as of the prior year-end (black dashed line). We compare this to the median institutional percentage among all prime institutional shareclasses (blue line with triangles) and among all prime funds (grey line). Funds with heavy outflows during the week of the Lehman episode had median true institutional ownership of 53% of fund assets as of year-end 2007. This is much higher than the median institutional ownership of prime institutional shareclasses (36%). Interestingly, those funds with heavy outflows during the failure of Lehman do not exhibit a noticeable shift in their investor base following the crisis. As of 2013, at the median, these funds still had 53% of assets held by institutions. In other words, we observe no move on the part of these funds or on the part of their investors to shift assets into funds with lower institutional ownership.

To summarize, true institutional investors were much more likely to redeem during the 2008 crisis, and we might expect that this tendency would be true for other market stress events. We confirm this next.

As documented by Collins and Gallagher (2015), during the summer of 2011, MMMFs experienced outflows during two distinct periods of unusual market stress. The first period occurred during late June, as investors withdrew from funds with greater exposures to securities issued by Eurozone banks, in response to a sudden decrease in the perceived creditworthiness of such banks. The second period of outflows occurred just before the August 2 resolution of the U.S. debt ceiling impasse, in response to a perceived sudden reduction in the creditworthiness of the U.S. Treasury.

[20] This result may be due to the larger median account minimums (see Table 2) of purely institutional funds, making it harder to quickly move large balances.

The influence of shareholder base is somewhat lower, although still statistically significant, during the summer of 2011, compared with the 2008 crisis. Table 3, in addition to showing results for the 3-week period of the 2008 crisis, shows cross-sectional regressions of fund flows during separate 3-week periods covering the Eurozone crisis and the U.S. debt ceiling crisis. Specifically, the coefficient on institutional ownership is -0.188 and -0.218 during the Eurozone and U.S. debt-ceiling crises, respectively, compared to -0.309 during the 2008 crisis. This suggests that the difference in reactions between retail and institutional investors has narrowed somewhat during market stress events. One possibility is that retail investors now play a more active role in monitoring market events and the exposures of their prime funds to those events. However, this is unlikely, as retail shareclasses actually exhibited (small) net inflows during the summer of 2011, which includes the two market stress events (Eurozone and U.S. Debt Ceiling). It is also possible that the liquidity and diversification requirements instituted under the SEC's 2010 reforms reassured institutional investors to some extent during the 2011 stress events. Regardless, it is clear that higher institutional ownership remains significantly associated with MMMF outflows during market stress events.

Funds serving certain categories of institutional shareholders experienced larger redemptions than others during the three crises examined. Table 4, Panel A, shows the estimated marginal influence of different types of institutional ownership on fund flows. Note that we include, but do not show, the same control variables used in the specifications shown in Table 3. To ease comparison, all variables are standardized. Since we have omitted all retail categories in Panel A, coefficients may be interpreted as marginal effects relative to retail ownership. The results indicate that nonfinancial companies consistently withdraw from prime funds during market stress events. For example, during the Eurozone crisis, a one standard deviation higher nonfinancial company ownership (19%) results in a 0.25 standard deviation, or 2 percent (-0.25*8.2), higher outflow. This response of nonfinancials has remained relatively stable over the three different market stress events. In contrast to nonfinancial companies, financial companies, as well as state and local governments, were significantly less likely to withdraw assets during the summer of 2011 than they were during the Lehman crisis.[21]

[21] Of course, it is possible that financial companies may be more sophisticated, and, thus, refrained from redeeming from money market funds during the Eurozone and U.S. debt-ceiling crises. That is, they may have understood that these two events were likely to be resolved without a major market crisis.

Panel B shows that most retail investor categories had a significant stabilizing influence on fund assets during 2008 and, to a slightly lesser extent, subsequent crises. In particular, individual retail investors, retirement plans, and fiduciary accounts are associated with inflows (or lower outflows), relative to institutional ownership. Of particular note are that individuals who invest without the assistance of a full-service broker tend to be the most stabilizing influence of all during market stress events. There are a few possible explanations. Such individuals may receive or take longer to understand information about a crisis later than most fiduciaries. In addition, some have argued that individual investors are more likely to think of a MMMF as an insured bank-deposit-like account (Schapiro, 2012).

4.2. Ownership Structure and Asset Variation

Asset variation is a concern of MMMF management companies, as it impacts the ability to invest in less liquid, higher-yielding securities during normal times as well as during market stress events. And, as shown by STW, funds with higher asset variation (as generated by greater flow volatility) are more likely to exhibit run-like behavior during the crisis of 2008. All else equal, we expect that large-scale true institutional investors who move their money more frequently are more attentive to market conditions and fund-specific conditions.

In this section, we investigate the relation between the structure of ownership of MMMF shares and the size of their flows. To test this relation, in Table 5, we implement a series of panel regressions across fund-years, where the dependent variable is the standard deviation in a fund's weekly flows (as a percent of total net assets) during a given calendar year. We log this value, since some very small funds are very large outliers. (Year fixed effects are included in all models, and robust standard errors are shown in parentheses.)

The key explanatory variables are various permutations of a fund's institutional ownership (INST) at the prior year-end, as described in Section 3.3. We would expect, all else equal, for a larger fund to have lower (percentage) standard deviation of flows, due to the greater diversification of investors holding its shares–i.e., these funds provide a higher level of liquidity, at least in normal times. Additionally, funds with large balances per account may have more volatile assets due to

a lessening of the diversification effect.[22] Therefore, controls include the fund's logged average weekly total net assets during the year (ASSETS) and the fund's minimum investment requirement (in $ millions) as of end-March of that year (MININV). To see whether institutional ownership only matters when account minimums are large, we also interact MININV with the fund's prior year-end institutional ownership quintile. We look at three periods of time to evaluate whether the relationship between institutional ownership and asset volatility has changed since the crisis and since the implementation of the SEC's 2010 reforms.

The results, across all three multi-year periods, affirm that true institutions tend to generate higher flow volatility through their trades, controlling for their size (MININV) and their fund's size (ASSETS).[23] Funds in the top quintile, Q5, of institutional ownership have significantly higher weekly flow volatility than funds in the bottom two (omitted) quintiles. For example, the weekly flow volatility is 1% (or, exp(1)=2.7% of total net assets) higher for funds in Q5, relative to Q1 and Q2. By comparison, the median log flow volatility is 1.07 (or exp(1.07)=2.9% of fund assets). This coefficient is roughly double the level of Q4, again indicating a highly non-linear effect of true institutional ownership on flow volatility.

This result is consistent over the three multi-year periods. And, the flows of those funds consisting almost entirely of true institutional investors (INST>90%) have become significantly more variable than the rest of top quintile funds during the period following the 2010 Amendments.[24] We would expect that a portion of this is due to cash managers becoming more active in seeking better yields or more safety, given the very low short-interest rates and turmoil since the crisis. It is also possible that institutions have become more attuned to the nature of their cash investments, after learning about potential risks during the crisis.

It is also noteworthy that high institutional ownership in the presence of high minimum investment levels actually eliminates the impact of minimum investment on weekly flows. Specifically, the coefficients on INST[Q5]*MININV are almost identical to those on MININV. It is possible that

[22] We note that funds dominated by institutional investors–those in the top quintile (Q5)–have median investment minimums of $2.6 million, on average across their shareclasses.

[23] Consistent with our priors, larger funds have reduced flow volatility, as shown by the negative and significant coefficient on ASSETS. And, larger account size increases flow volatility (shown by a positive and significant coefficient on MININV), as each agent's trade decision can be expected to have a larger effect on total flow volatility.

[24] Recall that the coefficient on INST>90% is incremental to the coefficient on INST[Q5], since membership in the first group implies membership in the second.

the very large account minimums on a number of predominately institutional funds (see Table 3) make these investments comparatively less transactable. This result could also be driven by fund managers or institutional investors realizing that simultaneous large-scale transactions will impact the value of their shares, particularly in the absence of retail investors providing a buffer. Indeed, STW provide evidence that institutional investors are more likely to run during the 2008 crisis when there is a meaningful retail buffer in the same fund.

4.2.1. Insight into Factors Driving Asset Variation

While we have shown that institutional ownership is associated with greater week-to-week fund asset variation, we have not yet discussed the reasons. In Table 6, we document some of the factors driving this volatility. To achieve this, we run a series of daily time series regressions across six groups of funds, segregated by their level of institutional ownership. For each of these six groups, we aggregate fund assets, then take the aggregate percentage change in the group's assets on a daily basis (% daily flow). Then, we regress this on several factors of interest over the post-reform period (2010-2013), using a panel regression.

First, changes in overnight interest rates likely influence flows to/from prime funds by sophisticated institutional investors. Historically, prime funds tend to experience outflows when overnight repo rates spike above prime fund yields (Lyons, 1984; Collins and Mack, 1994). In such cases, institutional investors often elect to redeem out of MMMFs and invest directly in the repo market to earn a slightly higher yield.

To evaluate this influence on flow volatility, we move to a more granular (daily) analysis of flows and market conditions, compared to our weekly analysis of flow volatility of the last section. Specifically, we construct the daily change in the spread between each fund group's weighted average net yield and the overnight repo rate on general collateral (Δ(YIELD-REPO)). Note the positive and statistically significant coefficients on this measure for Q3 through Q5. And, the greater a fund's institutional ownership, the more sensitive its assets are to repo arbitrage trading.

To illustrate, for funds in the top quintile of institutional ownership, Q5, repo rates are about 3.1 basis points below MMMF yields, on average across all days in the sample. A one standard

deviation relative rise in repo rates is associated with outflows of about 0.15% of assets (5.5 * 0.029) today and 0.25% of assets (5.5 * 0.045) of assets tomorrow. While this is a simplification, at an annual rate, a daily change of 0.40% (0.15%+0.25%) amounts to 3.2% of fund assets. The influence of repo arbitrage trading is an even larger influence on flow volatility for funds with over 90% of assets held by institutions (INST>90%).

This table also confirms the strong influence of institutional ownership on fund flows during the U.S. debt ceiling crises of 2011 and 2013.[25] In these regressions, DEBTLIMIT is a dummy variable equaling one during the 5 business days preceding August 2, 2011 and October 17, 2013, and zero, otherwise. In aggregate, funds in the top quintile, Q5, experience outflows of nearly 1 percent (0.899) of assets on each of the 5 days preceding the resolution of a debt ceiling crisis! The size of these outflows is nearly twice those of funds in fourth quintile, Q4, again indicating a strong nonlinear impact of institutional ownership of MMMFs on flow behavior. To avoid uncertainties created by the federal debt ceiling impasse, some institutional investors reportedly moved liquid balances to demand deposit accounts at banks that had unlimited deposit insurance. In contrast, in unreported results, we find that predominately retail funds actually incurred inflows during these periods.

Finally, another factor driving asset variation among institutional funds is corporate tax payments. We compile total federal tax deposits, TAX, from the U.S. Treasury's Daily Treasury Statement. Regression results show that funds with greater institutional ownership experience heavier redemptions around corporate tax days. However, compared to repo arbitrage trading or the debt ceiling-related outflows, tax effects are less concerning, since MMMF managers can more easily predict these outflows (from past experience as well as "knowing their investors") and adjust their liquidity in advance.

4.3. Shareholder Concentrations Over Time

Institutional investors generate greater flow volatility and, as we will show, funds that serve institutional clients tend to hold more liquidity and maintain shorter maturities to absorb this volatility.

[25] In October 2013, another standoff between Congressional Republicans and Democrats (and President Obama) occurred over raising the debt ceiling.

This might create an incentive, either on the part of funds or their investors, to commingle institutional clients with retail clients. For example, a corporation might choose to transfer its prime assets from a fund dominated by institutional investors into a fund with more "stabilizing" retail investor types with the goal of achieving lower asset volatility and a lower liquidity ratio (and, thereby, possibly higher yield). After all, this was likely part of the rationale behind the industry's recommendation that funds post their shareholder concentrations on their website (MMWG, 2009). And, STW show that institutions pay attention to the level of retail shareholders and their actions: institutions were more likely to redeem in funds where significant levels of retail shareholders had redeemed the prior day.

To evaluate whether funds or investors have acted on incentives to mix together client types, we calculate Herfindahl concentration indexes for each prime fund over time. Results are shown in Figure 6. Presumably, if funds or investors were doing this commingling, we should see the concentration of retail versus institutional clientele decreasing over time. Eventually, all funds would start to reflect the market portfolio, which is 35% institutional and 65% retail (see Table 1). On a Herfindahl scale, the market portfolio corresponds to an index level of about 5,500.

There is no evidence that funds are converging toward the market portfolio. If anything, funds have become slightly more concentrated in whatever type of shareholder they predominately serve. Even funds that experienced heavy outflows during the 2008 crisis have maintained similar clientele concentrations, on average.[26]

[26] We have discussed this issue with industry experts. There are two likely explanations for this modest trend toward greater concentration. First, on the part of funds, changing the shareholder composition is not something that can be accomplished quickly nor is it an exact science. To shift shareholder bases, a fund's portfolio manager would usually need to work with its distributor, who would work through its wholesaler network. The distributor would devise a strategy to identify likely intermediaries that may have a large book of clients that meet the desired profile and then the wholesalers would work with these intermediaries to promote the particular fund to the target client base. In short, changing the investor composition is not easy and is likely to happen slowly over an extended period. On the investor side, it is possible that some institutional investors, such as corporate treasurers, do not focus much on client risk in their MMFs – instead, paying more attention to net yields and liquidity ratios. Furthermore, clientele information is typically not readily available to investors.

4.4. Institutional Ownership and Portfolio Concentration

4.4.1. Holdings of Sectors

In this section, we investigate how MMMFs with differing levels of institutional ownership vary in their holdings of portfolio securities. We begin with panel regressions across fund-years in the 2005-2013 period. In Table 7, we regress the percentage of fund assets invested in certain security types (e.g., U.S. Treasury securities) on our true institutional ownership quintile dummies. These holdings variables are calculated as annual averages of monthly holdings observations during a particular calendar year (from 2005 to 2013), regressed on dummy variables indicating a fund's level of institutional ownership as of the prior year-end. Since larger MMMF funds are more likely to have the economies-of-scale necessary to research certain credits (e.g., foreign banks), we control for the fund's logged average assets during the year (ASSETS). Year fixed effects are employed in all panel regressions.

The results indicate some degree of heterogeneity in holdings preferences across institutional ownership quintiles. Most notably, compared to funds with less than 3% institutional ownership (Q1 and Q2), funds with higher levels of institutional ownership tend to invest a greater proportion of their assets in repurchase agreements (repo) and bank time deposits. They also tend to invest less in Treasury securities and commercial paper, including asset-backed commercial paper. Extremely institutional funds (INST>90%) appear more likely to avoid asset-backed commercial paper than their closest peers, Q5. In results not shown, we determine that lower levels of ABCP holdings of the extreme institutional funds are only present during the crisis period of 2008-2009. Extreme institutional-owned funds likely shed exposures that were not highly liquid during this period.

In sum, the results suggest that funds with higher levels of institution ownership prefer to hold liquidity in short-dated collateralized repo than in Treasury securities. They are also more likely to allocate a portion of assets to time deposits (TDs), which are typically less liquid than CDs (TDs cannot be traded in secondary markets) but are also available at shorter tenors than CDs (the vast majority of TD issuance is on an overnight basis). Thus, TDs are often used as another form of daily liquidity, which helps explain the demand from institutionally-owned funds. Furthermore, since the repo supply often dries up by afternoon, funds that experience heavy flows late in the

day may be more likely to invest in TDs. In unreported tests, we find that this effect is strongest during the reform period (2010-2013), which indicates that this may be a technique for obtaining daily liquidity at slightly higher yield during a very low interest rate environment.

In a second set of results shown in Table 7, we run cross-sectional regressions, using the same explanatory variables, over May 2011, prior to the eurozone crisis in June. The dependent variable is the percentage of fund assets invested in eurozone banks, as of May 31, 2011. To demonstrate the value of our refined measure of institutional ownership (INST), we show alternative estimates using a less precise, but commonly employed, measure for institutional ownership (CRUDEINST). This is calculated as the portion of fund assets held in self-declared institutional shareclasses. Using a similar measure, Chernenko and Sunderam (2014) conclude that, in the period just before June 2011, prime funds were rewarded with greater assets (more inflows) for investing in securities issued by eurozone banks, and that this positive flow sensitivity is concentrated in funds with large institutional shareclasses. According to this hypothesis, if institutionally-owned funds face greater performance-flow incentives, we might expect these funds to invest more heavily in eurozone banks in order to boost yield.

However, this hypothesis is not supported by our data. At first glance, in column (9) of Table 7, there appears to be a marginally significant relationship between a fund's institutional ownership quintile (only for the most extreme institutional quintile) and its eurozone bank exposure. However, after controlling for a fund's size in column (10), this relationship falls apart. This result also holds when, instead of using binary variables for different degrees of institutional ownership, we use the percentage of a fund's assets held by institutions (INST), in column (11). In column (12), we employ the less precise measure of institutional ownership used in prior studies (CRUDEINST), that is, the fund's prospectus-reported shareclass type. Only now do we find a statistical relationship between fund's "institutional" percentage and its eurozone exposure.[27]

[27] This example demonstrates a problem in the literature. Institutional share classes of funds tend to be larger. At the same time, large funds tend to invest in higher yielding securities, such as those offered by foreign banks. This is because large funds are better able to devote resources to researching riskier credits. As a result, these factors – fund size and institutional ownership – are not fully disentangled in other academic studies.

4.4.2. Maturity and Liquidity of Holdings

Our earlier results showed that institutional ownership is positively correlated with daily asset variation. We might, therefore, expect that portfolio managers of funds that are majority owned by true institutions would hold greater portfolio liquidity, and would maintain lower average portfolio maturity.

In Table 8, we run regressions that are similar to the panel regressions shown in Table 7, except that the dependent variable now measures a fund's average liquidity or maturity over the year. The first dependent variable, "%Liquidity," is the percentage of fund assets that meet the SEC Rule 2a-7 definition of weekly liquid assets.[28] This variable is only available starting November 2010, when SEC Form N-MFP data became available. Next, "%Treasury" is the percentage of fund assets invested in U.S. Treasury securities. The third dependent variable, "% <7days," is the percentage of fund assets maturing in less than 7 days. Finally, WAM, is the weighted-average maturity of the fund's holdings. These dependent variables are measured as annual averages of month-end observations. In these panel regressions, we split the results into three periods: pre-crisis (2005-2007), crisis (2008-2009), and reform (2010-2013). We also run a set of cross-sectional regressions during the eurozone and U.S. debt ceiling crises. In the cross-sectional set of regressions, the dependent variable is measured as of the end of May, June, and July 2011, separately. In all regressions, we control for fund size. Also, in panel regressions, we include year fixed effects.

Funds with greater institutional ownership tend to maintain higher levels of weekly liquidity (%Liquidity). For example, compared to a fund in the bottom two quintiles of institutional ownership, a fund in the top two quintiles has 4.6-5.0% greater weekly liquidity, as a percentage of fund assets.[29]

Just before the start of the eurozone and U.S. debt ceiling crisis, highly institutional funds had 6% greater weekly liquidity than funds in the bottom two quintiles (see the column labeled "May 2011"). This liquidity appears to have been partly drawn down during the heavy outflows of

[28] The SEC's definition of "weekly liquidity" includes all securities maturing within 5 business days, U.S. Treasury securities, and U.S. agency securities maturing within 60 days.

[29] Interestingly, funds with extremely high institutional ownership (INST>90%) do not hold portfolios with significantly more liquidity than other funds in the top quintile. This suggests that there might be a maximum threshold of weekly liquidity that funds are willing to hold while competing with other prime funds and outside products on the basis of yield.

June and July, however. By July-end 2011, there is no statistical difference in the weekly liquidity ratios of highly institutional funds, compared to funds that are predominately retail owned. This finding demonstrates the importance of a portfolio manager accurately measuring a MMMFs needed liquidity prior to a market stress event.

Funds with greater institutional ownership also exhibit a clear preference for short-dated securities over other forms of liquidity, like U.S. Treasury securities. Compared to predominately retail funds, funds in the top quintile of institutional ownership had 6.7-6.9% more assets invested in securities maturing in less than 7 days (% <7days) during the pre-crisis and crisis periods. That number rises to 8.8% after the SEC's 2010 reforms (i.e., during the 2010-2013 period).

While extremely institutional funds (INST>90%) invest less in Treasury securities, they perhaps make up for that by maintaining lower WAMs than other funds in the top quintile. For example, compared to other Q5 funds during the 2010-2013 period, funds with over 90% of assets coming from institutions held 1.5% less of assets in Treasuries, but held securities with an average maturity of nearly 3 days less.

While most MMMFs maintain a well-laddered portfolio maturity strategy, MMMFs in the top quintile of institutional ownership are more likely to employ a "barbell" maturity strategy in their portfolio holdings. Table 9 shows the average proportion of portfolio securities, by value, that fall within each maturity segment across funds during the period 2011-2013.[30] Funds are grouped based on the percentage of shares held by true institutions, with Q5 and Q1 being the highest and lowest institutional ownership quintiles, respectively. To ease interpretation, in Panel B, we force fund groups to be mutually exclusive. Therefore, we remove funds that are over 90% institutional from the top quintile, allowing these extremely institutional-held funds to be in their own unique group.

Panel A shows that securities in the extreme maturity segments–less than 7 days, less than 30 days (but greater than 7 days), and greater than (or equal to) 120 days–tend to be held in larger

[30] We exclude the small level of holdings of U.S. Treasurys and Agency securities by prime funds from these computations, as we wish to focus on securities with credit risk. Also, institutional holdings are based on the ICI's shareholder survey at the end of the prior year. Finally, to compare the statistical equivalence of means between institutional ownership groups, we use Duncan's multiple range test (critical alpha=0.05). Means with the same letter beside them are not significantly different. Also, the statistically largest mean in each bucket is in bold, while the smallest average is shaded.

proportions than maturity segments between these short- and long-maturity extremes. Further, note that this barbell strategy is more pronounced for Q5, which holds substantially greater levels of < 7 day and $>= 120$ day securities than Q1 through Q3 (these differences are, for the most part, statistically significant). Interestingly, those funds with the highest level of true institutional ownership (INST>90%) tend to shift about 3.5% of holdings from $>= 120$ days to < 7 days, giving them a less pronounced barbell maturity structure than Q5 (but still greater than Q3). The results also show that these funds hold greater levels of securities maturing within 30 days, consistent with holding precautionary liquidity because of the existence of "hot money" investors, but continue to hold less in the 7-60 day window.

4.5. Institutional Ownership and Yield-Maximizing

Since the 2014 Amendments will lead to a complete segregation of true institutional investors from true retail investors, it is important to understand whether this will alter competitive incentives between funds and, therefore, the portfolio choice of the VNAV funds that will cater to true institutions. While the combined effect of a variable NAV and segregation of investor types is difficult to predict, we can lend some insight into the segregation part of this change. Whether the variable NAV provision will offset what we find will be a matter of great interest for future research.

It is well-known by the industry and academics (e.g., Bair, 2013; Scharfstein, 2012; STW) that institutional investors are more likely to watch markets and react by moving large amounts of money in and out of funds (the so-called "hot-money" effect). This has also been demonstrated in our paper by the tendency of true institutions to redeem from prime funds during crisis periods, as well as their trading patterns when repo rates rise above prime fund yields. We have also observed that institution-dominated funds charge lower expenses and have higher net yields (but only marginally higher gross yields than retail-dominated funds).

All of these observations suggest that funds might indeed be subject to tournament-like incentives, such that funds with the highest net yields subsequently garner more institutional assets. In this section, we set out to uncover whether institutional investors actively shift between prime

funds based on yield incentives (i.e., "chasing yield"). If so, this could imply that future 100% institutional VNAV funds (mandated by October 2016) will be pushed to increase portfolio yield (either through boosting risk or reducing expenses) in order to attract more assets (to benefit from economies-of-scale in the costs of running a fund).

We begin with a series of classic flow-performance regressions in Table 10. These are panel regressions across fund-months over three periods. The first period is the pre-crisis period (2005-2007). The second period is the crisis period (2008-2009). The last period is the reform period (2010-2013). The dependent variable (%FLOW) is the fund's net new cash flow over the month, as a percentage of its prior month-end assets. We group prime MMMFs based on their prior year-end institutional ownership percentile. For example, the first column consists of funds in the first two quintiles (INST[Q1,Q2]). Funds in this group are comprised, at most, of 3% true institutional owners. The fifth column consists of prime funds having at least 90% of their shares held by institutions. The key explanatory variables are the current and lagged month-over-month change in the fund's *net* yield (non-parametric) percentile rank (ΔNYR); this change in percentile ranking captures the shift in yield, relative to all prime funds at the same time. In all regressions, we control for, but do not show, the fund's net yield percentile rank (in levels) at time t-2, gross yield level at t-1, change in *gross* yield at t (to control for changes in the fund's riskiness), logged total net assets at time t-1, minimum investment requirement as of March of the current year, and the lagged dependent variable. Month and fund fixed effects are employed in all regressions.

The results show evidence of a substantial flow-performance effect during the pre-crisis period, and this effect is closely related to a fund's institutional ownership. For example, funds that have over 90% of their assets deriving from institutional investors (INST>90%) grow their assets by 0.7% over the month following a (relatively small) 1 percentile increase in net yield rank. As another example, a fund in the top quintile of institutional ownership (INST(Q5]) that increases its yield rank by 5 percentiles grows its assets by (5*0.358) 1.8% that same month. Note, again, that this flow/yield sensitivity is highly nonlinear as institutional ownership increases from Q1/Q2 to Q5.

Over time, however, institutional ownership appears to become less deterministic of how fund flows respond to performance. During the crisis period of 2008-2009, a fund in the top quintile of

institutional ownership (INST(Q5]) that increases its yield rank by 5 percentiles grows its assets by (5*0.089) 0.45% that same month, compared to 1.8% during the pre-crisis period. By the time the SEC's 2010 reforms are implemented, the flow/yield sensitivity does not appear to vary across institutional ownership quintiles.

We suspect that flow-performance sensitivity is not only a function of institutional ownership but also of the amount of dispersion in prime funds' net yields, as well as yields on competing cash investments, such as treasuries, repos, and bank deposits. Figure 7 helps to visualize how these factors coincide. First, we plot average prime fund net yields by institutional ownership group, monthly over 2005-2013. We also plot the risk-free rate (3-month Tbill). On the right axis, we plot the dispersion in prime fund net yields (STDNY). This is calculated as the cross-sectional standard deviation in net yields across all prime funds by date.

Prime fund net yields mostly track the risk-free rate until mid-2007. During this period, prime funds in the top quintile of institutional ownership, Q5, offer net yields that are about 23 basis points higher, on average, than funds with no institutional investors, Q1. Fund yields rise much further above the 3-month T-bill rate in the second part of 2007.[31] At the same time in late-2007, the cross-sectional dispersion in fund yields begins to spike. Before this time, dispersion in net yields is fairly constant, about 30 basis points per year, despite rising interest rates. By September 30th of 2008, net yield dispersion reaches 63 basis points. At this point, funds in the top quintile of institutional ownership have net yields that are 34 basis points higher than funds in the bottom quintile. Net yield dispersion falls from 63 basis points back to 30 basis points by April 2009 and, in early 2010, it largely flattens to below 10 basis points per year. Similarly, from 2010-2013, the average net yield differential between funds in the top and bottom quintiles of institutional ownership is just 7 basis points.

We attribute this decline in the dispersion of fund net yields to the near-zero fixing of the Treasury yield curve in the short-maturity sector resulting from monetary easing in the U.S. And, with the tighter liquidity and maturity restrictions of the 2010 Amendments to Rule 2a-7, it is

[31] This finding is consistent with Kacperczyk and Schnabl (2013), who argue that MMFs experienced an expansion in their risk-taking opportunities, writing: "after the run on asset-backed commercial paper conduits in August 2007, many investors became aware that collateral and liquidation values underlying money market instruments had declined due to the U.S. subprime mortgage crisis, which then prompted a repricing of risks in money markets."

difficult for funds to attract institutional investors by differentiating on yield in the current interest rate environment. To help determine whether the lack of dispersion in prime MMMF yields is having a temporal effect on the flow/yield sensitivity and its relation to institutional ownership, in Table 11, we rerun the previous regression specification, now using the full 2005-2013 (monthly) period and adding an interaction variable between changes in a fund's net yield rank (ΔNYR) and the same month-end amount of cross-sectional dispersion in prime fund yields (STDNY). The idea is that a rise in yield rank will not mean much if it corresponds to a very trivial yield advantage over other other funds. As a side note, to show that flows respond positively to net yields and not gross yields–as we would expect–we also show the estimates for a fund's gross yield in differences and levels (ΔGY and GY). The same controls as before are included, along with the date and fund fixed effects.

The results in Panel A indicate that there is a strong flow-performance sensitivity in funds with greater institutional assets, but only when there is a high level of cross-sectional yield dispersion. The coefficients on the interaction terms are usually positive and significant for funds with greater institutional ownership, and, again, its economic magnitude is non-linear as we progress from Q1/Q2 to Q5. In Panel B, we repeat the regression only now we interact changes in fund net yields with date fixed effects (not shown, for brevity). We do this to ensure that our results (i.e., the estimates for ΔNYR*STDNY) are indeed caused by changes in net yield dispersion and not by some unidentified time trend. We lose a number of degrees of freedom doing this; however, for the most part, the results hold: it is not a time trend, rather, it is the dispersion in fund yields that matters for the flow/yield sensitivity.

Thus, it appears that the tighter restrictions posed by the 2010 Amendments, in combination with the current (almost) zero interest rates in the short end of the yield curve, have weakened the ability of funds to boost net-yields in order to attract institutional investors from other funds. In the current environment, institutional prime funds appear to be competing primarily with repo rates, bank deposits, and other investment products, rather than with each other. However, once short rates and the slope of the yield curve and credit term structure increase, it is possible that MMMFs catering primarily to institutional investors will again compete on yield to attract flows (although

they will be constrained to an unknown extent by the tighter 2010 Amendment restrictions).

5. Conclusion

This paper uses a new dataset to study the cross-sectional concentration of true institutional investors in prime money market mutual funds (MMMFs). We find that institutions are concentrated in a minority of funds, and that this concentration will only increase in response to the recent 2014 Amendments to Rule 2a-7. Our study indicates that funds that are predominantly held by true institutions, while holding much higher levels of liquidity since the 2010 Amendments, still tend to exhibit greater outflows during market stress events, and tend to use different portfolio strategies (such as holding more repo and bank-issued securities) than funds held predominantly by retail investors. Further, we find that institutions shift assets in order to maximize yield, although the ability for prime funds to differentiate on yield is, for the time-being, curtailed.

We also note that a different type of risk may also be present. If the effect of the 2014 Amendments is to shift institutional money from prime MMMFs to government MMMFs, there may be a significant impact on short-term interest rates. For instance, Ho, Iborg, and Roever (2014) estimate that if only $300 billion out of our estimated $500 billion in prime institutional assets were to shift to government MMMFs, "This would boost the current balances of government institutional MMMFs to $1.0tn, a level last seen in June 2009. At that time, we estimate that the outstanding stock of investable government securities was $6.88tn. Today, that number has fallen to $6.12tn. In other words, using June 2009 as a proxy of how much government supply is needed to meet $1.0tn of government MMMF demand, all else equal there's a deficiency of $761bn in eligible government securities.... Given how constrained bills and these other asset classes are already trading currently, an increase of this magnitude could keep these rates structurally low even in a rising rate environment." Alternatively, even if the bulk of institutional assets remain in prime MMMFs, our results indicate that a greater concentration of institutional investors in certain funds (coupled with the pre-existing liquidity floors on all prime funds) will spur higher levels of liquidity per institutional dollar invested. This scenario could also contribute to the demand for Treasuries, Agencies, and repo.

6. Appendices

6.1. Appendix A. The 2010 Amendments to Rule 2a-7

The 2010 Amendments, effective on May 5, 2010, have imposed the following requirements on money market mutual funds:

1. Reduce holdings of "second tier securities" (those short-term fixed income securities that are lower than top-rated by ratings agencies or, if unrated, deemed equivalent by the fund's board) from 5% to 3%, and reduce holdings of second tier securities of a single issuer from (the greater of) 1% of total asset (or $1 million) to 0.5% of total assets; also, second tier securities must have a remaining maturity less than or equal to 45 days;

2. Require fund boards to identify four nationally recognized statistical rating organizations ("NRSROs") and to evaluate the appropriateness of their assigned ratings at least once per year;

3. Remove the requirement that any asset-backed security must be rated by at least one NRSRO to be eligible for holding by a money fund;

4. Reduce the maximum weighted average maturity from 90 to 60 days and the weighted average life (which includes adjustable rate securities) to 120 days;

5. All taxable money funds must hold at least 10% of total assets in "daily liquid assets" (assets from which cash can be demanded upon sale by the fund within one day), and all money funds must hold at least 30% in "weekly liquid assets;"

6. Require fund management to "know your clients" to assess the potential volatility of fund flows, and to adjust upward the liquidity of the fund (from the minimums in #5) accordingly, if necessary;

7. Require the board of each money fund to adopt procedures for periodic stress testing of the fund's portfolio, and its ability to maintain a stable net asset value per share in the presence of certain hypothetical events, including:

   a. Increase in short-term interest rates;

   b. Increase in shareholder redemptions;

   c. Downgrade of or default on portfolio securities;

d. Widening or narrowing between yields on an appropriate overnight interest rate and portfolio securities held by the fund;

8. Limits repurchase agreements to those collateralized by cash items or Government securities in order to obtain special treatment of those investments under the diversification provisions of rule 2a-7;

9. Requires the board of a fund to evaluate the counterparty risk for each repurchase agreement;

10. Report portfolio holdings for the end of each month to the SEC and on a website available to the public, by the 5th day of the following month (more detailed information will be provided to the SEC, and will be made available to the public—through EDGAR—60 days after the end of the given month);

11. Allow a fund that has "broken the buck" (or is at imminent risk of doing so) to suspend redemptions to allow for the orderly liquidation of fund assets,

12. Require that a fund have the ability to sell or to redeem shares at the so-called "shadow NAV" rather than the stable $1 per share if necessary (the board will still have the prerogative of determining when and whether this approach is needed);

13. Allows a money fund to sell defaulted securities to an affiliated party (previously disallowed);

6.2. Appendix B. Description of Shareholder Dataset

This appendix provides further information on the Investment Company Institute's (ICI) Shareholder Dataset used in this study.

The mutual fund industry and its transfer agents use what are called "social codes" to categorize shareholder types. These social codes classify different types of investor accounts, such as 529 college savings plans and defined benefit retirement accounts. Different transfer agents have different classification schemes, thus, the data coming to the ICI from the transfer agents is modified in order to fit a unified classification system. The final dataset tells us that the high-level category of "fiduciary accounts" consists of subcategories such as "estates" and "inheritance trusts." Although

we only know aggregate shareclass assets in the higher-level categories (e.g., "retirement plans"), knowledge of the underlying subcategories (e.g., "401(k) accounts") helps to guide our process of separating high-level shareholder types into either truly institutional or retail. In the end, we chose to classify shares held by these investor types as being truly institutional in nature: nonfinancial companies, financial companies, nonprofits, state and local governments, other funds, and "other" institutions. Within these six categories, the vast majority of assets come from financial and nonfinancial companies, which are clearly truly institutional. Our retail categories include: retirement plans, 529 plans, fiduciary accounts, brokers dealer/omnibus accounts, and individual investor accounts. While these categorizations may not be perfect, conversations with industry experts lead us to believe that this approach, given the limitations of the categorizations, produces the lowest asset misclassification.

Since this is survey data, it has the potential for measurement error. As of 2013, the survey captures 95% of prime MMMF dollar assets and 81% of shareclasses, by number, excluding estimates. Since transfer agents often charge funds to return information on the types of shareholders in their funds, in any given year, a fund may choose not to acquire the data. When a fund does not respond to the survey at the end of a particular year, the ICI estimates its responses by interpolating between prior and future responses or, until a future response is available, using the prior response. In the rare instances when a fund has never reported, the ICI estimates the assets belonging to each shareholder-type in each shareclass of the fund based on responses from the fund's peer group. Once these estimates are incorporated, 100% of dollar assets and numbers of shareclasses are represented.

Our study uses the full dataset, including estimates. We do this for a two reasons. First, after omitting estimates, we find that investor make-up changes very little over time, meaning the ICI's estimates are likely to be fairly accurate. Second, since it is mostly small funds' responses that must occasionally be estimated, omitting the estimates could result in a selection bias, if small funds behave differently than large funds. Our main results are robust to excluding these estimates, however. In sum, we believe this to be the best dataset in existence on MMMF shareholders.

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Table 1: The Distribution of Institutional Onwership Across Prime Funds

Year	20th pctl	40th pctl	median	60th pctl	80th pctl	Mean	Std. dev.	Aggregate
2005	0.0	5.1	12.0	19.4	42.6	22.7	28.6	35
2006	0.0	4.8	11.0	19.0	44.5	22.7	28.6	35
2007	0.0	3.5	9.3	17.2	44.4	22.0	28.7	34
2008	0.0	3.0	6.6	17.1	45.1	21.5	28.6	33
2009	0.0	2.4	5.3	15.6	40.0	20.4	27.6	35
2010	0.0	2.4	6.1	14.9	43.0	21.6	29.4	35
2011	0.0	2.1	5.0	14.0	41.2	21.3	30.0	33
2012	0.0	2.5	7.9	16.9	47.5	22.8	30.2	33
2013	0.0	2.7	6.3	15.8	46.5	22.0	30.0	35

Table 2: Characteristics of Funds by Institutional Ownership, 2013

Institutional	TNA ($ bil)			Min. investment ($ thou)		
ownership	mean	std. dev	median	mean	std. dev	median
INST[Q1]	1.0	2.6	0.2	0.6	1.3	0.0
INST(Q2]	10.8	30.6	1.1	421	1,890	2.5
INST(Q3]	7.8	11.4	2.1	873	1,981	7.7
INST(Q4]	8.5	14.8	2.3	5,149	10,169	34
INST(Q5]	11.2	19.8	4.1	55,702	176,839	2,623
INST>90%	16.4	30.5	7.6	12,746	16,184	5,822

Institutional	Treasury holdings (%)		Maturing < 7 days (%)		WAM	
ownership	mean	std. dev	mean	a	mean	std. dev
INST[Q1]	5.2	5.7	40.0	15.1	42.8	9.4
INST(Q2]	4.6	6.1	37.4	14.7	44.1	8.7
INST(Q3]	4.8	5.1	41.3	16.4	42.8	10.0
INST(Q4]	6.1	7.6	42.9	15.5	39.9	12.6
INST(Q5]	4.1	4.7	44.8	13.7	41.0	11.5
INST>90%	4.0	5.7	47.5	20.2	37.9	15.0

Institutional	Gross yield (%)		Charged Expenses (%)		Net yield (%)	
ownership	mean	std. dev	mean	std. dev	mean	std. dev
INST[Q1]	0.19	0.06	0.19	0.06	0.01	0.01
INST(Q2]	0.20	0.06	0.19	0.06	0.01	0.02
INST(Q3]	0.22	0.05	0.19	0.05	0.03	0.03
INST(Q4]	0.20	0.05	0.17	0.04	0.03	0.04
INST(Q5]	0.21	0.04	0.16	0.04	0.05	0.03
INST>90%	0.21	0.05	0.15	0.03	0.06	0.02

Table 3: Institutional Ownership and Prime Fund Flows during Market Crises

These are cross-sectional regressions across prime MMFs studying the influence of institutional ownership on fund flows during three periods of heavy outflows. The periods studied include the 3-weeks surrounding the failure of Lehman (Sep 9-30, 2008), the 3-weeks when prime MMFs experienced heavy outflows due to their eurozone bank exposures (Jun 14-Jul 5, 2011), and the 3-week period preceding the resolution of the U.S. debt ceiling crisis (Jul 12-Aug 2, 2011). The dependent variable ($\%\triangle ASSETS_f$) is the percentage change in a fund's assets over the period examined. The key explanatory variables are various permutations of a fund's institutional ownership as of the prior year-end. INST is the percentage of fund assets coming from true institutional investors. For each prior year-end, we split this variable into three binary variables equaling one if the fund's institutional ownership is within the third, forth, or fifth quintile. These coefficients may be interpreted as effects relative to a fund with less than 3% institutional ownership (i.e., a fund in the bottom two quintiles). INST>90% is a binary variable equaling one if at least 90% of fund assets are held by institutions. Controls not shown include the fund's logged total net assets as of the start of the period and the fund's minimum investment requirement (in $ millions) as of end-March of the year. We also control for the fund's riskiness using its maturity (WAM), weekly liquidity, and yield as of the beginning of the period examined (also not shown). In designated specifications we show standardized results in order to facilitate comparison. Robust standard errors are shown in parentheses. Estimates with a p-value below 0.10, 0.05, and 0.01 are marked with a *, **, and ***, respectively.

	Dependent variable: $\%\Delta ASSETS_f$								
	Lehman Crisis			Eurozone Crisis			U.S. Debt Ceiling		
Regressors:	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Constant	40.611**		43.952***	-2.296		-2.540	14.101***		13.369***
	(16.642)		(15.030)	(5.841)		(5.761)	-4.609		-4.495
INST	-0.203***	-0.309***		-0.052**	-0.188**		-0.060***	-0.218***	
	(0.041)	(0.063)		(0.022)	(0.079)		(0.018)	(0.065)	
INST(Q3]			-1.177			-1.241			0.979
			(1.988)			(1.084)			(1.196)
INST(Q4]			-9.313***			-4.638**			-1.596
			(2.612)			(1.968)			(1.659)
INST(Q5]			-19.666***			-3.510**			-3.720**
			(3.819)			(1.673)			(1.642)
INST>90%			5.148			-2.476			-0.943
			(6.076)			(3.013)			(2.543)
Standardized Est.:	N	Y	N	N	Y	N	N	Y	N
Risk Controls:	Y	Y	Y	Y	Y	Y	Y	Y	Y
Adj. R-squared	0.34	0.34	0.37	0.12	0.12	0.13	0.25	0.25	0.24
N	227	227	227	190	190	190	190	190	190

Table 4: Shareholder Ownership and Prime Fund Flows during Market Crises

These are cross-sectional regressions across prime MMFs studying the influence of shareholder type on fund flows during three periods of heavy outflows. The periods studied include the 3-weeks surrounding the failure of Lehman (Sep 9-30, 2008), the 3-weeks when prime MMFs experienced heavy outflows due to their eurozone bank exposures (Jun 14-Jul 15, 2011), and the 3-week period preceding the resolution of the U.S. debt ceiling crisis (Jul 12-Aug 2, 2011). The dependent variable ($\%\triangle ASSETS_f$) is the percentage change in a fund's assets over the period examined. The key explanatory variables measure the portion of fund assets owned by different types of insitutional investors (Panel A) and retail investors (Panel B) as of the prior year-end. In Panel A, coefficients may be interpreted as effects relative to being 100% retail owned. In Panel B, coefficients may be interpreted as effects relative to being 100% institution owned. Controls not shown include the fund's logged total net assets as of the start of the period and minimum investment requirement (in $ millions) as of end-March of the year, maturity (WAM), weekly liquidity, and gross yield as of the beginning of the period examined. In all specifications we show standardized results in order to facilitate comparison. Robust standard errors are shown in parentheses. Estimates with a p-value below 0.10, 0.05, and 0.01 are marked with a *, **, and ***, respectively.

Panel A: Institutional Shareholder Types

	Dependent variable: $\%\Delta ASSETS_f$		
	Lehman Crisis	Eurozone Crisis	U.S. Debt Ceiling
Regressors:	(1)	(1)	(1)
NONFINANCIAL	-0.218***	-0.250***	-0.188***
	(0.060)	(0.083)	(0.071)
FINANCIAL	-0.218***	-0.023	-0.090
	(0.060)	(0.059)	(0.060)
NONPROFIT	0.001	0.036	-0.070
	(0.037)	(0.058)	(0.086)
STATE/LOCAL	-0.194***	-0.089	0.053
	(0.053)	(0.075)	(0.040)
OTHERFUNDS	-0.034***	0.046***	-0.060*
	(0.006)	(0.012)	(0.034)
OTHERINST	-0.001	-0.018	-0.035
	(0.018)	(0.019)	(0.030)
Standardized Est.:	Y	Y	Y
Controls:	Y	Y	Y
Adj. R-squared	0.37	0.14	0.24
N	204	182	182

Panel B: Retail Shareholder Types

	Dependent variable: $\%\Delta ASSETS_f$		
	Lehman Crisis	Eurozone Crisis	U.S. Debt Ceiling
Regressors:	(1)	(1)	(1)
FIDUCIARY	0.209***	0.143*	0.144*
	(0.073)	(0.080)	(0.075)
RETIREMENT	0.240***	0.193***	0.126**
	(0.045)	(0.071)	(0.052)
529PLAN	0.094***	0.004	0.068
	(0.027)	(0.020)	(0.043)
RETAILBROKER	0.217***	0.057	0.128
	(0.066)	(0.098)	(0.078)
RETAILINDIV	0.399***	0.258***	0.307***
	(0.072)	(0.094)	(0.081)
Standardized Est.:	Y	Y	Y
Controls:	Y	Y	Y
Adj. R-squared	0.36	0.13	0.25
N	204	182	182

Table 5: The Influence of Institutional Ownership on Fund Flow Volatility

These are panel regressions across fund-years over the period 2005-2013. We split our results into three subperiods: the pre-crisis period (2005-2007), the financial crisis period (2008-2009), and the period following the adoption of the SEC 2010 Reforms to Rule 2a-7 (2010-2013). The dependent variable is a fund's weekly asset volatility ($ASSETVOL_{f,t}$) over the year. It is measured as the standard deviation in a fund's weekly percentage change in assets over the 52 weeks within each year. This measure is logged to reduce outliers. The key explanatory variables are various permutations of a fund's institutional ownership as of the prior year-end. For each prior year-end, we split a fund's institutional ownsership (as a percentage of its assets) into three binary variables equaling one if the fund's institutional ownership is within the third, forth, or fifth quintile. These coefficients may be interpreted as effects relative to a fund with less than 3% institutional ownership (i.e., a fund in the bottom two quintiles). INST>90% is a binary variable equaling one if at least 90% of fund assets are held by institutions. Controls include the fund's logged average weekly total net assets during the year (ASSETS) and the fund's minimum investment requirement (in $ millions) as of end-March (MININV). To see whether institutional ownership only matters when account minimums are large, we interact MININV with the fund's institutional ownership quintile. Year fixed effects are employed in all regressions. Robust standard errors are shown in parentheses. Estimates with a p-value below 0.10, 0.05, and 0.01 are marked with a *, **, and ***, respectively.

	Dependent Variable: $ASSETVOL_{f,t}$								
	Pre-crisis (2005-2007)			Crisis (2008-2009)			Reform (2010-2013)		
Regressors	(1)	(2)	(2)	(1)	(2)	(2)	(1)	(2)	(2)
Constant	1.793***	1.790***	1.902***	1.209***	1.208***	1.336***	1.390***	1.374***	1.448***
	(0.193)	(0.193)	(0.191)	(0.147)	(0.148)	(0.144)	(0.144)	(0.144)	(0.138)
INST(Q3]	0.103	0.103	0.036	0.076	0.076	0.035	-0.002	-0.005	-0.073
	(0.106)	(0.106)	(0.102)	(0.107)	(0.107)	(0.103)	(0.099)	(0.099)	(0.099)
INST(Q4]	0.484***	0.483***	0.526***	0.623***	0.623***	0.628***	0.761***	0.745***	0.796***
	(0.107)	(0.107)	(0.108)	(0.097)	(0.097)	(0.099)	(0.093)	(0.093)	(0.093)
INST(Q5]	1.002***	0.992***	1.089***	1.141***	1.134***	1.208***	0.993***	0.943***	1.017***
	(0.097)	(0.098)	(0.097)	(0.105)	(0.108)	(0.108)	(0.085)	(0.085)	(0.086)
INST>90%	-0.168	-0.170	-0.179	-0.113	-0.109	-0.139	0.232**	0.265**	0.265**
	(0.126)	(0.126)	(0.133)	(0.142)	(0.142)	(0.152)	(0.113)	(0.113)	(0.121)
INST(Q3]*MININV			0.075*			-0.035			0.001
			(0.044)			(0.034)			(0.034)
INST(Q4]*MININV			-0.132***			-0.109***			-0.179***
			(0.034)			(0.027)			(0.018)
INST(Q5]*MININV			-0.147***			-0.124***			-0.180***
			(0.033)			(0.027)			(0.018)
INST>90%*MININV			-0.0002			0.002			0.00001
			(0.0004)			(0.001)			(0.001)
ASSETS	-0.141***	-0.140***	-0.164***	-0.104***	-0.104***	-0.125***	-0.128***	-0.126***	-0.144***
	(0.024)	(0.024)	(0.024)	(0.019)	(0.019)	(0.019)	(0.018)	(0.017)	(0.017)
MININV		0.0003	0.147***		0.0001	0.124***		0.001***	0.181***
		(0.0002)	(0.033)		(0.0003)	(0.027)		(0.0002)	(0.018)
Adj. R-squared	0.17	0.17	0.23	0.28	0.28	0.32	0.24	0.24	0.28
N	603	603	603	416	416	416	692	692	692

Table 6: Institutional Ownership, Repo Arbitrage, and Tax Payments

These are time-series regressions exploring whether funds with greater institutional ownership are subject to more daily repo arbitrage trading over the post-reform period (2010-2013). We group prime MMFs into 5 quitiles based on their prior year-end institutional ownership percentile. We make a sixth group consisting of prime MMFs with at least 90% of fund assets held by institutions. For each of these six groups, g, we aggregate fund assets and take the aggregate percentage change in the group's assets ($\%\triangle ASSETS_{g,t}$) on a daily basis. We also calculate the asset-weighted average net yield of funds within each of the six groups. The key explanatory variable is the daily change in the spread between each fund group's average yield and the overnight repo rate on general collateral, $\triangle(YIELD - REPO)_{g,t}$. A positive coefficient signals that funds experience outflows on days when repo rates rise relative to fund yields. We also examine the influence of the daily change and level of the Markit iTraxx 5-year CDS premium on an index of European financials, $CDSEUROPE$, the average CDS premiums of the five largest U.S. banks, $CDSUSA$ (intended to help capture risk of investments in eurozone or U.S. banks), total federal tax deposits, TAX, which we compiled from the U.S. Treasurys Daily Treasury Statement, and the yield on three-month Treasury bills, Rf. To ensure that our results are not soley due to repo rate spikes around U.S. debt ceiling crises, we use a dummy variable ($DEBTLIMIT_t$) to mark the 5 days preceeding the Aug 2, 2011 and Oct 17, 2013. Finally, we include the lag of the dependent variable, $\%\triangle ASSETS_{g,t-1}$, and the lag of the fund group's logged aggregate assets, $LOGASSETS_{g,t-1}$.

	Dependent variable: $\%\Delta ASSETS_{g,t}$ by institutional ownership group					
Regressors	INST[Q1]	INST(Q2]	INST(Q3]	INST(Q4]	INST(Q5]	INST>90%
Constant	1.441	0.690*	2.991*	5.100**	18.157***	-1.732
	(2.019)	(0.402)	(1.574)	(2.272)	(4.687)	(1.204)
$\Delta(YIELD\text{-}REPO)_{g,t}$	-0.002	-0.002	0.009***	0.038***	0.045***	0.049***
	(0.004)	(0.003)	(0.003)	(0.009)	(0.010)	(0.017)
$\Delta(YIELD\text{-}REPO)_{g,t-1}$	-0.014***	-0.008***	-0.003	0.016**	0.029***	0.041**
	(0.004)	(0.003)	(0.003)	(0.008)	(0.009)	(0.016)
$(YIELD\text{-}REPO)_{g,t-2}$	-0.006***	-0.004**	-0.003	0.001	0.005	0.007
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.009)
$\Delta CDSEUROPE_{t}$	-0.002	0.002	-0.001	0.002	-0.009**	-0.006
	(0.002)	(0.002)	(0.001)	(0.003)	(0.004)	(0.007)
$CDSEUROPE_{t-1}$	-0.000	0.001**	-0.001	0.000	-0.001	0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)
$\Delta CDSUSA_{t}$	0.003	-0.005*	-0.002	-0.002	0.007	0.016*
	(0.003)	(0.003)	(0.002)	(0.004)	(0.005)	(0.009)
$CDSUSA_{t-1}$	0.001	-0.001**	0.001	-0.000	0.001	-0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
TAX_{t}	0.001	-0.001	-0.007***	-0.030***	-0.037***	-0.048***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.005)
TAX_{t-1}	0.009***	0.005***	0.006***	0.009***	0.008**	0.007
	(0.001)	(0.001)	(0.001)	(0.003)	(0.004)	(0.005)
ΔRf_{t}	-0.014	-0.003	0.007	-0.002	0.025	-0.007
	(0.010)	(0.008)	(0.009)	(0.019)	(0.022)	(0.039)
Rf_{t-1}	-0.001	-0.003	-0.001	0.007	0.018**	0.004
	(0.003)	(0.003)	(0.003)	(0.005)	(0.007)	(0.009)
$DEBTLIMIT_{t}$	0.166**	0.144***	-0.077	-0.471**	-0.899***	-0.873*
	(0.083)	(0.044)	(0.072)	(0.219)	(0.321)	(0.502)
$\%\Delta ASSETS_{g,t-1}$	0.194***	-0.396**	-0.048	-0.139***	-0.058	-0.135***
	(0.044)	(0.179)	(0.036)	(0.044)	(0.038)	(0.036)
$LOGASSETS_{g,t-1}$	-0.146	-0.054*	-0.230*	-0.390**	-1.376***	0.172*
	(0.203)	(0.030)	(0.126)	(0.182)	(0.362)	(0.099)
Adj. R-squared	0.12	0.17	0.09	0.20	0.22	0.12
N	985	985	985	985	985	985

Table 7: The Influence of Institutional Ownership on Prime Fund Portfolio Holdings

These are panel and cross-sectional regressions across prime MMFs over specified periods. Dependent variables measure the percentage in fund assets invested in certain security types (e.g., domestic and foreign bank CDs). In panel regressions, dependent variables are calculated as annual averages of monthly observations. In cross-section, the dependent variable is the percentage of fund assets invested in eurozone banks as of May 31, 2011 (just before the worsening of the eurozone crisis). The key explanatory variables are various permutations of a fund's institutional ownership as of the prior year-end (INST). For each prior year-end, we split a fund's institutional ownership (as a percentage of its assets) into three binary variables equaling one if the fund's institutional ownership is within the third, forth, or fifth quintile. These coefficients may be interpreted as effects relative to a fund with less than 3% institutional ownership (i.e., a fund in the bottom two quintiles). INST>90% is a binary variable equaling one if at least 90% of fund assets are held by institutions. Since large funds are more likely to have the economies of scale necessary to research certain credits (e.g., foreign banks) we control for the fund's logged average assets during the year (ASSETS). Finally, to demonstrate the importance of using a fund's true institutional ownership (INST), we calculate a crude, but commonly employed, measure for institutional ownsership: the portion of fund assets held in institutional share classes (CRUDEINST). Year fixed effects are employed in all panel regressions. Robust standard errors are shown in parentheses. Estimates with a p-value below 0.10, 0.05, and 0.01 are marked with a *, **, and ***, respectively.

Time period:	All (2005-2013)								May 2011			
Dep. Var.:	*%Treasury*	*%Agency*	*%Repo*	*%Time Dep.*	*%CP*	*%ABCP*	*%CD*	*%CD*	*%Eurozone*			
Regressors:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	5.203***	6.745***	12.835***	3.140***	38.726***	10.326***	16.312***	16.089***	13.570***	13.317***	12.284***	11.678***
	(0.495)	(1.017)	(1.075)	(0.470)	(1.573)	(0.853)	(0.963)	(1.087)	(1.675)	(1.502)	(0.956)	(1.048)
INST(Q3]	-0.210	0.523	1.049	0.182	0.008	-1.085	-0.676	1.457*	-0.057	-1.450		
	(0.316)	(0.844)	(1.006)	(0.233)	(1.375)	(0.816)	(0.766)	(0.818)	(2.136)	(2.007)		
INST(Q4]	-0.040	2.238**	2.955***	0.746***	-4.531***	-2.756***	-0.353	1.462*	1.373	-0.221		
	(0.303)	(0.887)	(0.928)	(0.233)	(1.317)	(0.821)	(0.739)	(0.794)	(2.149)	(1.885)		
INST(Q5]	-0.533*	0.686	2.781***	2.936***	-7.789***	-1.526	1.164	5.877***	4.134*	0.886		
	(0.300)	(1.055)	(0.898)	(0.364)	(1.432)	(0.974)	(0.927)	(0.981)	(2.397)	(2.086)		
INST>90%	-0.835**	-0.358	2.235	0.358	1.654	-2.625**	2.288	0.311	-2.274	0.506		
	(0.330)	(1.266)	(1.540)	(0.751)	(2.063)	(1.282)	(1.402)	(1.538)	(3.968)	(2.876)		
ASSETS	-0.040	-1.717***	-0.648***	0.431***	-1.264***	1.057***	2.851***			2.483***	2.457***	2.382***
	(0.090)	(0.210)	(0.232)	(0.072)	(0.280)	(0.153)	(0.165)			(0.355)	(0.350)	(0.359)
INST											0.031	
											(0.023)	
CRUDEINST												0.029**
												(0.015)
Fixed effects	Year	Year	Year	Year	Year	Year	Year	Year	None	None	None	None
Adj. R-squared	0.17	0.09	0.04	0.14	0.13	0.05	0.20	0.05	0.01	0.25	0.26	0.27
N	1,839	1,839	1839	1,839	1839	1,831	1,839	1,839	161	161	161	161

Table 8: The Influence of Institutional Ownership on Prime Fund Liquidity

These are panel and cross-sectional regressions across prime MMFs over specified periods. We use four dependent variables to measure a fund's liquidity and maturity. First, $\%Liquidity$ is the percentage of fund assets that meet the SEC Rule 2a-7 definition of weekly liquid assets. This variable is only available after November 2010, when SEC Form N-MFP data became available. Second, $\%Treasury$ is the percentage of fund assets invested in U.S. Treasury securities. Third, $>7days$ is the percentage of fund assets maturing in less than 7 days. Fourth, WAM is the weighted-average maturity of the fund's holdings. In panel regressions, dependent variables are calculated as annual averages of monthly observations. In cross-section, the dependent variable is measured as of the specified month-end. The panel periods are: Pre-crisis (2005-2007), Crisis (2008-2009), and Reform (2010-2013). The key explanatory variables measure a fund's institutional ownership as of the prior year-end. For each prior year-end, we split a fund's institutional ownsership (as a percentage of its assets) into three binary variables equaling one if the fund's institutional ownership is within the third, forth, or fifth quintile. These coefficients may be interpreted as effects relative to a fund with less than 3% institutional ownership (i.e., a fund in the bottom two quintiles). INST>90% is a binary variable equaling one if at least 90% of fund assets are held by institutions. Thus, it can be interpreted as an additive effect on top of the effect of also being in the fifth quintile (INST(Q5]). We control for a fund's logged average monthly total net assets during the year (ASSETS). Year fixed effects are employed in all panel regressions. Robust standard errors are shown in parentheses. Estimates with a p-value below 0.10, 0.05, and 0.01 are marked with a *, **, and ***, respectively.

Dep. Var.:	$\%Liquidity$ (2a-7 definition)				$\%Treasury$			$\%<7days$			WAM		
Regressors:	Reform	May 2011	Jun 2011	Jul 2011	Pre-crisis	Crisis	Reform	Pre-crisis	Crisis	Reform	Pre-crisis	Crisis	Reform
Constant	44.015***	42.422***	44.867***	49.851***	0.125**	2.407***	5.171***	29.596***	29.384***	39.206***	42.726***	45.052***	42.607***
	(1.198)	(1.828)	(2.072)	(2.137)	(0.050)	(0.827)	(0.591)	(1.433)	(1.617)	(1.383)	(0.830)	(1.348)	(0.894)
INST(Q3]	2.577	1.730	-0.201	-3.010	-0.085	-0.435	-0.088	-1.379	-1.692	2.974*	-0.329	1.160	-1.479
	(1.567)	(3.093)	(3.213)	(3.233)	(0.053)	(0.664)	(0.640)	(1.863)	(2.104)	(1.794)	(1.075)	(1.687)	(1.042)
INST(Q4]	4.950***	6.233**	2.939	2.973	-0.074	-0.906	0.743	-2.366	3.456	4.564***	-0.159	-2.266	-2.012*
	(1.529)	(3.045)	(3.260)	(3.266)	(0.054)	(0.624)	(0.666)	(1.636)	(2.222)	(1.675)	(1.066)	(1.709)	(1.056)
INST(Q5]	4.620***	6.226*	4.275	2.644	-0.09	-1.093*	-0.553	6.713***	6.913***	8.845***	-4.140***	-4.006**	-3.145***
	(1.446)	(3.230)	(3.304)	(3.295)	(0.059)	(0.604)	(0.662)	(1.789)	(2.159)	(1.604)	(1.163)	(1.961)	(1.182)
INST>90%	2.343	0.384	0.107	2.165	-0.029	-0.594*	-1.556**	-2.000	1.635	1.727	1.439	-5.127*	-2.912*
	(2.035)	(4.772)	(5.886)	(5.513)	(0.034)	(0.341)	(0.751)	(3.254)	(2.764)	(2.279)	(2.164)	(2.813)	(1.764)
ASSETS	-3.610***	-3.667***	-3.502***	-3.396***	0.016**	0.177	-0.226	-1.303***	-1.829***	-2.713***	1.071***	1.635***	1.933***
	(0.342)	(0.676)	(0.751)	(0.701)	(0.008)	(0.223)	(0.182)	(0.427)	(0.506)	(0.396)	-0.259	-0.376	-0.232
Fixed effects	Year	None	None	None	Year	Year	Year	Year	Year	Year	Year	Year	Year
Adj. R-squared	0.20	0.19	0.15	0.16	0.01	0.02	0.04	0.05	0.06	0.13	0.11	0.07	0.14
N	716	188	185	185	658	442	739	650	440	737	657	442	739

Table 9: Maturity Structure of Prime Funds, by Institutional Ownership Level

This table shows the average percentage of fund assets maturing within various time intervals, split apart by institutional ownership level. To arrive at this, for each fund-month, we calculate the percentage of a funds assets maturing within certain time intervals as of each month-end over the November 2010 through December 2013 (i.e., the periods when SEC Form N-MFP data is available). Then we bucket fund-month observations based on the fund's institutional ownership level as of the prior year-end and take the mean across observations within each bucket. To compare the statistical equivalence of means between institutional ownership groups, we use the Duncan's multiple range test (critical alpha=0.05). Means with the same letter beside them are not significantly different. In order to focus on securities with some degree of credit risk, we exclude all U.S. Treasury securities as well as agency securities maturing in less than 60 days. The largest mean in each bucket is in bold while the smallest mean is shaded. To ease interpretation, in Panel B, we force fund groups to be mutually exclusive. Therefore, we remove funds that are over 90% institutional from the top quintile, allowing these extremely institutional funds to be in their own group.

Panel A:

Fund institutional ownership	Mean percentage of assets (across fund-months) by final maturity (in days)											
	<7		7<30		30<60		60<90		90<120		>=120	
INST[Q1]	28.4	d	**23.4**	**a**	**14.5**	**a**	12.8	b	**5.4**	**a,b**	15.4	b
INST(Q2]	31.0	c	20.4	b	13.2	c	**14.1**	**a**	**5.8**	**a**	15.3	b
INST(Q3]	30.3	c	**24.2**	**a**	13.8	b	11.2	c	5.2	b	14.8	b
INST(Q4]	33.9	b	20.1	b	12.4	d	11.2	c	**5.6**	**a**	**16.5**	**a**
INST(Q5]	**35.1**	**a**	19.0	c	12.8	c,d	10.8	c	**5.6**	**a**	**16.2**	**a**

Panel B:

Fund institutional ownership	Mean percentage of assets (across fund-months) by final maturity (in days)											
	<7		7<30		30<60		60<90		90<120		>=120	
INST[Q1]	28.4	d	**23.4**	**a**	**14.5**	**a**	12.8	b	**5.4**	**a,b**	15.4	c
INST(Q2]	31.0	c	20.4	b	13.2	b	**14.1**	**a**	**5.8**	**a**	15.3	c
INST(Q3]	30.3	c	**24.2**	**a**	13.8	b,c	11.2	c	5.2	b	14.8	c
INST(Q4]	33.9	b	20.1	b	12.4	d	11.2	c	**5.6**	**a**	16.5	b
INST(Q5] (excl. INST>90%)	34.0	b	18.6	c	12.9	c,d	11.1	c	**5.8**	**a**	**17.4**	**a**
INST>90%	**37.4**	**a**	19.9	b	12.5	d	10.0	d	5.1	b	13.7	d

Table 10: The Influence of Institutional Ownership on the Performance-Flow Relationship

These are panel regressions across fund-months over three periods within 2005 to 2013. The first period is the pre-financial crisis period (2005-2007). The second period is the crisis period (2008-2009). The last period is the reform period (2010-2011). The dependent variable ($\%FLOW_{f,t}$) is the fund's net new cash flow over the month as a percentage of its prior month-end assets. We group prime MMFs based on their prior year-end institutional ownership percentile. For example, the first column consists of funds in the first two quintiles (INST[Q1,Q2]). Funds in this group are less than 3% institutional. The fifth column constists of prime MMFs with at least 90% of fund assets held by institutions. The key explanatory variables are the current and lagged month-over-month change in the fund's net yield percentile rank ($\triangle NYR$). In all regressions, we control for, but do not show, the fund's net yield rank (level) at time $t-2$, gross yield at $t-1$, change in gross yield at t (to control for changes in the fund's riskiness), lagged total net assets at t, minimum investment requirement as of March of the current year, and the lagged dependent variable. Date and fund fixed effects are employed in all regressions. Estimates with a p-value below 0.10, 0.05, and 0.01 are marked with a *, **, and ***, respectively.

	Dependent variable: $\%FLOW_{f,t}$ by institutional ownership group				
Regressors:	INST[Q1,Q2]	INST(Q3]	INST(Q4]	INST(Q5]	INST>90%
	Pre-crisis (2005-2007, monthly)				
$\Delta NYR_{f,t}$	0.01947	-.02599	0.08726**	0.35823***	0.56941***
	(0.03907)	(0.04113)	(0.04104)	(0.08531)	(0.21234)
$\Delta NYR_{f,t-1}$	-.03699	-.02605	0.07464*	0.18119***	0.73374***
	(0.03871)	(0.04801)	(0.04252)	(0.06632)	(0.21967)
Adj. R-squared	0.11	0.05	0.05	0.03	0.12
N	2,014	1,641	2,035	1,854	395
	Crisis (2008-2009, monthly)				
$\Delta NYR_{f,t}$	-.00006	0.00609	0.06966**	0.08999**	0.14357
	(0.02080)	(0.02593)	(0.03132)	(0.04094)	(0.09935)
$\Delta NYR_{f,t-1}$	0.01125	0.02178	0.02438	0.07737*	0.21051**
	(0.01674)	(0.02051)	(0.02652)	(0.03969)	(0.08610)
Adj. R-squared	0.22	0.19	0.21	0.23	0.22
N	1,421	1,205	1,274	1,125	308
	Reform (2010-2013, monthly)				
$\Delta NYR_{f,t}$	-.00099	0.03046	0.02591	-.01305	-.01847
	(0.01265)	(0.01988)	(0.02248)	(0.02905)	(0.03968)
$\Delta NYR_{f,t-1}$	0.01115	0.06313***	0.03256	0.00235	-.07334*
	(0.01370)	(0.02012)	(0.02458)	(0.02986)	(0.03880)
Adj. R-squared	0.11	0.10	0.04	0.13	0.23
N	2,577	2,019	1,886	1,999	515
Controls:	Y	Y	Y	Y	Y

Table 11: Institutional Ownership, Yield Dispersion and the Performance-Flow Relationship

These are panel regressions across fund-months over the full 2005-2013 period. The dependent variable ($\%FLOW_{f,t}$) is the fund's net new cash flow over the month as a percentage of its prior month-end assets. In each column, we group prime MMFs based on their prior year-end institutional ownership percentile. For example, the first column consists of funds in the first two quintiles (INST[Q1,Q2]). Funds in this group are less than 3% institutional. The fifth column constists of prime MMFs with at least 90% of fund assets held by institutions. The key explanatory variables are the current and lagged month-over-month change in the fund's net yield percentile rank ($\triangle NYR$). These two yield change variables are interacted with the standard deviation in prime fund net yields (STDNY). In all regressions, we control for, but do not show, the fund's net yield rank (level) at time $t-2$, lagged total net assets at t, minimum investment requirement as of March of the current year, and the lagged dependent variable (not shown). To test whether funds attract flow by boosting gross yield (i.e., risk), we also show the change in gross yield at t and the level at $t-1$ ($\triangle GY_{f,t}$ and $GY_{f,t-1}$). Date and fund fixed effects are employed in all regressions. Panel B differs from Panel A only in that changes in a fund's net yield rank over the prior two periods are interacted with date fixed effects (not shown, for brevity). We do this to ensure that our results are driven by changes in net yield dispersion (STDNY) rather than by some unidentified time trend. Estimates with a p-value below 0.10, 0.05, and 0.01 are marked with a *, **, and ***, respectively.

Full period (2005-2013, monthly)					
	Dependent variable: $\%FLOW_{f,t}$				
Panel A:	by institutional ownership group				
Regressors:	INST[Q1,Q2]	INST(Q3]	INST(Q4]	INST(Q5]	INST>90%
$\Delta NYR_{f,t}$	-.00885	0.00958	0.02724	-.00511	-.01172
	(0.01252)	(0.01866)	(0.02355)	(0.02935)	(0.03729)
$\Delta NYR_{f,t-1}$	0.00744	0.03400***	0.01766	0.03168	-.00968
	(0.00940)	(0.01300)	(0.01549)	(0.02097)	(0.03769)
$\Delta NYR_{f,t} \times STDNY_{t}$	0.10506	0.04968	0.06773	0.44597***	0.20835
	(0.07457)	(0.10007)	(0.09978)	(0.12232)	(0.22466)
$\Delta NYR_{f,t-1} \times STDNY_{t-1}$	0.02405	-.01298	0.10105**	0.26443***	0.31907**
	(0.02966)	(0.03648)	(0.04004)	(0.05727)	(0.13140)
$\Delta GY_{f,t}$	-1.0062	-3.4479	-3.2497*	-6.8709***	-.70435
	(1.13538)	(2.33549)	(1.70726)	(2.54597)	(5.86537)
$GY_{f,t-1}$	0.32043	-.41435	0.51476	-5.0358**	-5.1696
	(0.79349)	(1.16863)	(1.32645)	(2.18323)	(4.43941)
Controls:	Y	Y	Y	Y	Y
Adj. R-squared	0.14	0.09	0.07	0.08	0.09
N	6,012	4,865	5,195	4,978	1,218
Panel B:					
Regressors:	INST[Q1,Q2]	INST(Q3]	INST(Q4]	INST(Q5]	INST>90%
$\Delta NYR_{f,t} \times STDNY_{t}$	0.16071*	0.11233	0.35984*	0.44916***	0.11259
	(0.09081)	(0.15863)	(0.20186)	(0.16544)	(0.27674)
$\Delta NYR_{f,t-1} \times STDNY_{t-1}$	0.12915	0.15486	0.42918**	0.37061**	0.29503
	(0.07878)	(0.12938)	(0.19715)	(0.14902)	(0.30000)
Interaction (ΔNYR*Date):	Y	Y	Y	Y	Y
Controls:	Y	Y	Y	Y	Y
Adj. R-squared	0.15	0.10	0.09	0.09	0.08
N	6,012	4,865	5,195	4,978	1,218

Figure 1: Total Assets of Prime Funds, by Shareholder Type

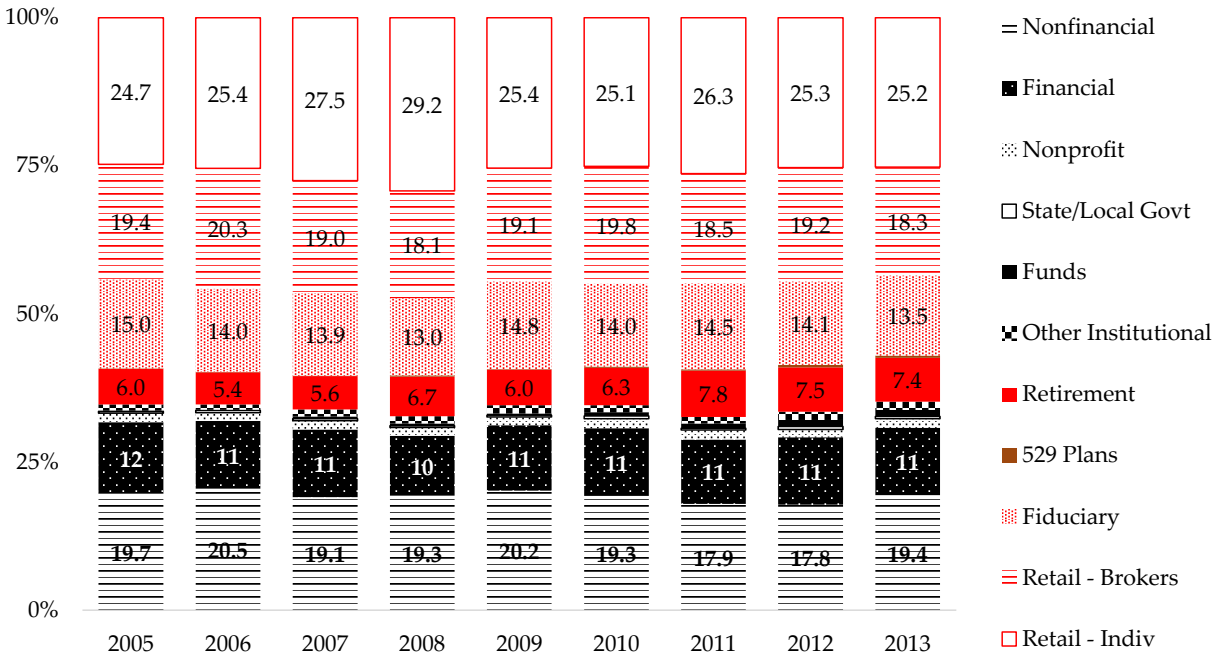


Figure 2: Total Assets of Prime Institutional Shareclasses, by Shareholder Type

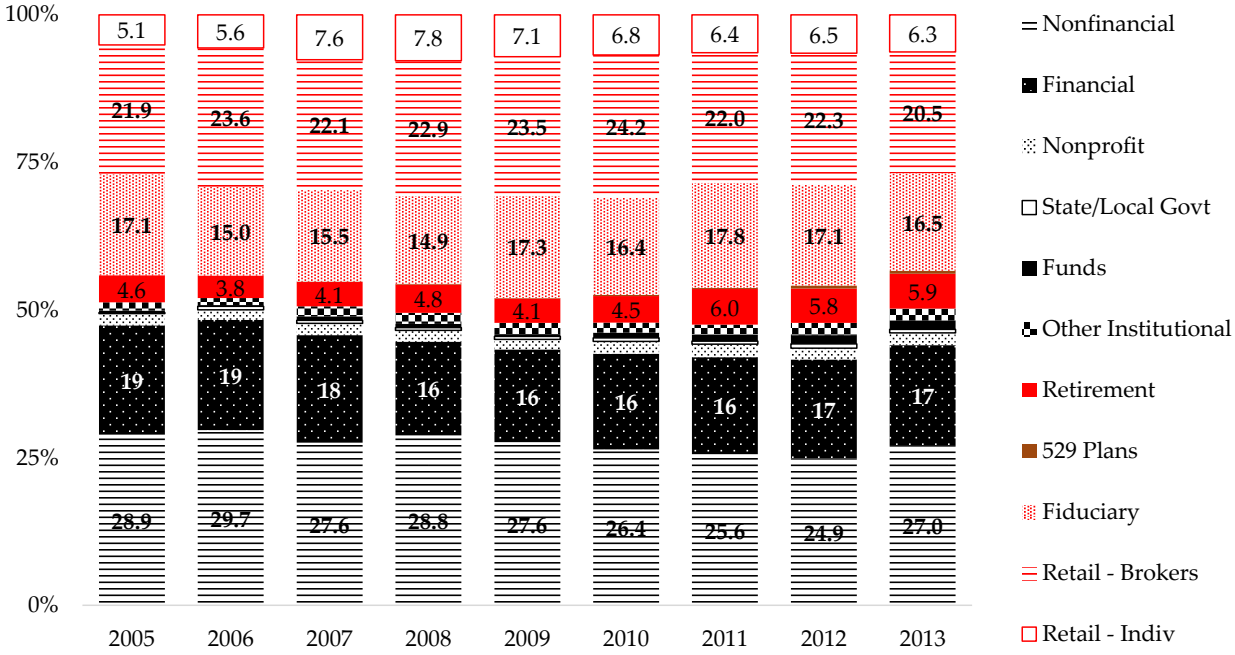
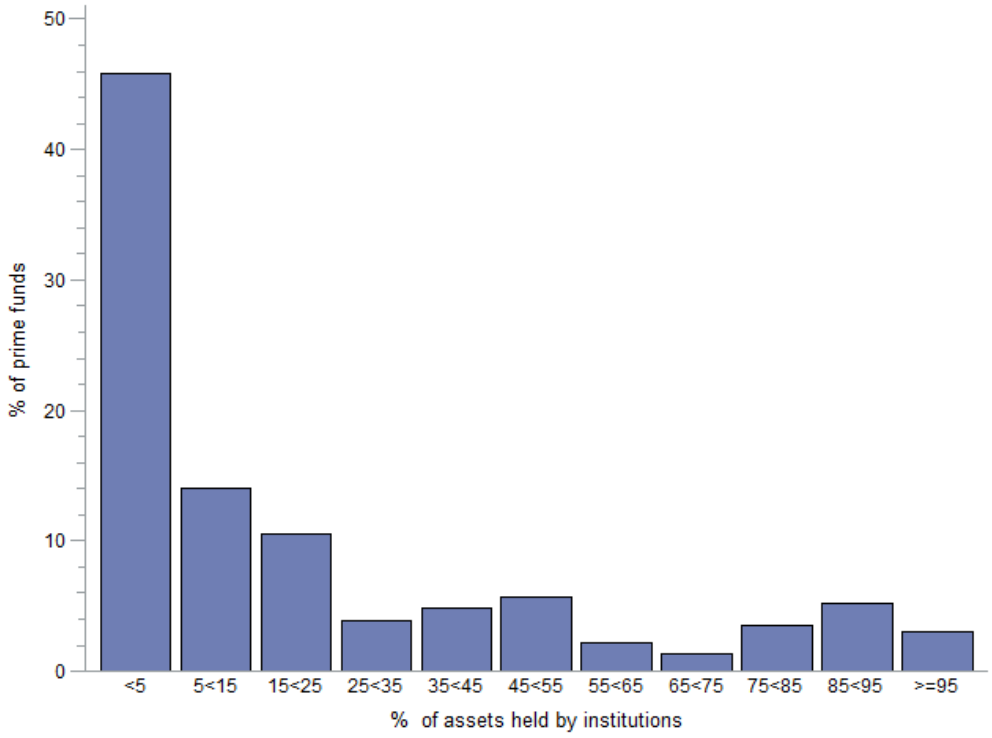


Figure 3: The Distribution of Prime Funds and their Companies by Institutional Ownership Bin, 2013

(a) Prime funds



(b) Fund companies that offer prime funds

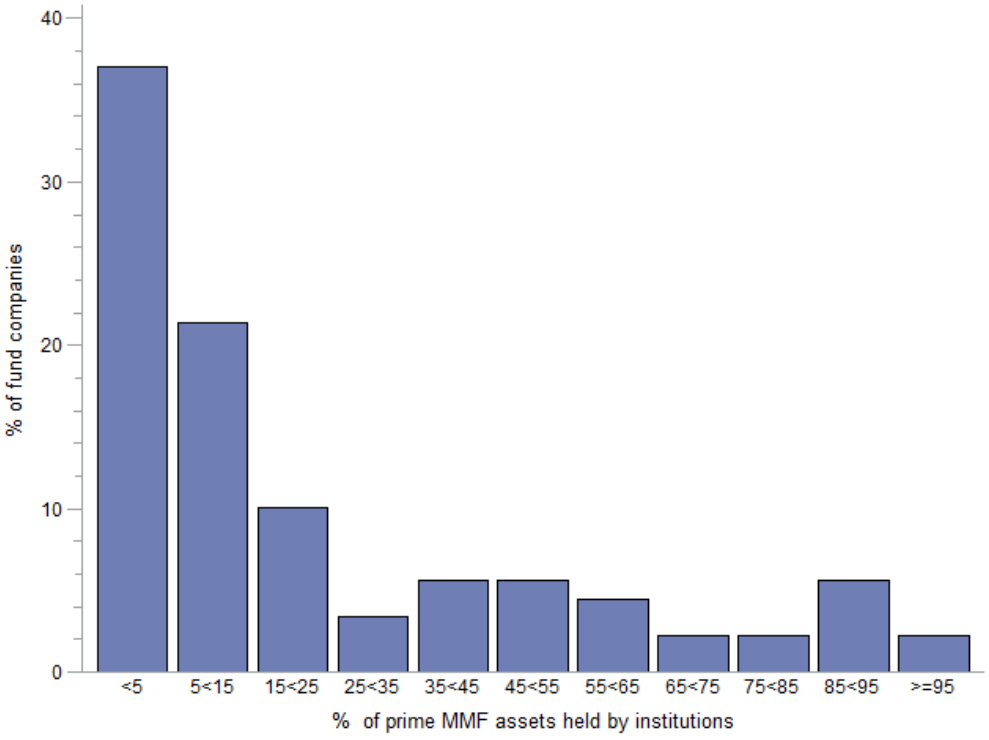
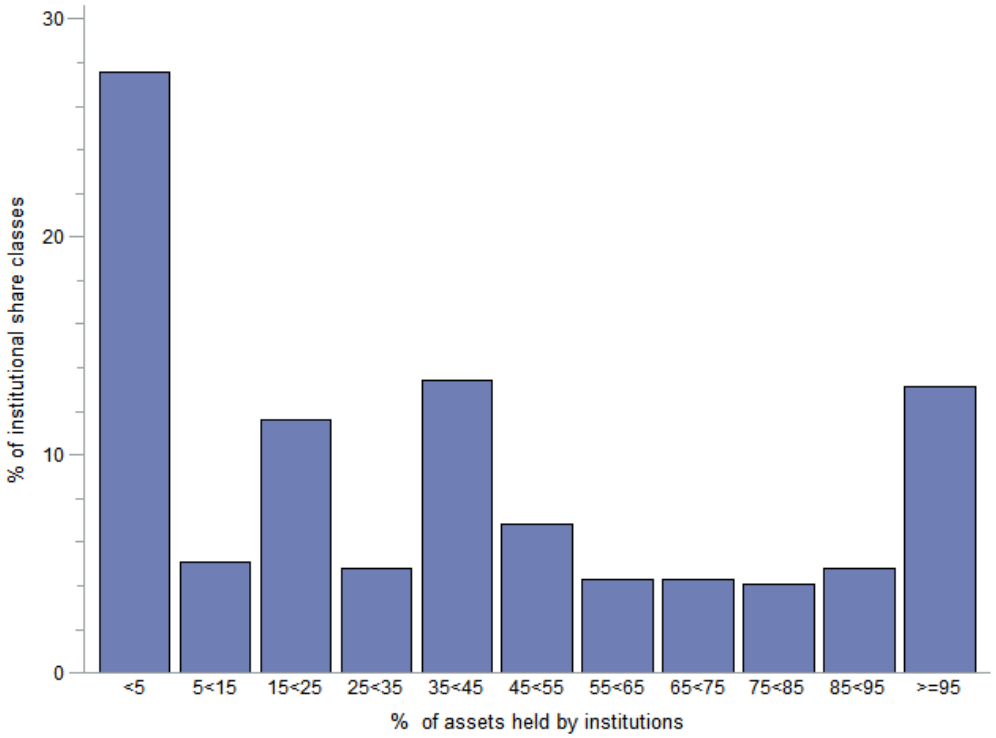


Figure 4: The Distribution of Prime Institutional Shareclasses by Institutional Ownership Bin

(a) 2007



(b) 2013

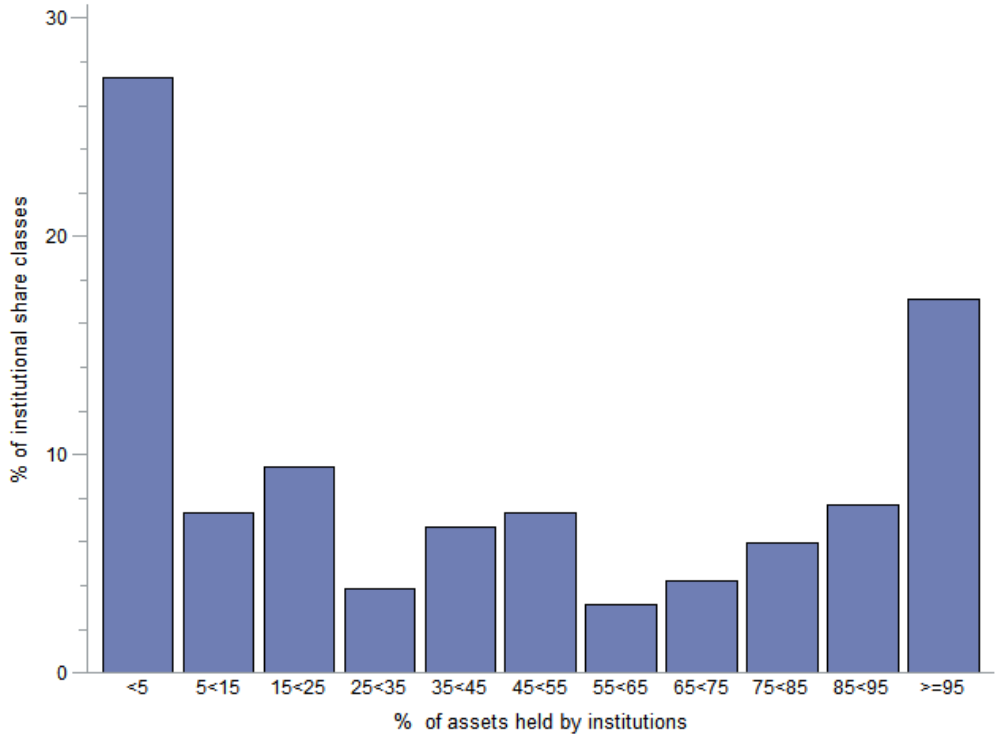


Figure 5: Median Institutional Ownership by Group

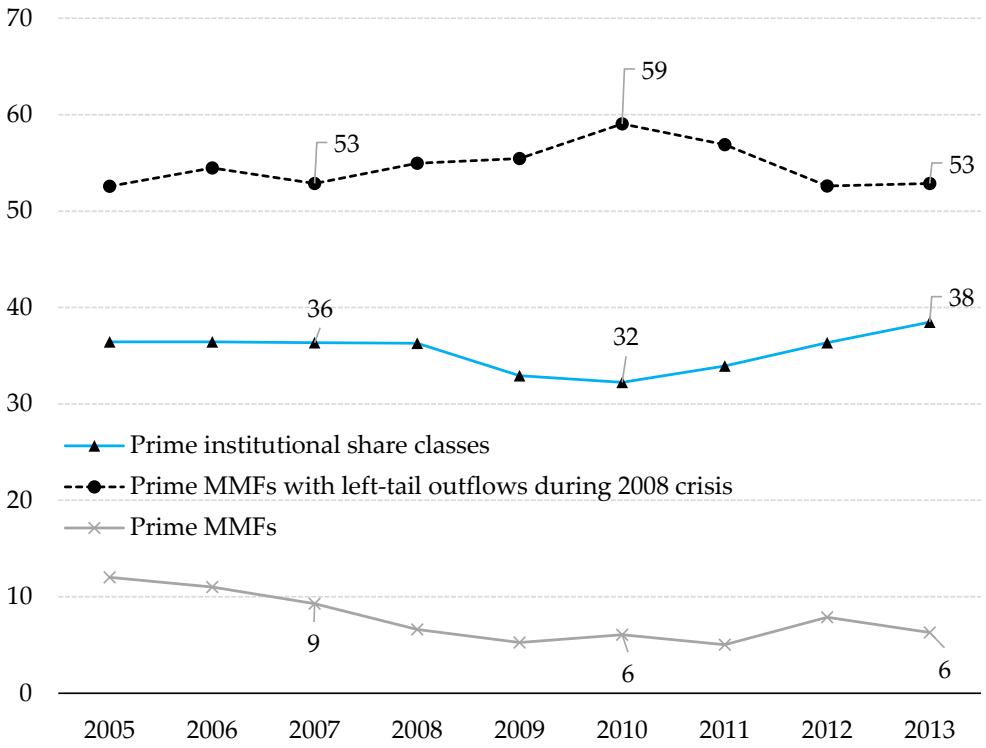


Figure 6: Herfindahl Concentration Index: Institutional v. Retail

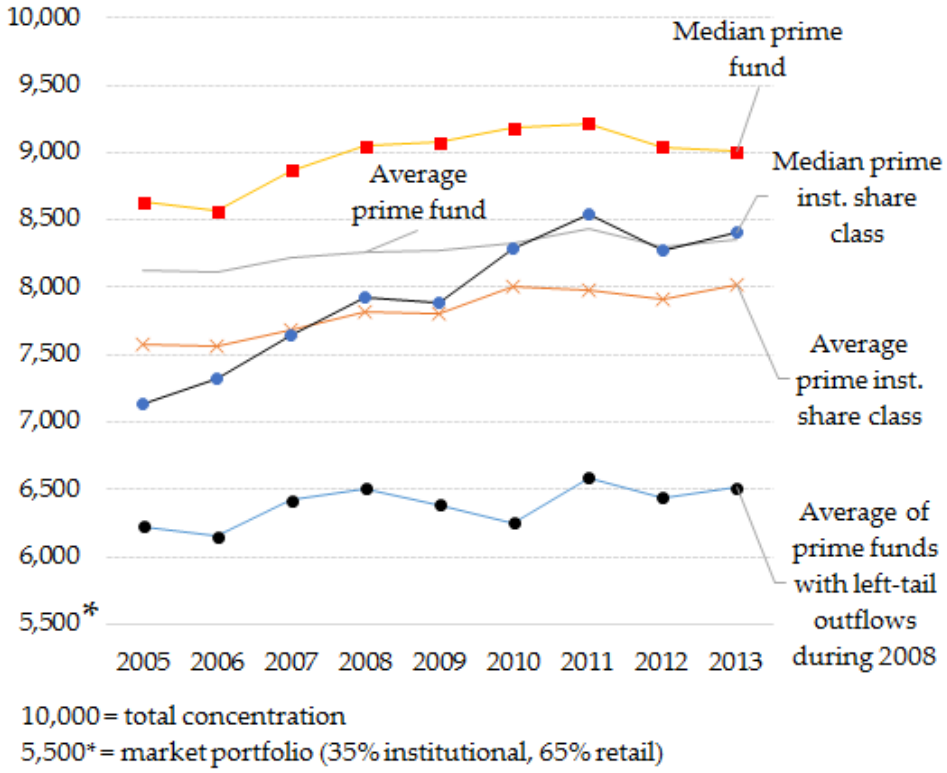


Figure 7: Prime Fund Net Yields, the Risk-Free Rate, and Yield Dispersion Over Time